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U.S. BUREAU OF LABOR STATISTICS

Occupational Outlook Handbook

2008-09 Edition

January 2008 U.S. Department of Labor Bulletin 2700



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Guide to the *Handbook*

- Highlights of the job outlook between 2006 and 2016 are presented in **Tomorrow's Jobs**, page 1.

- A list of occupations growing the fastest and having the largest numerical increases in employment, by the most significant source of postsecondary education or training, appears on page 9.

- Additional sources of information on careers and State occupational employment projections, are described in **Sources of Career Information**, page 10.

- Additional sources of information are described in **Sources of Education, Training, and Financial Aid** on page 15.

- Job search methods and tips on applying for a job and evaluating a job offer are discussed in **Finding and Applying for Jobs and Evaluating Offers**, page 18.

- Highlights and an explanation of information presented in the *Handbook*, how the information was acquired, and hints on how to interpret this information, appear in **Occupational Information Included in the *Handbook***, page 23.

- Brief descriptions of the nature of the work, the number of jobs in 2006, the projected employment change over the 2006-16 period, and the most significant source of postsecondary education or training, are presented in **Data for Occupations Not Studied in Detail**, page 843.

- The **Assumptions and Methods Used in Preparing Employment Projections** are described briefly on page 857.

- A list of ***Occupational Information Network (O*NET)*** codes that are related to *Handbook* occupations are found on page 859.

- An alphabetical **Index** of occupations found in the *Handbook* is on page 867.

- A description of BLS employment outlook information on the Internet appears at the end of the *Handbook*.

- Information about publications closely related to the *Handbook—Career Guide to Industries, 2008-09 Edition,* Bulletin 2701; *Occupational Projections and Training Data, 2008-09 Edition,* Bulletin 2702; and *Occupational Outlook* Quarterly—appears at the end of the *Handbook* and on the inside back cover.

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Occupational Outlook Handbook

2008-09 Library Edition

U.S. Department of Labor
Elaine L. Chao, Secretary

U.S. Bureau of Labor Statistics
Philip L. Rones, Acting Commissioner

January 2008

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Note

Many trade associations, professional societies, unions, industrial organizations, and government agencies provide career information that is valuable to counselors and jobseekers. For the convenience of *Handbook* users, some of these organizations and, in some cases, their Internet addresses are listed at the end of each occupational statement. Although these references were carefully compiled, the Bureau of Labor Statistics has neither authority nor facilities for investigating the organizations or the information or publications that may be sent in response to a request and cannot guarantee the accuracy of such information. The listing of an organization, therefore, does not constitute in any way an endorsement or recommendation by the Bureau either of the organization and its activities or of the information it may supply. Each organization has sole responsibility for whatever information it may issue.

The *Handbook* describes the job outlook over a projected 10-year period for occupations across the Nation; consequently, short-term labor market fluctuations and regional differences in job outlook generally are not discussed. Similarly, the *Handbook* provides a general, composite description of jobs and cannot be expected to reflect work situations in specific establishments or localities. The *Handbook*, therefore, is not intended and should never be used for any legal purpose. For example, the *Handbook* should not be used as a guide for determining wages, hours of work, the right of a particular union to represent workers, appropriate bargaining units, or formal job evaluation systems. Nor should earnings data in the *Handbook* be used to compute future loss of earnings in adjudication proceedings involving work injuries or accidental deaths.

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Additional Information About the 2006-16 Projections

Readers interested in more information about the projections; about the methods and assumptions that underlie them; or about details on economic growth, the labor force, or industry and occupational employment, should consult the November 2007 *Monthly Labor Review*, or the Fall 2007 *Occupational Outlook Quarterly*.

For more information about employment change, job openings, earnings, unemployment rates, and training requirements by occupation, consult *Occupational Projections and Training Data, 2008-09 Edition*, BLS Bulletin 2702.

For occupational information from an industry perspective, including discussions of some occupations and career paths that the *Occupational Outlook Handbook* does not cover, consult the *Career Guide to Industries, 2008-09 Edition*, BLS Bulletin 2701.

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Tomorrow's Jobs

Making informed career decisions requires reliable information about opportunities in the future. Opportunities result from the relationships between the population, labor force, and the demand for goods and services.

Population ultimately limits the size of the labor force—individuals working or looking for work—which limits the goods and services that can be produced. Demand for various goods and services is largely responsible for employment in the industries providing them. Employment opportunities, in turn, result from demand for skills needed within specific industries. Opportunities for medical assistants and other healthcare occupations, for example, have surged in response to rapid growth in demand for health services.

Examining the past and present, and projecting changes in these relationships is the foundation of the Occupational Outlook Program. This chapter presents highlights of Bureau of Labor Statistics' projections of the labor force and occupational and industry employment that can help guide your career plans. Sources of additional information about the projections appear on the preceding page.

Population

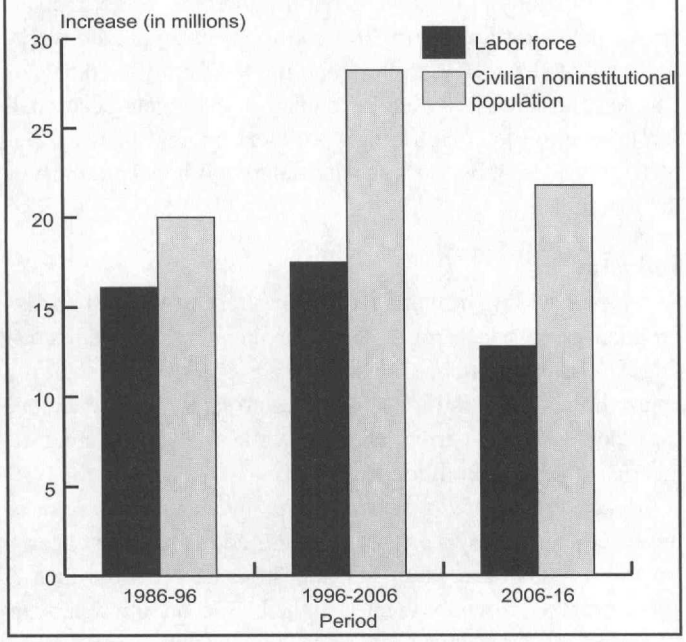
Population trends affect employment opportunities in a number of ways. Changes in population influence the demand for goods and services. For example, a growing and aging population has increased the demand for health services. Equally important, population changes produce corresponding changes in the size and demographic composition of the labor force.

The U.S. civilian noninstitutional population is expected to increase by 21.8 million over the 2006-2016 period (chart 1). The 2006-2016 rate of growth is slower than the growth rate over the 1986-1996 and 1996-2006 periods—9 percent, 11 percent, and 13 percent, respectively. Continued growth, however, will mean more consumers of goods and services, spurring demand for workers in a wide range of occupations and industries. The effects of population growth on various occupations will differ. The differences are partially accounted for by the age distribution of the future population.

As the baby boomers continue to age, the 55 to 64 age group will increase by 30.3 percent or 9.5 million persons, more than any other group. The 35 to 44 age group will decrease by 5.5 percent, reflecting a slowed birth rate following the baby boom generation, while the youth population, aged 16 to 24, will decline 1.1 percent over the 2006-2016 period.

Minorities and immigrants will constitute a larger share of the U.S. population in 2016. The number of Asians and people of Hispanic origin are projected to continue to grow much faster than other racial and ethnic groups.

Chart 1. **Numeric change in the population and labor force, 1986-96, 1996-2006, and projected 2006-16**

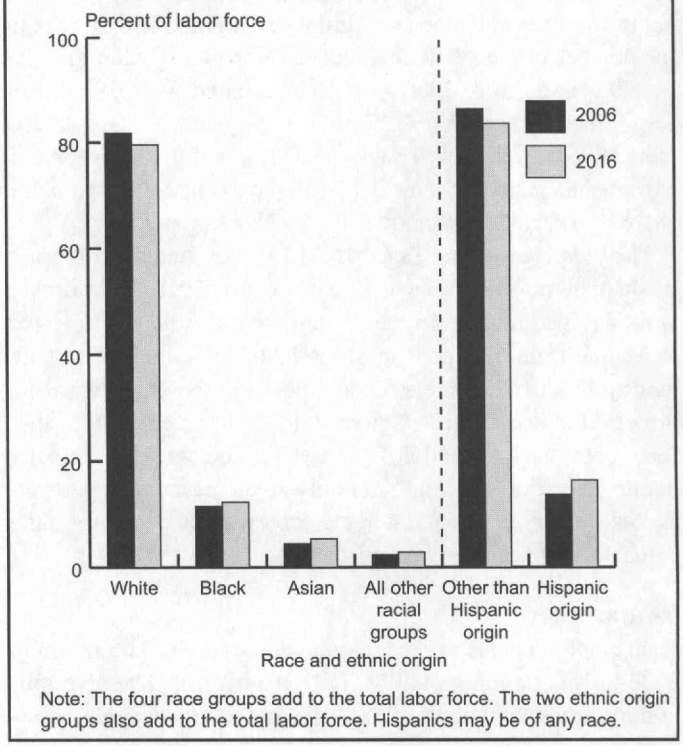


Labor force

Population is the single most important factor in determining the size and composition of the labor force—people either working or looking for work. The civilian labor force is projected to increase by 12.8 million, or 8.5 percent, to 164.2 million over the 2006-2016 period.

The U.S. workforce will become more diverse by 2016. White, non-Hispanic persons will continue to make up a decreasing share of the labor force, falling from 69.1 percent in 2006 to 64.6 percent in 2016 (chart 2). However, despite rela-

Chart 2. **Percent of labor force by race and ethnic origin, 2006 and projected 2016**



Note: The four race groups add to the total labor force. The two ethnic origin groups also add to the total labor force. Hispanics may be of any race.

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Chart 3. **Percent of labor force by age group, 2006 and projected 2016**

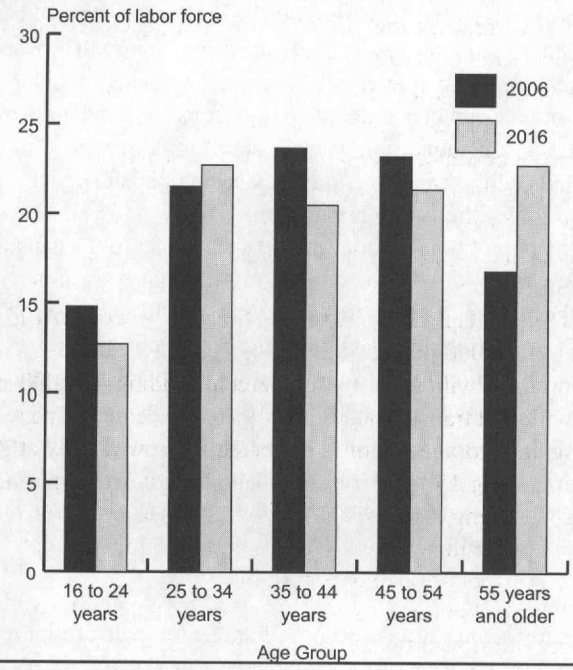
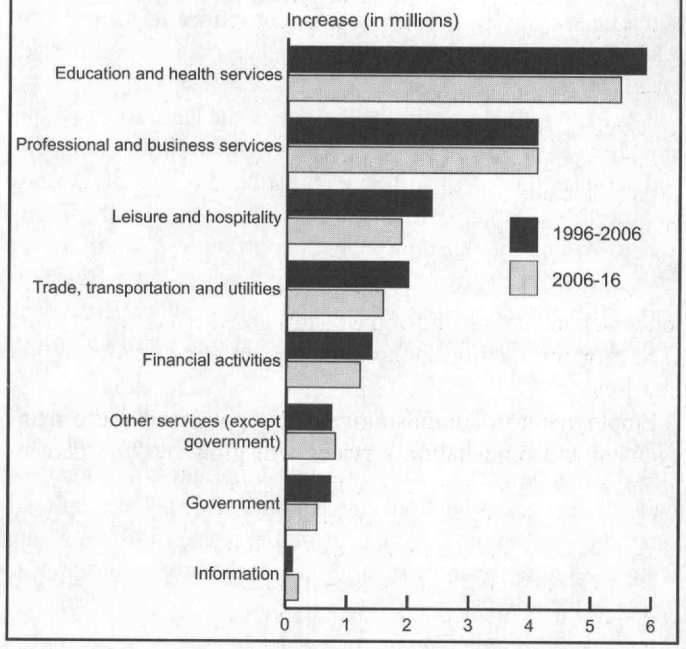


Chart 4. **Numeric change in wage and salary employment, service-providing industry divisions, 1996-2006 and projected 2006-16**



tively slow growth, white non-Hispanics will remain the overwhelming majority of the labor force. Hispanics are projected be the fastest growing ethnic group, growing by 29.9 percent. By 2016, Hispanics will continue to constitute an increasing proportion of the labor force, growing from 13.7 percent to 16.4 percent. Asians are projected to account for an increasing share of the labor force by 2016, growing from 4.4 to 5.3 percent. Blacks will also increase their share of the labor force, growing from 11.4 percent to 12.3 percent.

The numbers of men and women in the labor force will grow, but the number of women will grow at a slightly faster rate than the number of men. The male labor force is projected to grow by 8.0 percent from 2006 to 2016, compared with 8.9 percent for women, down from 12.7 and 13.4 percent, respectively, from 1996 to 2006. As a result, men's share of the labor force is expected to decrease from 53.7 to 53.4 percent, while women's share is expected to increase from 46.3 to 46.6 percent.

The youth labor force, aged 16 to 24, is expected to decrease its share of the labor force to 12.7 percent by 2016. The primary working age group, between 25 and 54 years old, is projected to decline from 68.4 percent of the labor force in 2006 to 64.6 percent by 2016. Workers 55 and older, on the other hand, are projected to leap from 16.8 percent to 22.7 percent of the labor force between 2006 and 2016 (chart 3). The aging of the baby boom generation will cause not only an increase in the percentage of workers in the oldest age category, but a decrease in the percentage of younger workers.

Employment

Total employment is expected to increase from 150.6 million in 2006 to 166.2 million in 2016, or by 10 percent. The 15.6 million jobs that will be added by 2016 will not be evenly distributed across major industrial and occupational groups. Changes in consumer demand, technology, and many other factors will contribute to the continually changing employment structure in the U.S. economy.

The following two sections examine projected employment change from industrial and occupational perspectives. The industrial profile is discussed in terms of primary wage and salary employment. Primary employment excludes secondary jobs for those who hold multiple jobs. The exception is employment in agriculture, which includes self-employed and unpaid family workers in addition to wage and salary workers.

The occupational profile is viewed in terms of total employment—including primary and secondary jobs for wage and salary, self-employed, and unpaid family workers. Of the roughly 150 million jobs in the U.S. economy in 2006, wage and salary workers accounted for 138.3 million, self-employed workers accounted for 12.2 million, and unpaid family workers accounted for about 130,000. Secondary employment accounted for 1.8 million jobs. Self-employed workers held nearly 9 out of 10 secondary jobs and wage and salary workers held most of the remainder.

Industry

Service-providing industries. The long-term shift from goods-producing to service-providing employment is expected to continue. Service-providing industries are expected to account for approximately 15.7 million new wage and salary jobs generated over the 2006-2016 period (chart 4), while goods-producing industries will see overall job loss.

Education and health services. This industry supersector is projected to grow by 18.8 percent, and add more jobs, nearly 5.5 million, than any other industry supersector. More than 3 out of every 10 new jobs created in the U.S. economy will be in either the healthcare and social assistance or public and private educational services sectors.

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Healthcare and social assistance—including public and private hospitals, nursing and residential care facilities, and individual and family services—will grow by 25.4 percent and add 4 million new jobs. Employment growth will be driven by increasing demand for healthcare and social assistance because of an aging population and longer life expectancies. Also, as more women enter the labor force, demand for childcare services is expected to grow.

Public and private educational services will grow by 10.7 percent and add 1.4 million new jobs through 2016. Rising student enrollments at all levels of education will create demand for educational services.

Professional and business services. This industry supersector, which includes some of the fastest growing industries in the U.S. economy, will grow by 23.3 percent and add 4.1 million new jobs.

Employment in administrative and support and waste management and remediation services will grow by 20.3 percent and add 1.7 million new jobs to the economy by 2016. The largest industry growth in this sector will be enjoyed by employment services, which will be responsible for 692,000 new jobs, or over 40 percent of all new jobs in administrative and support and waste management and remediation services. Employment services ranks second among industries with the most new employment opportunities in the Nation and is expected to have a growth rate that is faster than the average for all industries. This will be due to the need for seasonal and temporary workers and for highly specialized human resources services.

Employment in professional, scientific, and technical services will grow by 28.8 percent and add 2.1 million new jobs by 2016. Employment in computer systems design and related services will grow by 38.3 percent and add nearly one-fourth of all new jobs in professional, scientific, and technical services. Employment growth will be driven by the increasing reliance of businesses on information technology and the continuing importance of maintaining system and network security. Management, scientific, and technical consulting services also will grow at a staggering 78 percent and account for another third of growth in this supersector. Demand for these services will be spurred by the increased use of new technology and computer software and the growing complexity of business.

Management of companies and enterprises will grow by 14.9 percent and add 270,000 new jobs.

Information. Employment in the information supersector is expected to increase by 6.9 percent, adding 212,000 jobs by 2016. Information contains some of the fast-growing computer-related industries such as software publishing, Internet publishing and broadcasting, and wireless telecommunication carriers. Employment in these industries is expected to grow by 32 percent, 44.1 percent, and 40.9 percent, respectively. The information supersector also includes motion picture production; broadcasting; and newspaper, periodical, book, and directory publishing. Increased demand for telecommunications services, cable service, high-speed Internet connections, and software will fuel job growth among these industries.

Leisure and hospitality. Overall employment will grow by 14.3 percent. Arts, entertainment, and recreation will grow by 30.9 percent and add 595,000 new jobs by 2016. Most of these new job openings, 79 percent, will be in the amusement, gambling, and recreation sector. Job growth will stem from public participation in arts, entertainment, and recreation activities—reflecting increasing incomes, leisure time, and awareness of the health benefits of physical fitness.

Accommodation and food services is expected to grow by 11.4 percent and add 1.3 million new jobs through 2016. Job growth will be concentrated in food services and drinking places, reflecting increases in population, dual-income families, and the convenience of many new food establishments.

Trade, transportation, and utilities. Overall employment in this industry supersector will grow by 6 percent between 2006 and 2016. Transportation and warehousing is expected to increase by 496,000 jobs, or by 11.1 percent through 2016. Truck transportation will grow by 11 percent, adding 158,000 new jobs, while rail transportation is projected to decline. The warehousing and storage sector is projected to grow rapidly at 23.5 percent, adding 150,000 jobs. Demand for truck transportation and warehousing services will expand as many manufacturers concentrate on their core competencies and contract out their product transportation and storage functions.

Employment in retail trade is expected to increase by 4.5 percent. Despite slower than average growth, this industry will add almost 700,000 new jobs over the 2006-2016 period, growing from 15.3 million employees to 16 million. While consumers will continue to demand more goods, consolidation among grocery stores and department stores will temper growth. Wholesale trade is expected to increase by 7.3 percent, growing from 5.9 million to 6.3 million jobs.

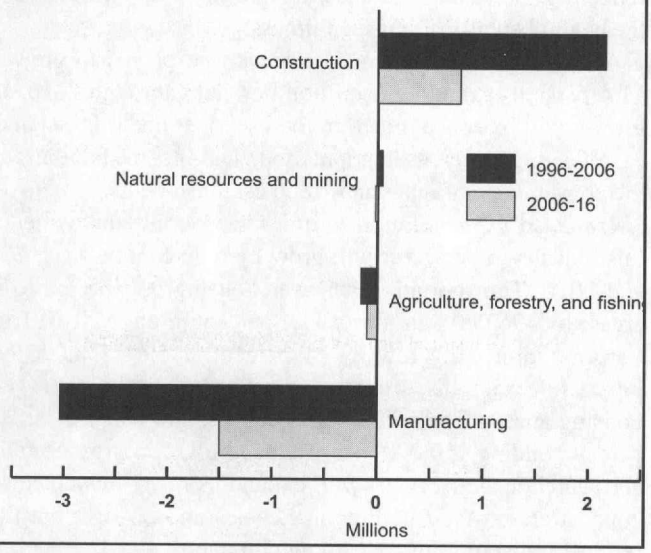
Employment in utilities is projected to decrease by 5.7 percent through 2016. Despite increased output, employment in electric power generation, transmission, and distribution and natural gas distribution is expected to decline through 2016 due to improved technology that increases worker productivity. However, employment in water, sewage, and other systems is expected to increase 18.7 percent by 2016. Jobs are not easily eliminated by technological gains in this industry because water treatment and waste disposal are very labor-intensive activities.

Financial activities. Employment is projected to grow 14.4 percent over the 2006-2016 period. Real estate and rental and leasing is expected to grow by 18 percent and add 392,000 jobs by 2016. Growth will be due, in part, to increased demand for housing as the population grows. The fastest growing industry in the real estate and rental and leasing services sector will be activities related to real estate, such as property management and real estate appraisal, which will grow by 29 percent—remnants of the housing boom that pervaded much of the first half of the decade.

Finance and insurance are expected to add 815,000 jobs, an increase of 13.2 percent, by 2016. Employment in securities, commodity contracts, and other financial investments and related activities is expected to grow 46 percent by 2016, reflecting the increased number of baby boomers in their peak savings years, the growth of tax-favorable retirement plans, and the globalization of the securities markets. Employment in credit intermediation and related services, including banks, will grow by 8.2 percent and add almost one-third of all new jobs within

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Chart 5. **Numeric change in wage and salary employment, goods-producing industry divisions, 1996-2006 and projected 2006-16**



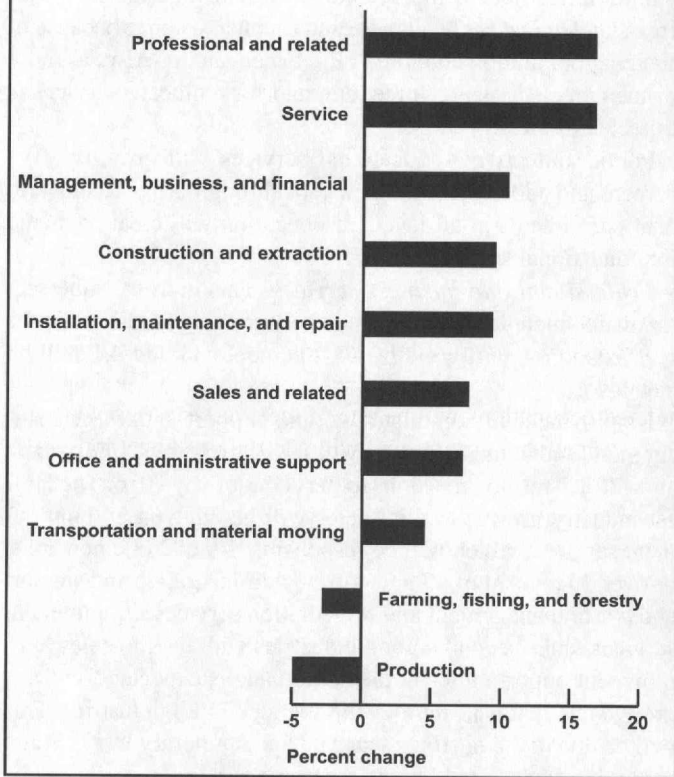
finance and insurance. Insurance carriers and related activities are expected to grow by 7.4 percent and add 172,000 new jobs by 2016. The number of jobs within agencies, brokerages, and other insurance related activities is expected to grow about 15.4 percent. Growth will stem from the needs of an increasing population and new insurance products on the market.

Government. Between 2006 and 2016, government employment, not including employment in public education and hospitals, is expected to increase by 4.8 percent, from 10.8 million to 11.3 million jobs. Growth in government employment will be fueled by an increased demand for pubic safety, but dampened by budgetary constraints and outsourcing of government jobs to the private sector. State and local governments, excluding education and hospitals, are expected to grow by 7.7 percent as a result of the continued shift of responsibilities from the Federal Government to State and local governments. Federal Government employment, including the Postal Service, is expected to decrease by 3.8 percent.

Other services (except government and private households). Employment will grow by 14.9 percent. About 2 out of every 5 new jobs in this supersector will be in religious organizations, which are expected to grow by 18.9 percent. Other automotive repair and maintenance will be the fastest growing industry at 40.7 percent, reflecting demand for quick maintenance services for the increasing number of automobiles on the Nation's roads. Also included among other services are business, professional, labor, political, and similar organizations, which are expected to increase by 13.6 percent and add 68,000 new jobs. This industry includes homeowner, tenant, and property owner associations.

Goods-producing industries. Employment in the goods-producing industries has been relatively stagnant since the early 1980s. Overall, this sector is expected to decline 3.3 percent over the 2006-2016 period. Although employment is expected to decline overall, projected growth among goods-producing industries varies considerably (chart 5).

Chart 6. **Percent change in total employment by major occupational group, projected 2006-16**



Construction. Employment in construction is expected to increase by 10.2 percent, from 7.7 million to 8.5 million. Demand for commercial construction and an increase in road, bridge, and tunnel construction will account for the bulk of job growth in this supersector.

Manufacturing. While overall employment in this supersector will decline by 10.6 percent or 1.5 million jobs, employment in a few detailed manufacturing industries will increase. For example, employment in pharmaceutical and medicine manufacturing is expected to grow by 23.8 percent and add 69,000 new jobs by 2016. However, productivity gains, job automation, and international competition will adversely affect employment in most manufacturing industries. Employment in household appliance manufacturing is expected to decline by 25.8 percent and lose 21,000 jobs over the decade. Similarly, employment in machinery manufacturing, apparel manufacturing, and computer and electronic product manufacturing will decline by 146,000, 129,000, and 157,000 jobs, respectively.

Agriculture, forestry, fishing, and hunting. Overall employment in agriculture, forestry, fishing, and hunting is expected to decrease by 2.8 percent. Employment is expected to continue to decline due to rising costs of production, increasing consolidation, and more imports of food and lumber. The only industry within this supersector expected to grow is support activities for agriculture and forestry, which includes farm labor contractors and farm management services. This industry is expected to grow by 10.5 percent and add 12,000 new jobs. Crop production will see the largest job loss, with 98,000 fewer jobs in 2016 than in 2006.

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Mining. Employment in mining is expected to decrease 1.6 percent, or by some 10,000 jobs, by 2016. Employment in support activities for mining will be responsible for most of the employment decline in this industry, seeing a loss of 17,000 jobs. Other mining industries, such as coal mining and metal ore mining, are expected to see little or no change or a small increase in employment. Employment stagnation in these industries is attributable mainly to technology gains that boost worker productivity and strict environmental regulations.

Occupation

Expansion of service-providing industries is expected to continue, creating demand for many occupations. However, projected job growth varies among major occupational groups (chart 6).

Professional and related occupations. These occupations include a wide variety of skilled professions. Professional and related occupations will be one of the two fastest growing major occupational groups, and will add the most new jobs. Over the 2006-2016 period, a 16.7-percent increase in the number of professional and related jobs is projected, which translates into nearly 5 million new jobs. Professional and related workers perform a wide variety of duties, and are employed throughout private industry and government. Almost three-quarters of the job growth will come from three groups of professional occupations—computer and mathematical occupations, healthcare practitioners and technical occupations, and education, training, and library occupations—which together will add 3.5 million jobs.

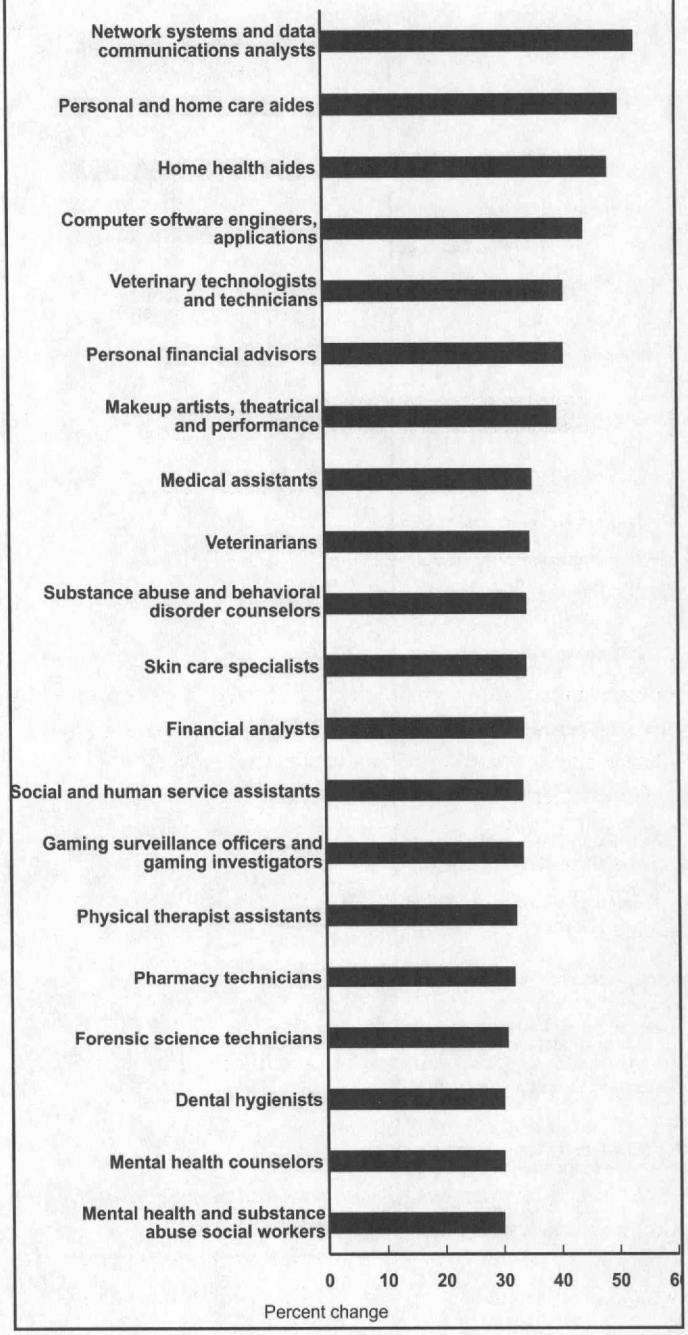
Service occupations. Duties of service workers range from fighting fires to cooking meals. Employment in service occupations is projected to increase by 4.8 million, or 16.7 percent, the second largest numerical gain and tied with professional and related occupations for the fastest rate of growth among the major occupational groups. Food preparation and serving related occupations are expected to add the most jobs among the service occupations, 1.4 million, by 2016. However, healthcare support occupations and personal care and service occupations are expected to grow the fastest, at 26.8 percent and 22 percent, respectively. Combined, these two occupational groups will account for 2.1 million new jobs.

Management, business, and financial occupations. Workers in management, business, and financial occupations plan and direct the activities of business, government, and other organizations. Their employment is expected to increase by 1.6 million, or 10.4 percent, by 2016. Among management occupations, the numbers of social and community service mangers and gaming managers will grow the fastest, by 24.7 percent and 24.4 percent, respectively. Construction managers will add the most new jobs—77,000—by 2016. Farmers and ranchers are the only workers whose numbers are expected to see a large decline, losing 90,000 jobs. Among business and financial occupations, accountants and auditors and all other business operation specialists will add the most jobs, 444,000 combined. Financial analysts and personal financial advisors will be the fastest growing occupations in this group, with growth rates of 33.8 percent and 41 percent, respectively.

Construction and extraction occupations. Construction and extraction workers build new residential and commercial buildings, and also work in mines, quarries, and oil and gas fields. Employment of these workers is expected to grow 9.5 percent, adding 785,000 new jobs. Construction trades and related workers will account for nearly 4 out of 5 of these new jobs, or 622,000, by 2016. Minor declines in extraction occupations will reflect overall employment stagnation in the mining and oil and gas extraction industries.

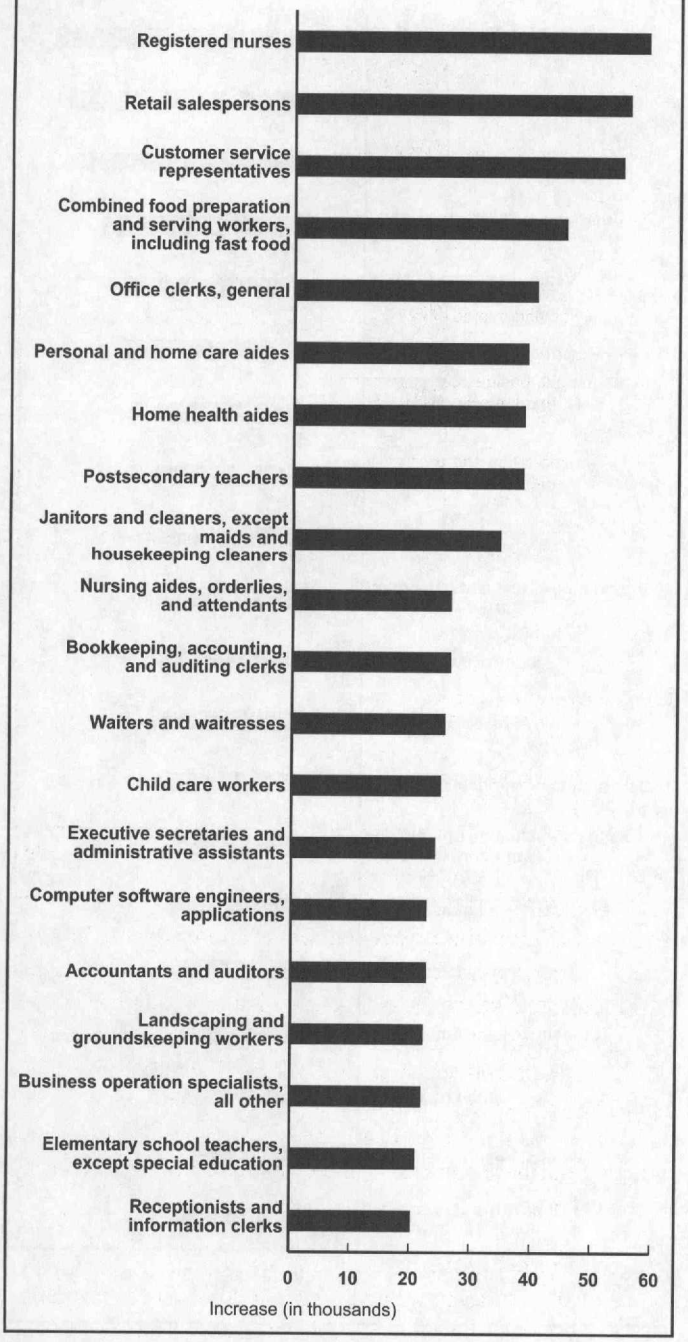
Installation, maintenance, and repair occupations. Workers in installation, maintenance, and repair occupations install new equipment and maintain and repair older equipment. These occupations will add 550,000 jobs by 2016, growing by 9.3 percent. Automotive service technicians and mechanics and general maintenance and repair workers will account for close to

Chart 7. **Percent change in employment in occupations projected to grow fastest, 2006-16**



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Chart 8. **Occupations with the largest numerical increases in employment, projected 2006-16**



half of all new installation, maintenance, and repair jobs. The fastest growth rate will be among locksmiths and safe repairers, an occupation that is expected to grow 22.1 percent over the 2006-2016 period.

Transportation and material moving occupations. Transportation and material moving workers transport people and materials by land, sea, or air. Employment of these workers should increase by 4.5 percent, accounting for 462,000 new jobs by 2016. Among transportation occupations, motor vehicle operators will add the most jobs, 368,000. Material moving occupations will decline slightly, 0.5 percent, losing 25,000 jobs.

Sales and related occupations. Sales and related workers solicit goods and services to businesses and consumers. Sales and related occupations are expected to add 1.2 million new jobs by 2016, growing by 7.6 percent. Retail salespersons will contribute the most to this grow by adding 557,000 new jobs.

Office and administrative support occupations. Office and administrative support workers perform the day-to-day activities of the office, such as preparing and filing documents, dealing with the public, and distributing information. Employment in these occupations is expected to grow by 7.2 percent, adding 1.7 million new jobs by 2016. Customer service representatives will add the most new jobs, 545,000, while stock clerks and order fillers is expected to see the largest employment decline among all occupations, losing 131,000 jobs.

Farming, fishing, and forestry occupations. Farming, fishing, and forestry workers cultivate plants, breed and raise livestock, and catch animals. These occupations will decline 2.8 percent and lose 29,000 jobs by 2016. Agricultural workers, including farmworkers and laborers, will account for nearly 3 out of 4 lost jobs in this group. The number of fishing and hunting workers is expected to decline by 16.2 percent, while the number of forest, conservation, and logging workers is expected to decline by 1.4 percent.

Production occupations. Production workers are employed mainly in manufacturing, where they assemble goods and operate plants. Production occupations are expected to decline by 4.9 percent, losing 528,000 jobs by 2016. Some jobs will be created in production occupations, mostly in food processing and woodworking. Metal workers and plastic workers; assemblers and fabricators; textile, apparel, and furnishings occupations; and other production workers will account for most of the job loss among production occupations.

Among all occupations in the economy, healthcare occupations are expected to make up 7 of the 20 fastest growing occupations, the largest proportion of any occupational group (chart 7). These 7 healthcare occupations, in addition to exhibiting high growth rates, will add nearly 750,000 new jobs between 2006 and 2016. Other occupational groups that have more than one occupation in the 20 fastest growing occupations are computer occupations, personal care and service occupations, community and social services occupations, and business and financial operations occupations. High growth rates among occupations in the top 20 fastest growing occupations reflect projected rapid growth in the health care and social assistance industries and the professional, scientific, and technical services industries.

The 20 occupations listed in chart 8 will account for more than one-third of all new jobs, 6.6 million combined, over the 2006-2016 period. The occupations with the largest numerical increases cover a wider range of occupational categories than do those occupations with the fastest growth rates. Health occupations will account for some of these increases in employment, as will occupations in education, sales, and food service. Occupations in office and administrative services will grow by 1.7 million jobs, one-fourth of the job growth among the 20 occupations with the largest job growth. Many of the occupations listed below are very large, and will create more new jobs than will those with high growth rates. Only 3 out of the 20 fastest growing occupations—home health aides, personal and home care aides, and computer software application engineers—also

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Chart 9. **Occupations with the largest numerical decreases in employment, projected 2006-16**

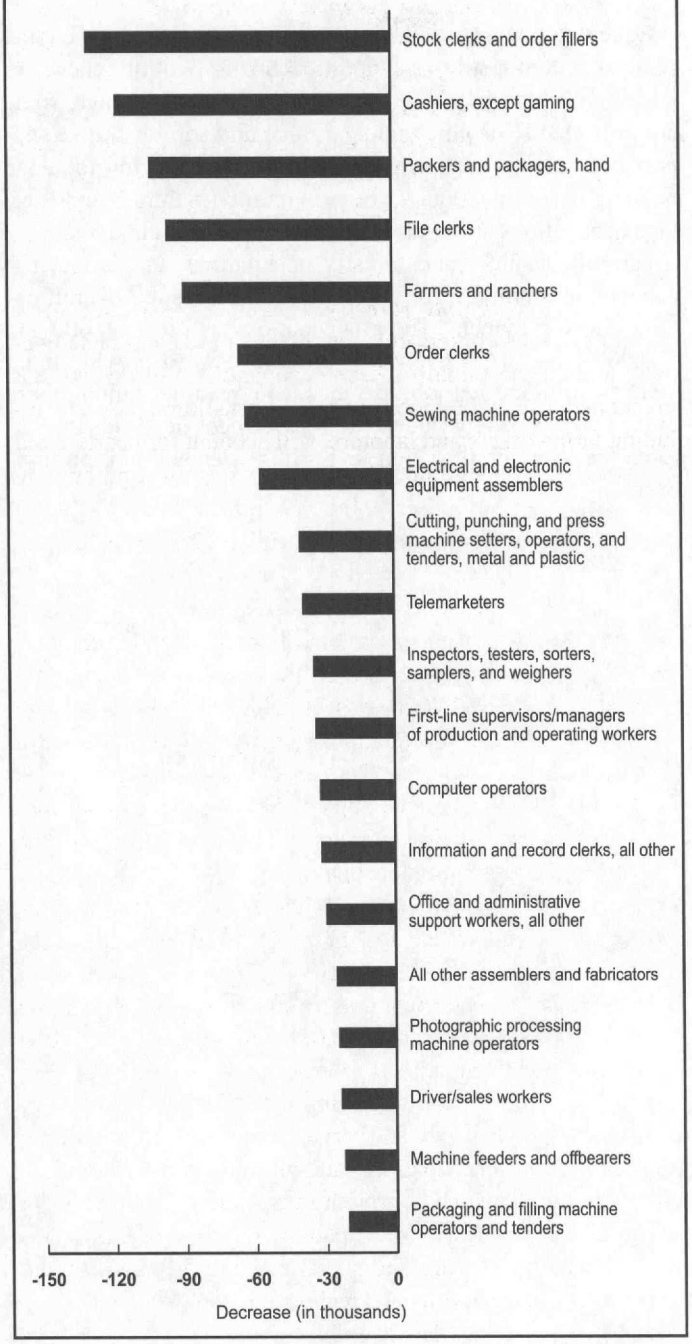
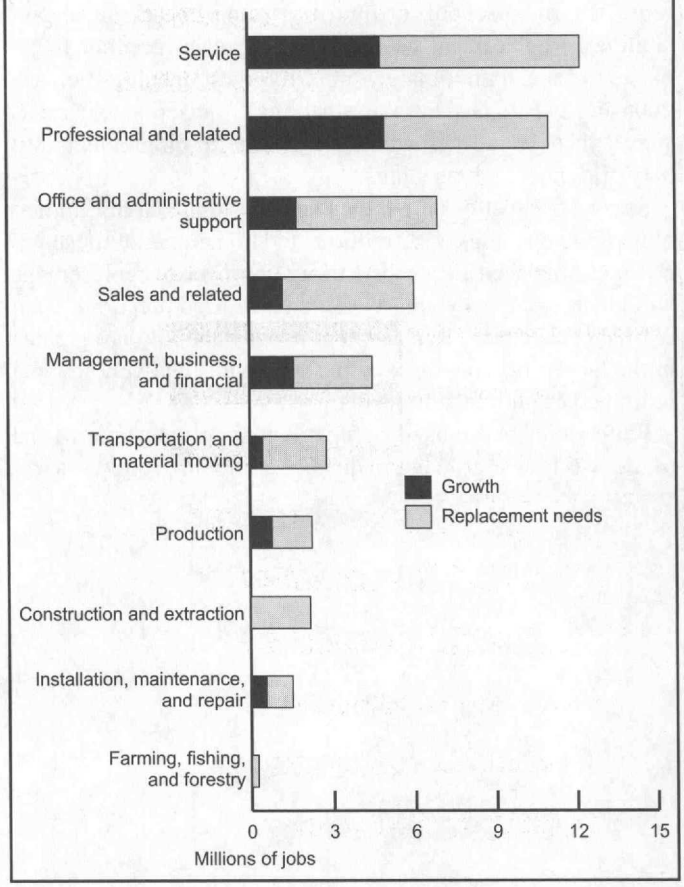


Chart 10. **Number of jobs due to growth and replacement needs by major occupational group, projected 2006-16**



are projected to be among the 20 occupations with the largest numerical increases in employment.

Declining occupational employment stems from declining industry employment, technological advances, changes in business practices, and other factors. For example, installation of self-checkouts and other forms of automation will increase productivity and are expected to contribute to a decline of 118,000 cashiers over the 2006-2016 period (chart 9). Fourteen of the 20 occupations with the largest numerical decreases are either production occupations or office and administrative support occupations, which are affected by increasing plant and factory automation and the implementation of office technology that reduces the need for these workers. The difference between the office and administrative occupations that are expected to experience the largest declines and those that are expected to see the largest increases is the extent to which job functions can be easily automated or performed by other workers. For instance, the duties of executive secretaries and administrative assistants involve a great deal of personal interaction that cannot be automated, while the duties of file clerks—adding, locating, and removing business records—can be automated or performed by other workers.

Education and training

For 12 of the 20 fastest growing occupations, an associate degree or higher is the most significant level of postsecondary education or training. On-the-job training is the most significant level of postsecondary education or training for another 6 of the 20 fastest growing occupations. In contrast, on-the-job training is the most significant level of postsecondary education or training for 12 of the 20 occupations with the largest numerical increases, while 6 of these 20 occupations have an associate degree or higher as the most significant level of postsecondary education or training. On-the-job training is the most significant level of postsecondary education or training for 19 of the 20 occupations with the largest numerical decreases. Table 1 lists the fastest growing occupations and occupations projected to have the largest numerical increases in employment between 2006 and 2016, by level of postsecondary education or training.

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Total job openings

Job openings stem from both employment growth and replacement needs (chart 10). Replacement needs arise as workers leave occupations. Some transfer to other occupations while others retire, return to school, or quit to assume household responsibilities. Replacement needs are projected to account for 68 percent of the approximately 50 million job openings between 2006 and 2016. Thus, even occupations projected to experience slower than average growth or to decline in employment still may offer many job openings.

Service occupations are projected to have the largest number of total job openings, 12.2 million, and 60 percent of those will be due to replacement needs. A large number of replacements will be necessary as young workers leave food preparation and service occupations. Replacement needs generally are greatest in the largest occupations and in those with relatively low pay or limited training requirements.

Professional and related occupations are projected to be one of the two fastest growing major occupational groups, and are expected to add more jobs than any other major occupational group, about 5 million, by 2016. However, the majority of job openings are expected to come from more than 6 million replacements.

Office automation will significantly affect many individual office and administrative support occupations. While these occupations are projected to grow about as fast as average, some are projected to decline rapidly. Office and administrative support occupations are projected to create 6.9 million total job openings over the 2006-2016 period, ranking third behind service occupations and professional and related occupations.

Farming, fishing, and forestry occupations and production occupations should offer job opportunities despite overall declines in employment. These occupations will lose 29,000 and 528,000 jobs, respectively, but are expected to provide more than 2.4 million total job openings. Job openings among these groups will be solely due to the replacement needs of a workforce that is exhibiting high levels of retirement and job turnover.

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Table 1. Fastest growing occupations and occupations projected to have the largest numerical increases in employment between 2006 and 2016, by level of postsecondary education or training

Fastest growing occupations	*Occupations having the largest numerical job growth*
First-professional degree	
Veterinarians	Physicians and surgeons
Pharmacists	Lawyers
Chiropractors	Pharmacists
Physicians and surgeons	Veterinarians
Optometrists	Dentists
Doctoral degree	
Postsecondary teachers	Postsecondary teachers
Computer and information scientists, research	Clinical, counseling, and school psychologists
Medical scientists, except epidemiologists	Medical scientists, except epidemiologists
Biochemists and biophysicists	Computer and information scientists, research
Clinical, counseling, and school psychologists	Biochemists and biophysicists
Master's degree	
Mental health counselors	Clergy
Mental health and substance abuse social workers	Physical therapists
Marriage and family counselors	Mental health and substance abuse social workers
Physical therapists	Educational, vocational, and school counselors
Physician assistants	Rehabilitation counselors
Bachelor's or higher degree, plus work experience	
Actuaries	Management analysts
Education administrators, preschool and child care center/program	Financial managers
Management analysts	Computer and information systems managers
Training and development specialists	Medical and health services managers
Public relations managers	Training and development specialists
Bachelor's degree	
Network systems and data communications analysts	Computer software engineers, applications
Computer software engineers, applications	Accountants and auditors
Personal financial advisors	Business operations specialists, all other
Substance abuse and behavioral disorder counselors	Elementary schoolteachers, except special education
Financial analysts	Computer systems analysts
Associate degree	
Veterinary technologists and technicians	Registered nurses
Physical therapist assistant	Computer support specialists
Dental hygienists	Paralegals and legal assistants
Environmental science and protection technicians, including health	Dental hygienists
Cardiovascular technologists and technicians	Legal secretaries
Postsecondary vocational award	
Makeup artists, theatrical and performance	Nursing aides, orderlies, and attendants
Skin care specialists	Preschool teachers, except special education
Manicurists and pedicurists	Automotive service technicians and mechanics
Fitness trainers and aerobics instructors	Licensed practical and licensed vocational nurses
Preschool teachers, except special education	Hairdressers, hairstylists, and cosmetologists
Work experience in a related occupation	
Sales representatives, services, all other	Executive secretaries and administrative assistants
Gaming managers	Sales representatives, services, all other
Gaming supervisors	Sales representatives, wholesale and manufacturing, except technical and scientific products
Aircraft cargo handling supervisors	First-line supervisors/managers of food preparation and serving workers
Self-enrichment education teachers	First-line supervisors/managers of office and administrative support workers
Long-term on-the-job training	
Audio and video equipment technicians	Carpenters
Interpreters and translators	Cooks, restaurant
Athletes and sports competitors	Police and sheriff's patrol officers
Motorboat mechanics	Plumbers, pipefitters, and steamfitters
Automotive glass installers and repairers	Electricians
Moderate-term on-the-job training	
Medical assistants	Customer service representatives
Social and human service assistants	Bookkeeping, accounting, and auditing clerks
Gaming surveillance officers and gaming investigators	Truck drivers, heavy and tractor-trailer
Pharmacy technicians	Medical assistants
Dental assistants	Maintenance and repair workers, general
Short-term on-the-job training	
Personal and home care aides	Retail salespersons
Home health aides	Combined food preparation and serving workers, including fast food
Gaming and sports book writers and runners	Office clerks, general
Physical therapist aides	Personal and home care aides
Amusement and recreation attendants	Home health aides

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Sources of Career Information

This section identifies some major sources of information on careers. These sources are meant to be used in addition to those listed at the end of each *Handbook* statement, and may provide additional information.

How to best use this information. The sources mentioned in this section offer different types of information. For example, people you know may provide very specific information because they have knowledge of you, your abilities and interests, and your qualifications. Other sources, such as those found in State Sources below, provide information on occupations in each State. Gathering information from a wide range of sources is the best way to determine what occupations may be appropriate for you, and in what geographic regions these occupations are found. The sources of information discussed in this section are not exhaustive, and other sources could prove equally valuable in your career search.

Career information

Like any major decision, selecting a career involves a lot of fact finding. Fortunately, some of the best informational resources are easily accessible. You should assess career guidance materials carefully. Information that seems out of date or glamorizes an occupation—overstates its earnings or exaggerates the demand for workers, for example—should be evaluated with skepticism. Gathering as much information as possible will help you make a more informed decision.

People you know. One of the best resources can be those you know, such as friends and family. They may answer some questions about a particular occupation or put you in touch with someone who has some experience in the field. This personal networking can be invaluable in evaluating an occupation or an employer. These people will be able to tell you about their specific duties and training, as well as what they did or did not like about a job. People who have worked in an occupation locally also may be able to recommend and get you in touch with specific employers.

Employers. This is the primary source of information on specific jobs. Employers may post lists of job openings and application requirements, including the exact training and experience required, starting wages and benefits, and advancement opportunities and career paths.

Informational interviews. People already working in a particular field often are willing to speak with people interested in joining their field. An informational interview will allow you to get good information from experts in a specific career without the pressure of a job interview. These interviews allow you to determine how a certain career may appeal to you while helping you build a network of personal contacts.

Professional societies, trade groups, and labor unions. These groups have information on an occupation or various related occupations with which they are associated or which they actively represent. This information may cover training requirements, earnings, and listings of local employers. These groups may train members or potential members themselves, or may be able to put you in contact with organizations or individuals who perform such training.

Each occupational statement in the *Handbook* concludes with a section on sources of additional information, which lists organizations that may be contacted for more information. Another valuable source for finding organizations associated with occupations is *The Encyclopedia of Associations*, an annual publication that lists trade associations, professional societies, labor unions, and other organizations.

Guidance and career counselors. Counselors can help you make choices about which careers might suit you best. They can help you determine what occupations suit your skills by testing your aptitude for various types of work, and determining your strengths and interests. Counselors can help you evaluate your options and search for a job in your field or help you select a new field altogether. They can also help you determine which educational or training institutions best fit your goals, and find ways to finance them. Some counselors offer other services such as interview coaching, résumé building, and help in filling out various forms. Counselors in secondary schools and postsecondary institutions may arrange guest speakers, field trips, or job fairs.

Common places where guidance and career counselors are employed include:

- High school guidance offices
- College career planning and placement offices
- Placement offices in private vocational or technical schools and institutions
- Vocational rehabilitation agencies
- Counseling services offered by community organizations
- Private counseling agencies and private practices
- State employment service offices

When using a private counselor, check to see that the counselor is experienced. One way to do so is to ask people who have used their services in the past. The National Board of Certified Counselors and Affiliates is an institution which accredits career counselors. To verify the credentials of a career counselor and to find a career counselor in your area, contact:

➤ National Board for Certified Counselor and Affiliates, 3 Terrace Way, Suite D, Greensboro, NC 27403-3660. Internet: **http://www.nbcc.org/cfind**

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Postsecondary institutions. Colleges, universities, and other postsecondary institutions may put a lot of effort into helping place their graduates in good jobs, because the success of their graduates may indicate the quality of their institution and may affect the institution's ability to attract new students. Postsecondary institutions typically have career centers with libraries of information on different careers, listings of related jobs, and alumni contacts in various professions. Career centers frequently employ career counselors who generally provide their services only to their students and alumni. Career centers can help you build your résumé, find internships and co-ops—which can lead to full-time positions—and tailor your course selection or program to make you a more attractive job applicant.

Local libraries. Libraries can be an invaluable source of information. Since most areas have libraries, they can be a convenient place to look for information. Also, many libraries provide access to the Internet and e-mail.

Libraries may have information on job openings, locally and nationally; potential contacts within occupations or industries; colleges and financial aid; vocational training; individual businesses or careers; and writing résumés. Libraries frequently have subscriptions to various trade magazines that can provide information on occupations and industries. Your local library also may have video materials. These sources often have references to organizations which can provide additional information about training and employment opportunities.

If you need help getting started or finding a resource, ask your librarian for assistance.

Internet resources. With the growing popularity of the Internet, a wide verity of career information has become easily accessible. Many online resources include job listings, résumé posting services, and information on job fairs, training, and local wages. Many of the resources listed elsewhere in this section have Internet sites that include valuable information on potential careers. Since no single source contains all information on an occupation, field, or employer, you will likely need to use a variety of sources.

When using Internet resources, be sure that the organization is a credible, established source of information on the particular occupation. Individual companies may include job listings on their Web sites, and may include information about required credentials, wages and benefits, and the job's location. Contact information, such as whom to call or where to send a résumé, is usually included.

Some sources exist primarily as a Web service. These services often have information on specific jobs, and can greatly aid in the job hunting process. Some commercial sites offer these services, as do Federal, State, and some local governments. *Career OneStop*, a joint program by the Department of Labor and the States as well as local agencies, provides these services free of charge.

Online Sources from the Department of Labor. A major portion of the U.S. Department of Labor's Labor Market Information System is the Career OneStop site. This site includes:

- *State Job Banks* allow you to search over a million job openings listed with State employment agencies.
- *America's Career InfoNet* provides data on employment growth and wages by occupation; the knowledge, skills, and abilities required by an occupation; and links to employers.
- *America's Service Locator* is a comprehensive database of career centers and information on unemployment benefits, job training, youth programs, seminars, educational opportunities, and disabled or older worker programs.

Career OneStop, along with the National Toll free Helpline (877-USA-JOBS) and the local One-Stop Career Centers in each State, combine to provide a wide range of workforce assistance and resources:

➤ Career OneStop. Internet: **http://www.careeronestop.org**

Use the O*NET numbers at the start of each *Handbook* statement to find more information on specific occupations:

➤ O*NET Online. Internet: **http://www.onetcenter.org**

Provided in collaboration with the U.S. Department of Education, *Career Voyages* has information on certain high-demand occupations:

➤ Career Voyages. Internet: **http://www.careervoyages.gov**

The Department of Labor's Bureau of Labor Statistics publishes a wide range of labor market information, from regional wages for specific occupations to statistics on National, State, and area employment.

➤ Bureau of Labor Statistics. Internet: **http://www.bls.gov**

While the *Handbook* discusses careers from an occupational perspective, a companion publication—*Career Guide to Industries*—discusses careers from an industry perspective. The *Career Guide* is also available at your local career center and library:

➤ *Career Guide to Industries.*
Internet: **http://www.bls.gov/oco/cg/home.htm**

For information on occupational wages:

➤ Wage Data. Internet: **http://www.bls.gov/bls/blswage.htm**

For information on training, workers' rights, and job listings:

➤ Education and Training Administration.
Internet: **http://www.doleta.gov/jobseekers**

Organizations for specific groups. Some organizations provide information designed to help specific groups of people. Consult directories in your library's reference center or a career guidance office for information on additional organizations associated with specific groups.

Disabled workers:

State counseling, training, and placement services for those with disabilities are available from:

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- State Vocational Rehabilitation Agency. Internet: **http://wdcrobcolp01.ed.gov/Programs/EROD**

Information on employment opportunities, transportation, and other considerations for people with all types of disabilities is available from:

- National Organization on Disability, 910 Sixteenth St. NW., Suite 600, Washington, DC 20006. Telephone: (202) 293-5960. TTY: (202) 293-5968. Internet: **http://www.nod.org/economic**

For information on making accommodations in the work place for people with disabilities:

- Job Accommodation Network (JAN), P.O. Box 6080, Morgantown, WV 26506. Internet: **http://www.jan.wvu.edu**

A comprehensive Federal Web site of disability-related resources is accessible at:

Blind workers:

Information on the free national reference and referral service for the blind can be obtained by contacting:

- National Federation of the Blind, Job Opportunities for the Blind (JOB), 1800 Johnson St., Baltimore, MD 21230. Telephone: (410) 659-9314. Internet: **http://www.nfb.org**

Older workers:

- National Council on the Aging, 1901 2nd St. NW., 4th Floor., Washington, DC 20036. Telephone: (202) 479-1200. Internet: **http://www.ncoa.org**
- National Caucus and Center on Black Aged, Inc., Senior Employment Programs, 1220 L St. NW., Suite 800, Washington, DC 20005. Telephone: (202) 637-8400. Fax: (202) 347-0895. Internet: **http://www.ncba-aged.org**

Veterans:

Contact the nearest regional office of the U.S. Department of Labor's Veterans Employment and Training Service or:

- Credentialing Opportunities Online (COOL), which explains how military personnel can meet civilian certification and license requirements related to their Military Occupational Specialty (MOS). Internet: **http://www.cool.army.mil/index.htm**

Women:

- Department of Labor, Women's Bureau, 200 Constitution Ave. NW., Washington, DC 20210. Telephone: (800) 827-5335. Internet: **http://www.dol.gov/wb**

Federal laws, executive orders, and selected Federal grant programs bar discrimination in employment based on race, color, religion, sex, national origin, age, and handicap. Information on how to file a charge of discrimination is available from U.S. Equal Employment Opportunity Commission offices around the country. Their addresses and telephone numbers are listed in telephone directories under U.S. Government, EEOC. Telephone: (800) 669-4000. TTY: (800) 669-6820). Internet: **http://www.eeoc.gov**

Office of Personnel Management. Information on obtaining civilian positions within the Federal Government is available from the U.S. Office of Personnel Management through USAJobs, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result.

- USA Jobs: **http://www.usajobs.opm.gov**

Military. The military employs and has information on hundreds of occupations. Information is available on the Montgomery G.I. Bill, which provides money for school and educational debt repayments. Information on military service can be provided by your local recruiting office. Also see the *Handbook* statement on Job Opportunities in the Armed Forces. You will find more information on careers in the military at:

- Today's Military. Internet: **http://www.todaysmilitary.com**

State Sources. Most States have career information delivery systems (CIDS), which may be found in secondary and postsecondary institutions, as well as libraries, job training sites, vocational-technical schools, and employment offices. A wide range of information is provided, from employment opportunities to unemployment insurance claims.

Whereas the *Handbook* provides information for occupations on a national level, each State has detailed information on occupations and labor markets within their respective jurisdictions. State occupational projections are available at: **http://www.projectionscentral.com**

Alabama
Labor Market Information Division, Alabama Department of Industrial Relations, 649 Monroe St., Room 422, Montgomery, AL 36131. Telephone: (334) 242-8859. Internet: **http://dir.alabama.gov**

Alaska
Research and Analysis Section, Department of Labor and Workforce Development, P.O. Box 25501, Juneau, AK 99802-5501. Telephone: (907) 465-4500. Internet: **http://www.jobs.state.ak.us**

Arizona
Arizona Department of Economic Security, P.O. Box 6123 SC 733A, Phoenix, AZ 85005-6123. Telephone: (602) 542-5984. Internet: **http://www.workforce.az.gov**

Arkansas
Labor Market Information, Department of Workforce Services, #2 Capital Mall, Little Rock, AR 72201. Telephone: (501) 682-3198. Internet: **http://www.arkansas.gov/esd**

California
State of California Employment Development Department, Labor Market Information Division, P.O. Box 826880, Sacramento, CA 94280-0001. Telephone: (916) 262-2162. Internet: **http://www.labormarketinfo.edd.ca.gov**

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Colorado

Labor Market Information, Colorado Department of Labor and Employment, 633 17th St., Suite 201, Denver, CO 80202-3660. Telephone: (303) 318-8000. Internet: **http://www.coworkforce.com/lmi**

Connecticut

Office of Research, Connecticut Department of Labor, 200 Folly Brook Blvd., Wethersfield, CT 06109-1114. Telephone: (860) 263-6275. Internet: **http://www.ctdol.state.ct.us/lmi**

Delaware

Office of Occupational and Labor Market Information, Department of Labor, 19 West Lea Blvd., Wilmington, DE 19802-. Telephone: (302) 761-8069.
Internet: **http://www.delawareworks.com/oolmi/welcome.shtml**

District of Columbia

DC Department of Employment Services, 609 H St. NE., Washington, D.C. 20002. Telephone: (202) 724-7000.
Internet: **http://www.does.dc.gov/does**

Florida

Labor Market Statistics, Agency for Workforce Innovation, MSC G-020, 107 E. Madison St., Tallahassee, FL 32399-4111. Telephone: (850) 245-7205. Internet: **http://www.labormarketinfo.com**

Georgia

Workforce Information and Analysis, Room 300, Department of Labor, 223 Courtland St., CWC Building, Atlanta, GA 30303. Telephone: (404) 232-3875. Internet:
http://www.dol.state.ga.us/em/get_labor_market_information.htm

Guam

Guam Department of Labor, 504 D St., Tiyan, Guam 96910.
Telephone: (671) 475-0101.

Hawaii

Research and Statistics Office, Department of Labor and Industrial Relations, 830 Punchbowl St., Room 304, Honolulu, HI 96813.
Telephone: (808) 586-8999. Internet: **http://www.hiwi.org**

Idaho

Research and Analysis Bureau, Department of Commerce and Labor, 317 West Main St., Boise, ID 83735-0670. Telephone: (208) 332-3570.
Internet: **http://lmi.idaho.gov**

Illinois

Illinois Department of Employment Security, Economic Information and Analysis Division, 33 S. State St., 9th Floor , Chicago, IL 60603.
Telephone: (312) 793-2316. Internet: **http://lmi.ides.state.il.us**

Indiana

Research and Analysis—Indiana Workforce Development, Indiana Government Center South, 10 North Senate Ave., Indianapolis, IN 46204. Telephone: (800) 891-6499. Internet: **http://www.in.gov/dwd**

Iowa

Policy and Information Division, Iowa Workforce Development, 1000 East Grand Ave., Des Moines, IA 50319-0209. Telephone: (515) 281-5116. Internet: **http://www.iowaworkforce.org/lmi**

Kansas

Kansas Department of Labor, Labor Market Information Services, 401 SW Topeka Blvd., Topeka, KS 66603-3182. Telephone: (785) 296-5000. Internet: **http://laborstats.dol.ks.gov**

Kentucky

Research and Statistics Branch, Office of Employment and Training, 275 East Main St., Frankfort, KY 40621. Telephone: (502) 564-7976.
Internet: **http://www.workforcekentucky.ky.gov**

Louisiana

Research and Statistics Division, Department of Labor, 1001 North 23rd St., Baton Rouge, LA 70802-3338. Telephone: (225) 342-3111.
Internet: **http://www.laworks.net**

Maine

Labor Market Information Services Division, Maine Department of Labor, State House Station 54, P.O. Box 259 45 Commerce Dr., Augusta, ME 04330. Telephone: (207) 621-5182.
Internet: **http://www.state.me.us/labor/lmis/index.html**

Maryland

Maryland Department of Labor Licensing and Regulation, Office of Labor Market Analysis and Information, Room 316, 1100 N. Eutaw, Baltimore, MD 21201. Telephone: (410) 767-2250. Internet:
http://www.dllr.state.md.us/lmi/index.htm

Massachusetts

Executive Office of Labor and Workforce Development, Division of Career Services, 19 Staniford St., Boston, MA 02114. Telephone: (617) 626-5300. Internet: **http://www.detma.org/LMIdataprog.htm**

Michigan

Bureau of Labor Market Information and Strategic Initiatives, Department of Labor and Economic Growth, 3032 West Grand Blvd., Suite 9-100, Detroit, MI 48202. Telephone: (313) 456-3090.
Internet: **http://www.milmi.org**

Minnesota

Department of Employment and Economic Development, Labor Market Information Office, 1st National Bank Building, 332 Minnesota St., Suite E200, St. Paul, MN 55101-1351. Telephone: (888) 234-1114.
Internet: **http://www.deed.state.mn.us/lmi**

Mississippi

Labor Market Information Division, Mississippi Department of Employment Security , 1235 Echelon Pkwy., P.O. Box 1699, Jackson, MS 39215. Telephone: (601) 321-6000. Internet: **http://mdes.ms.gov**

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Missouri
Missouri Economic Research and Information Center, P.O. Box 3150, Jefferson City, MO 65102-3150. Telephone: (866) 225-8113. Internet: **http://www.missourieconomy.org**

Montana
Research and Analysis Bureau, P.O. Box 1728, Helena, MT 59624. Telephone: (800) 541-3904. Internet: **http://www.ourfactsyourfuture.org**

Nebraska
Nebraska Workforce Development—Labor Market Information, Nebraska Department of Labor, 550 South 16th St., P.O. Box 94600, Lincoln, NE 68509. Telephone: (402) 471-2600.
Internet: **http://www.dol.state.ne.us/nelmi.htm**

Nevada
Research and Analysis, Department of Employment Training and Rehabilitation, 500 East Third St., Carson City, NV 89713. Telephone: (775) 684-0450. Internet: **http://www.nevadaworkforce.com**

New Hampshire
Economic and Labor Market Information Bureau, New Hampshire Employment Security, 32 South Main St., Concord, NH 03301-4857. Telephone: (603) 228-4124. Internet: **http://www.nhes.state.nh.us/elmi**

New Jersey
Division of Labor Market and Demographic Research, Department of Labor and Workforce Development, P.O. Box 388, Trenton, NJ 08625-0388. Telephone: (609) 984-2593.
Internet: **http://www.wnjpin.net**

New Mexico
New Mexico Department of Labor , Economic Research and Analysis, 401 Broadway NE., Albuquerque, NM 87102. Telephone: (505) 222-4683. Internet: **http://www.dws.state.nm.us/dws-lmi.html**

New York
Research and Statistics, New York State Department of Labor, State Office Campus, Room 490, Albany, NY 12240. Telephone: (518) 457-2919.
Internet: **http://www.labor.state.ny.us/workforceindustrydata/index.asp**

North Carolina
Labor Market Information Division, Employment Security Commission, 700 Wade Ave., Raleigh, NC 27605. Telephone: (919) 733-4329. Internet: **http://www.ncesc.com**

North Dakota
Labor Market Information Manager, Job Service North Dakota, 1000 East Divide Ave., Bismarck, ND 58506. Telephone: (800) 732-9787.
Internet: **http://www.ndworkforceintelligence.com**

Ohio
Bureau of Labor Market Information, Office of Workforce Development, Ohio Department of Job and Family Services, P.O. Box 1618, Columbus, OH 43216-1618.Telephone: (614) 752-9494.
Internet: **http://www.ohioworkforceinformer.org**

Oklahoma
Labor Market Information, Oklahoma Employment Security Commission, 2401 N. Lincoln Blvd., Oklahoma City, OK 73105. Telephone: (405) 557-7100.
Internet: **http://www.oesc.state.ok.us/lmi/default.htm**

Oregon
Oregon Employment Department, Research Division, 875 Union St. NE., Salem, OR 97311.Telephone: (503) 947-1200.
Internet: **http://www.qualityinfo.org/olmisj/OlmisZine**

Pennsylvania
Center for Workforce Information & Analysis, Pennsylvania Department of Labor and Industry, 220 Labor and Industry Building, Seventh and Forster Sts., Harrisburg, PA 17121. Telephone: (877) 493-3282. Internet: **http://www.paworkstats.state.pa.us**

Puerto Rico
Labor Market Information Office, P.O. Box 195540, San Juan, Puerto Rico 00919-5540.Telephone: (787) 281-5760. Internet:
http://www.dtrh.gobierno.pr/oficina_procurador_del_trabajo.asp

Rhode Island
Labor Market Information, Rhode Island Department of Labor and Training, 1511 Pontiac Ave., Cranston, RI 02920. Telephone: (401) 462-8740. Internet: **http://www.dlt.ri.gov/lmi**

South Carolina
Labor Market Information Department, South Carolina Employment Security Commission, 631 Hampton St., Columbia, SC 29202. Telephone: (803) 737-2660. Internet: **http://www.sces.org/lmi/index.asp**

South Dakota
Labor Market Information Center, Department of Labor, P.O. Box 4730, Aberdeen, SD 57402-4730. Telephone: (605) 626-2314. Internet: **http://www.state.sd.us/dol/lmic/index.htm**

Tennessee
Research and Statistics Division, Department of Labor and Workforce Development, 710 James Robertson Pkwy., Nashville, TN 37243. Telephone: (615) 741-6642.
Internet: **http://www.state.tn.us/labor-wfd/lmi.htm**

Texas
Labor Market Information, Texas Workforce Commission, 9001 North IH-35, Suite 103A, Austin, TX 75753. Telephone: (866) 938-4444. Internet: **http://www.tracer2.com**

Utah
Director of Workforce Information, Utah Department of Workforce Services, P.O. Box 45249, Salt Lake City, UT 84145-0249. Telephone: (801) 526-9675. Internet: **http://jobs.utah.gov/opencms/wi**

Vermont
Research and Analysis, Vermont Department of Labor, P.O. Box 488, Montpelier, VT 05601-0488. Telephone: (802) 828-4000. Internet: **http://www.labor.vermont.gov**

Virgin Islands
Bureau of Labor Statistics, Department of Labor, P.O. Box 302608, St Thomas, VI 00803-2608.Telephone: (340) 776-3700. Internet: **http://www.vidol.gov**

Virginia
Economic Information Services, Virginia Employment Commission, P.O. Box 1358, Richmond, VA 23218-1358. Telephone: (804) 786-8223. Internet: **http://velma.virtuallmi.com**

Washington
Labor Market and Economic Analysis, Washington Employment Security Department, PO Box 9046, Olympia, WA 98507-9046. Telephone: (800) 215-1617. Internet: **http://www.workforceexplorer.com**

West Virginia
WORKFORCE West Virginia, Research, Information and Analysis Division, 112 California Ave., Charleston, WV 25303-0112. Telephone: (304) 558-2660. Internet: **http://www.wvbep.org/bep/lmi**

Wisconsin
Bureau of Workforce Information, Department of Workforce Development, P.O.Box 7944, Madison, WI 53707-7944. Telephone: (608) 266-8212. Internet: **http://worknet.wisconsin.gov/worknet**

Wyoming
Research and Planning, Wyoming Department of Employment, 246 S. Center St., Casper, WY 82602. Telephone: (307) 473-3807. Internet: **http://doe.state.wy.us/lmi**

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Sources of Education, Training, and Financial Aid

Education can present opportunities for those looking to start a new career or change specialty within their current occupation. This section outlines some major sources of education and training required to enter many occupations, as well as some ways to finance that education or training.

For information on the specific training and educational requirements for a particular occupation, and what training is typically provided by an employer, consult the Training, Other Qualifications, and Advancement section of the appropriate *Handbook* statement.

Sources of Education and Training

Four-year colleges and universities. These institutions provide detailed information on theory and practice for a wide variety of subjects. Colleges and universities can provide students with the knowledge and background necessary to be successful in many fields. They also can help to place students in cooperative education programs—often called "co-ops"—or internships. Co-ops and internships are short-term jobs with firms related to a student's field of study that lead to college credit. In co-ops and internships, students learn the specifics of a job while making valuable contacts that can lead to a permanent position.

For more information on colleges and universities, go to your local library, consult your high school guidance counselor, or contact individual colleges. Also check with your State's higher education agency. A list of these agencies is available on the Internet: **http://wdcrobcolp01.ed.gov/Programs/EROD**.

Junior and community colleges. Junior and community colleges offer a mixture of programs that lead to associate degrees and training certificates. Community colleges tend to be less expensive than 4-year colleges and universities. They usually are more willing to accommodate part-time students than colleges and universities, and their programs are more tailored to the needs of local employers. Many community colleges have an open admissions policy, and they often offer weekend and night classes.

Community colleges often form partnerships with local businesses that allow students to gain job-specific training. For students who may not be able to enroll in a college or university because of their academic record, limited finances, or distance from such an institution, junior or community colleges are often used as a place to earn credits that can be applied toward a degree at a 4-year college. Junior and community colleges also are noted for their extensive role in continuing and adult education.

For more information on junior and community colleges, go to your local library, consult your high school guidance counselor, or contact individual schools. Also check with your State's higher education agency. A list of these agencies is available on the Internet: **http://wdcrobcolp01.ed.gov/Programs/EROD**.

Online colleges and universities. Online colleges and universities offer classes over the Internet that cover most of the same material as their traditional classroom counterparts. Offering classes on the Internet provides a great deal of flexibility to students, allowing many who work, travel frequently, or lack the ability or means to attend a traditional university to earn a degree from an accredited institution.

A prospective student should talk to a guidance counselor or advisor before deciding to enroll in an online college or university. Additionally, the prospective student should check the college or university's accreditation with the U.S. Department of Education. This can be done online at: **http://www.ope.ed.gov/accreditation/Search.asp**.

Vocational and trade schools. These institutions train people in specific trades. They offer courses designed to provide hands-on experience. Vocational and trade schools tend to concentrate on trades, services, and other types of skilled work.

Vocational and trade schools frequently engage students in real-world projects, allowing them to apply field methods while learning theory in classrooms. Graduates of vocational and trade schools have an advantage over informally trained or self-trained job seekers because graduates have an independent organization certifying that they have the knowledge, skills, and abilities necessary to perform the duties of a particular occupation. These schools also help students to acquire any license or other credentials needed to enter the job market.

For more information on vocational and trade schools, go to your local library, consult your high school guidance counselor, or contact individual schools. Also check with your State's director of vocational-technical education. A list of State directors of vocational-technical education is available on the Internet: **http://wdcrobcolp01.ed.gov/Programs/EROD**.

Apprenticeships. An apprenticeship provides work experience as well as education and training for people entering certain occupations. Apprenticeships are offered by sponsors, who employ and train the apprentice. The apprentice follows a training course under close supervision and receives some formal education to learn the theory related to the job.

Apprenticeships are a way for inexperienced people to become skilled workers that generally last between 1 and 4 years. Some apprenticeships allow the apprentice to earn an associate degree. An *Apprenticeship Completion Certificate* is granted to those completing programs. This certificate is administered by federally approved State agencies.

Information on apprenticeships is available from the Office of Apprenticeship Training, Employer, and Labor Services on the Internet: **http://www.doleta.gov/atels_bat**. For assistance finding an apprenticeship program, go to: **http://www.doleta.gov/atels_bat/fndprgm.cfm.**

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Professional societies, trade associations, and labor unions. These groups are made up of people with common interests, usually in related occupations or industries. The groups frequently are able to provide training, access to training through their affiliates, or information on acceptable sources of training for their field. If licensing or certification is required, they also may be able to assist you in meeting those requirements.

For a listing of professional societies, trade associations, and labor unions related to an occupation, check the Sources of Additional Information section at the end of that occupational statement in the *Handbook*.

Employers. Many employers provide on-the-job training, which can range from spending a few minutes watching another employee demonstrate a task to participating in formal training programs that may last for several months. In some jobs, employees may continually undergo training to stay up to date with new developments and technologies, or to add new skills.

Military. The United States Armed Forces trains and employs people in more than 4,100 different occupations. For more information, see the *Handbook* statement on "Job Opportunities in The Armed Forces." For detailed answers to specific questions, contact your local recruiting office. Valuable resources also are available on the Internet: **http://www.todaysmilitary.com.**

Sources of Financial Aid

Many people fund their education or training through financial aid or tuition assistance programs. Federal student aid comes in three forms: grants, work-study programs, and loans. All Federal student aid applicants must first fill out a Free Application for Federal Student Aid (FAFSA), which provides a Student Aid Report (SAR) and eligibility rating. Forms must be submitted to desired institutions of study, which determine the amount of aid you will receive.For information on applying for Federal financial aid, visit the FAFSA Internet site: **http://www.fafsa.ed.gov.**A U.S. Department of Education publication describing Federal financial aid programs, called *The Student Guide,* is available at: **http://www.studentaid.ed.gov/students/publications/student_guide/index.html.** Information on Federal programs is available from: **http://www.studentaid.ed.gov** and **www.students.gov.** Information on State programs is available from your State's higher education agency. A list of these agencies is available at: **http://wdcrobcolp01.ed.gov/Programs/EROD.**

Grants. A grant is money which is given to students or the institution they are attending in order to pay for their education or training and any associated expenses. Grants are usually given on the basis of financial need. Grants are considered gifts and are not paid back. Federal grants are almost exclusively for undergraduate students. They include Pell Grants, which can be worth up to $4,310 annually. Pell Grants of up to $4,800 will be available beginning in July 2008, with further increases to $5,000 and $5,400 available in July 2010 and July 2012, respectively. Federal Supplemental Educational Opportunity Grants (FSEOG) can be worth up to $4,000 annually. Priority for FSEOG awards is given to those who have also received the Pell Grant and have exceptional financial need.

Additional information on grants is available on the Internet: **http://www.studentaid.ed.gov.** Information also is available from your State Higher Education agency. A list of these agencies is available at: **http://wdcrobcolp01.ed.gov/Programs/EROD.**

Federal Work-Study program. The Federal Work-Study program is offered at most institutions and consists of Federal sponsorship of a student who works part time at the institution he or she is attending. The money a student earns through this program goes directly toward the cost of attending the institution. There are no set minimum or maximum amounts for this type of aid, although, on average, a student can expect to earn about $2,000 per school year.

For additional information on work-study opportunities offered, check with individual institutions. General information on the Federal Work-Study program is available at: **http://www.studentaid.ed.gov/students/publications/student_guide/2005-2006/english/types-fed-workstudy.htm**.

Scholarships. A scholarship is a sum of money donated to a student to help pay for his or her education or training and any associated costs. Scholarships can range from small amounts up to the full cost of schooling. They are based on financial need, academic merit, athletic ability, or a wide variety of other criteria set by the organizations that provide the scholarships. Frequently, students must meet minimum academic requirements to be considered for a scholarship. Other qualifying requirements—such as intended major field of study, heritage, or group membership—may be added by the organization providing the scholarship.

Scholarships are provided by a wide variety of institutions, including educational institutions, State and local governments, private associations, social groups, and individuals. There are no federally awarded scholarships based on academic merit. Most large scholarships are awarded to students by the institution they plan to attend. Students who have received State scholarships and plan to attend a school in another State should check with their State to see if the scholarship can be transferred.

Information on scholarships is typically available from high school guidance counselors and local libraries. Additional scholarship information is available from State higher education agencies. A list of these agencies is available at: **http://wdcrobcolp01.ed.gov/Programs/EROD**. The College Board has information on available scholarships at: **http://www.collegeboard.com/pay**.

Student loans. Many institutions, both public and private, provide low-interest loans to students and their parents or guardians. The Federal Government also provides several types of student loans based on the applicant's level of financial need. The amount of money a student can receive in loans varies by the distributing institution and depends on whether the student is claimed by a parent or guardian as a dependent. Since the process of applying for a loan may take several months, it is a good idea to start applying for Federal student loans well in advance.

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The available Federal loan programs can accommodate prospective undergraduate, graduate, vocational, and disabled students. Federal loans can be distributed through the school that the student is attending, from the Federal Government directly, or from a third-party private lender or bank. Perkins loans are distributed through the school the student is attending. Loans coming from the Federal Government directly from the William D. Ford Federal Direct Loan Program are dispersed by the Department of Education. Third-party loans through a private lender or bank are from the Federal Family Education Loan (FFEL) program. For all federally funded loans, payments are made to the institution that originally dispersed the funds.

For those with financial need, Federal Perkins loans and both Direct and FFEL-subsidized Stafford loans are available. Perkins loans have no minimum amount; they are capped at $4,000 per year for undergraduates, but will be increasing to $6,000 a year by 2012. Students should visit the Department of Education's Web site (**http://www.studentaid.ed.gov/PORTALSWebApp/students/english/fafsa.jsp**) to learn about the current level of aid available because it will vary by year and a student's status (married, single, dependent, or independent). Subsidized Stafford loans vary in size and can increase as a student completes more years of undergraduate, graduate, or professional education. Interest rates for both loans will be gradually decreasing until 2012. Information on specific interest rates is available through the school's financial aid officer or the Department of Education's Web site. Those with Perkins loans are not responsible for starting to repay the loan until they have been out of school for 9 months. Those with subsidized Stafford loans must begin payments within 6 to 9 months of leaving school but are not charged monthly interest while in school.

For those who do not demonstrate financial need, Direct and FFEL-unsubsidized Stafford Loans and Federal Parent Loans for Students (PLUS) are available. Unsubsidized Stafford loans vary in value and are capped at the cost of attendance. With Federal unsubsidized Stafford Loans, interest payments start almost immediately and can be paid monthly or accrued until the completion of studies. The latter option results in a larger total loan cost but may be more convenient for some students. With PLUS loans, the parent must pay interest and principal payments while the student is enrolled in school and must continue payments after completion. Check with your lender for available repayment schedules. Students usually have 10 years to repay Perkins loans and from 10 to 30 years for unsubsidized Stafford loans.

Subsidized and unsubsidized Stafford loans are only available to students who are enrolled in an academic program at least half time. As with any loan, be sure to investigate different lenders, and understand what your loan contract requires of you before agreeing to any loan. Check with established financial institutions to compare the terms of available private student loans. Comparisons of the various types of loans are available on the Internet: **http://www.studentaid.ed.gov/students/publications/student_guide/index.html**. The College Board has information on available loans at: **http://www.collegeboard.com/pay**.

Employer tuition support programs. Some employers offer tuition assistance programs as part of their employee benefits package. The terms of these programs depend on the firm and can vary by the type and amount of training subsidized, as well as by eligibility requirements. Consult your human resources department for information on tuition support programs offered by your employer.

Military tuition support programs. The United States Armed Forces offer various tuition assistance and loan repayment programs for military personnel. See the *Handbook* statement on "Job Opportunities in the Armed Forces" for more information. Also go to: **http://www.todaysmilitary.com/app/tm/get/collegehelp/support**.

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Finding and Applying for Jobs and Evaluating Offers

Finding—and getting—a job you want can be a challenging process, but knowing more about job search methods and application techniques can increase your chances of success. And knowing how to judge the job offers you receive makes it more likely that you will end up with the best possible job.

Where to learn about job openings

Personal contacts
School career planning and placement offices
Employers
Classified ads
—National and local newspapers
—Professional journals
—Trade magazines
Internet resources
Professional associations
Labor unions
State employment service offices
Federal Government
Community agencies
Private employment agencies and career consultants
Internships

Job search methods

Finding a job can take months of time and effort. But you can speed the process by using many methods to find job openings. Data from the Bureau of Labor Statistics suggest that people who use many job search methods find jobs faster than people who use only one or two.

In the box above, some sources of job openings are listed. Those sources are described more fully below.

Personal contacts. Many jobs are never advertised. People get them by talking to friends, family, neighbors, acquaintances, teachers, former coworkers, and others who know of an opening. Be sure to tell people that you are looking for a job because the people you know may be some of the most effective resources for your search. To develop new contacts, join student, community, or professional organizations.

School career planning and placement offices. High school and college placement offices help their students and alumni find jobs. Some invite recruiters to use their facilities for interviews or career fairs. They also may have lists of open jobs. Most also offer career counseling, career testing, and job search advice. Some have career resource libraries; host workshops on job search strategy, resume writing, letter writing, and effective interviewing; critique drafts of resumes; conduct mock interviews; and sponsor job fairs.

Employers. Directly contacting employers is one of the most successful means of job hunting. Through library and Internet research, develop a list of potential employers in your desired career field. Then call these employers and check their Web sites for job openings. Web sites and business directories can tell you how to apply for a position or whom to contact. Even if no open positions are posted, do not hesitate to contact the employer: You never know when a job might become available. Consider asking for an informational interview with people working in the career you want to learn more. Ask them how they got started, what they like and dislike about the work, what type of qualifications are necessary for the job, and what type of personality succeeds in that position. In addition to giving you career information, they may be able to put you in contact with other people who might hire you, and they can keep you in mind if a position opens up.

Classified ads. The "Help Wanted" ads in newspapers and the Internet list numerous jobs, and many people find work by responding to these ads. But when using classified ads, keep the following in mind:

- Follow all leads to find a job; do not rely solely on the classifieds.
- Answer ads promptly, because openings may be filled quickly, even before the ad stops appearing in the paper.
- Read the ads every day, particularly the Sunday edition, which usually includes the most listings.
- Keep a record of all ads to which you have responded, including the specific skills, educational background, and personal qualifications required for the position.

Internet resources. The Internet includes many job hunting Web sites with job listings. Some job boards provide National listings of all kinds; others are local. Some relate to a specific type of work; others are general. To find good prospects, begin with an Internet search using keywords related to the job you want. Also look for the sites of related professional associations.

Also consider checking Internet forums, also called message boards. These are online discussion groups where anyone may post and read messages. Use forums specific to your profession or to career-related topics to post questions or messages and to read about the job searches or career experiences of other people.

In online job databases, remember that job listings may be posted by field or discipline, so begin your search using keywords. Many Web sites allow job seekers to post their resumes online for free.

Professional associations. Many professions have associations that offer employment information, including career planning, educational programs, job listings, and job placement. To use these services, associations usually require that you be a mem-

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ber; information can be obtained directly from an association through the Internet, by telephone, or by mail.

Labor unions. Labor unions provide various employment services to members and potential members, including apprenticeship programs that teach a specific trade or skill. Contact the appropriate labor union or State apprenticeship council for more information.

State employment service offices. The State employment service, sometimes called the Job Service, operates in coordination with the U.S. Department of Labor's Employment and Training Administration. Local offices, found nationwide, help job seekers to find jobs and help employers to find qualified workers at no cost to either. To find the office nearest you, look in the State government telephone listings under "Job Service" or "Employment."

Job matching and referral. At the State employment service office, an interviewer will determine if you are "job ready" or if you need help from counseling and testing services to assess your occupational aptitudes and interests and to help you choose and prepare for a career. After you are job ready, you may examine available job listings and select openings that interest you. A staff member can then describe the job openings in detail and arrange for interviews with prospective employers.

Services for special groups. By law, veterans are entitled to priority job placement at State employment service centers. If you are a veteran, a veterans' employment representative can inform you of available assistance and help you to deal with problems.

State employment service offices also refer people to opportunities available under the Workforce Investment Act (WIA) of 1998. Educational and career services and referrals are provided to employers and job seekers, including adults, dislocated workers, and youth. These programs help to prepare people to participate in the State's workforce, increase their employment and earnings potential, improve their educational and occupational skills, and reduce their dependency on welfare.

Federal Government. Information on obtaining a position with the Federal Government is available from the U.S. Office of Personnel Management (OPM) through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result.

Community agencies. Many nonprofit organizations, including religious institutions and vocational rehabilitation agencies, offer counseling, career development, and job placement services, generally targeted to a particular group, such as women, youths, minorities, ex-offenders, or older workers.

Private employment agencies and career consultants. Private agencies can save you time and they will contact employers who otherwise might be difficult to locate. But these agencies may charge for their services. Most operate on a commission basis, charging a percentage of the first-year salary paid to a successful applicant. You or the hiring company will pay the fee. Find out the exact cost and who is responsible for paying associated fees before using the service. When determining if the service is worth the cost, consider any guarantees that the agency offers.

Internships. Many people find jobs with business and organizations with whom they have interned or volunteered. Look for internships and volunteer opportunities on job boards, career centers, and company and association Web sites, but also check community service organizations and volunteer opportunity databases. Some internships and long-term volunteer positions come with stipends and all provide experience and the chance to meet employers and other good networking contacts.

Applying for a job

After you have found some jobs that interest you, the next step is to apply for them. You will almost always need to complete resumes or application forms and cover letters. Later, you will probably need to go on interviews to meet with employers face to face.

Resumes and application forms. Resumes and application forms give employers written evidence of your qualifications and skills. The goal of these documents is to prove—as clearly and directly as possible—how your qualifications match the job's requirements. Do this by highlighting the experience, accomplishments, education, and skills that most closely fit the job you want.

Gathering information. Resumes and application forms both include the same information. As a first step, gather the following facts:

- Contact information, including your name, mailing address, e-mail address (if you have one you check often), and telephone number.
- Type of work or specific job you are seeking or a qualifications summary, which describes your best skills and experience in just a few lines.
- Education, including school name and its city and State, months and years of attendance, highest grade completed or diploma or degree awarded, and major subject or subjects studied. Also consider listing courses and awards that might be relevant to the position. Include a grade point average if you think it would help in getting the job.
- Experience, paid and volunteer. For each job, include the job title, name and location of employer, and dates of employment. Briefly describe your job duties and major accomplishments. In a resume, use phrases instead of sentences to describe your work; write, for example, "Supervised 10 children" instead of writing "I supervised 10 children."
- Special skills. You might list computer skills, proficiency in foreign languages, achievements, or and membership in organizations in a separate section.

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- References. Be ready to provide references if requested. Good references could be former employers, coworkers, or teachers or anyone else who can describe your abilities and job-related traits. You will be asked to provide contact information for the people you choose.

Throughout the application or resume, focus on accomplishments that relate most closely to the job you want. You can even use the job announcement as a guide, using some of the same words and phrases to describe your work and education.

Look for concrete examples that show your skills. When describing your work experience, for instance, you might say that you increased sales by 10 percent, finished a task in half the usual time, or received three letters of appreciation from customers.

Choosing a format. After gathering the information you want to present, the next step is to put it in the proper format. In an application form, the format is set. Just fill in the blanks. But make sure you fill it out completely and follow all instructions. Do not omit any requested information. Consider making a copy of the form before filling it out, in case you make a mistake and have to start over. If possible, have someone else look over the form before submitting it.

In a resume, there are many ways of organizing the information you want to include, but the most important information should usually come first. Most applicants list their past jobs in reverse chronological order, describing their most recent employment first and working backward. But some applicants use a functional format, organizing their work experience under headings that describe their major skills. They then include a brief work history section that lists only job titles, employers, and dates of employment. Still other applicants choose a format that combines these two approaches in some way. Choose the style that best showcases your skills and experience.

Whatever format you choose, keep your resume short. Many experts recommend that new workers use a one-page resume. Avoid long blocks of text and italicized material. Consider using bullets to highlight duties or key accomplishments.

Before submitting your resume, make sure that it is easy to read. Are the headings clear and consistently formatted with bold or some other style of type? Is the type face large enough? Then, ask at least two people to proofread the resume for spelling and other errors and make sure you use your computer's spell checker.

Keep in mind that many employers scan resumes into databases, which they then search for specific keywords or phrases. The keywords are usually nouns referring to experience, education, personal characteristics, or industry buzz words. Identify keywords by reading the job description and qualifications in the job ad; use these same words in your resume. For example, if the job description includes customer service tasks, use the words "customer service" on your resume. Scanners sometimes misread paper resumes, which could mean some of your keywords don't get into the database. So, if you know that your resume will be scanned, and you have the option, e-mail an electronic version. If you must submit a paper resume, make it scannable by using a simple font and avoiding underlines, italics, and graphics. It is also a good idea to send a traditionally formatted resume along with your scannable resume, with a note on each marking its purpose.

Cover letters. When sending a resume, most people include a cover letter to introduce themselves to the prospective employer. Most cover letters are no more than three short paragraphs. Your cover letter should capture the employer's attention, follow a business letter format, and usually should include the following information:

- Name and address of the specific person to whom the letter is addressed.
- Reason for your interest in the company or position.
- Your main qualifications for the position.
- Request for an interview.
- Your home and work telephone numbers.

If you send a scannable resume, you should also include a scannable cover letter, which avoids graphics, fancy fonts, italics, and underlines.

As with your resume, it may be helpful to look for examples on the Internet or in books at your local library or bookstore, but be sure not to copy letters directly from other sources.

Interviewing. An interview gives you the opportunity to showcase your qualifications to an employer, so it pays to be well prepared. The accompanying box provides some helpful hints.

Evaluating a job offer

Once you receive a job offer, you must decide if you want the job. Fortunately, most organizations will give you a few days to accept or reject an offer.

There are many issues to consider when assessing a job offer. Will the organization be a good place to work? Will the job be interesting? Are there opportunities for advancement? Is the salary fair? Does the employer offer good benefits? Now is the time to ask the potential employer about these issues—and to do some checking on your own.

The organization. Background information on an organization can help you to decide whether it is a good place for you to work. Factors to consider include the organization's business or activity, financial condition, age, size, and location.

You generally can get background information on an organization, particularly a large organization, on its Internet site or by telephoning its public relations office. A public company's annual report to the stockholders tells about its corporate philosophy, history, products or services, goals, and financial status. Most government agencies can furnish reports that describe their programs and missions. Press releases, company newsletters or magazines, and recruitment brochures also can be useful. Ask the organization for any other items that might interest a prospective employee. If possible, speak to current or former employees of the organization.

Background information on the organization may be available at your public or school library. If you cannot get an annual report, check the library for reference directories that may provide basic facts about the company, such as earnings, products and services, and number of employees. Some directories

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Job interview tips

Preparation:
Learn about the organization.
Have a specific job or jobs in mind.
Review your qualifications for the job.
Be ready to briefly describe your experience, showing how it relates it the job.
Be ready to answer broad questions, such as "Why should I hire you?" "Why do you want this job?" "What are your strengths and weaknesses?"
Practice an interview with a friend or relative.

Personal appearance:
Be well groomed.
Dress appropriately.
Do not chew gum or smoke.

The interview:
Be early.
Learn the name of your interviewer and greet him or her with a firm handshake.
Use good manners with everyone you meet.
Relax and answer each question concisely.
Use proper English—avoid slang.
Be cooperative and enthusiastic.
Use body language to show interest—use eye contact and don't slouch.
Ask questions about the position and the organization, but avoid questions whose answers can easily be found on the company Web site.
Also avoid asking questions about salary and benefits unless a job offer is made.
Thank the interviewer when you leave and shake hands.
Send a short thank you note.

Information to bring to an interview:
Social Security card.
Government-issued identification (driver's license).
Resume or application. Although not all employers require a resume, you should be able to furnish the interviewer information about your education, training, and previous employment.
References. Employers typically require three references. Get permission before using anyone as a reference. Make sure that they will give you a good reference. Try to avoid using relatives as references.
Transcripts. Employers may require an official copy of transcripts to verify grades, coursework, dates of attendance, and highest grade completed or degree awarded.

widely available in libraries either in print or as online databases include:

- *Dun & Bradstreet's Million Dollar Directory*
- *Standard and Poor's Register of Corporations*
- *Mergent's Industry Review (formerly Moody's Industrial Manual)*
- *Thomas Register of American Manufacturers*
- *Ward's Business Directory*

Stories about an organization in magazines and newspapers can tell a great deal about its successes, failures, and plans for the future. You can identify articles on a company by looking under its name in periodical or computerized indexes in libraries, or by using one of the Internet's search engines. However, it probably will not be useful to look back more than 2 or 3 years.

The library also may have government publications that present projections of growth for the industry in which the organization is classified. Long-term projections of employment and output for detailed industries, covering the entire U.S. economy, are developed by the Bureau of Labor Statistics and revised every 2 years. (See the *Career Guide to Industries*, online at **http://www.bls.gov/oco/cg**.) Trade magazines also may include articles on the trends for specific industries.

Career centers at colleges and universities often have information on employers that is not available in libraries. Ask a career center representative how to find out about a particular organization.

During your research consider the following questions:

Does the organization's business or activity match your own interests and beliefs?
It is easier to apply yourself to the work if you are enthusiastic about what the organization does.

How will the size of the organization affect you?
Large firms generally offer a greater variety of training programs and career paths, more managerial levels for advancement, and better employee benefits than do small firms. Large employers also may have more advanced technologies. However, many jobs in large firms tend to be highly specialized.

Jobs in small firms may offer broader authority and responsibility, a closer working relationship with top management, and a chance to clearly see your contribution to the success of the organization.

Should you work for a relatively new organization or one that is well established?
New businesses have a high failure rate, but for many people, the excitement of helping to create a company and the potential for sharing in its success more than offset the risk of job loss. However, it may be just as exciting and rewarding to work for a young firm that already has a foothold on success.

The job. Even if everything else about the job is attractive, you will be unhappy if you dislike the day-to-day work. Determining in advance whether you will like the work may be difficult. However, the more you find out about the job before accepting or rejecting the offer, the more likely you are to make the right choice. Consider the following questions:

Where is the job located?

If the job is in another section of the country, you need to consider the cost of living, the availability of housing and transportation, and the quality of educational and recreational facilities in that section of the country. Even if the job location is in your area, you should consider the time and expense of commuting.

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Does the work match your interests and make good use of your skills?

The duties and responsibilities of the job should be explained in enough detail to answer this question.

How important is the job to the company or organization?

An explanation of where you fit in the organization and how you are supposed to contribute to its overall goals should give you an idea of the job's importance.

What will the hours be?

Most jobs involve regular hours—for example, 40 hours a week, during the day, Monday through Friday. Other jobs require night, weekend, or holiday work. In addition, some jobs routinely require overtime to meet deadlines or sales or production goals, or to better serve customers. Consider the effect that the work hours will have on your personal life.

How long do most people who enter this job stay with the company?

High turnover can mean dissatisfaction with the nature of the work or something else about the job.

Opportunities offered by employers. A good job offers you opportunities to learn new skills, increase your earnings, and rise to positions of greater authority, responsibility, and prestige. A lack of opportunities can dampen interest in the work and result in frustration and boredom.

The company should have a training plan for you. What valuable new skills does the company plan to teach you?

The employer should give you some idea of promotion possibilities within the organization. What is the next step on the career ladder? If you have to wait for a job to become vacant before you can be promoted, how long does this usually take? When opportunities for advancement do arise, will you compete with applicants from outside the company? Can you apply for jobs for which you qualify elsewhere within the organization, or is mobility within the firm limited?

Salaries and benefits. When an employer makes a job offer, information about earnings and benefits are usually included. You will want to research to determine if the offer is fair. If you choose to negotiate for higher pay and better benefits, objective research will help you strengthen your case.

You may have to go to several sources for information. One of the best places to start is the information from the Bureau of Labor Statistics. Data on earnings by detailed occupation from the Occupational Employment Statistics (OES) Survey are available from:

➤ Bureau of Labor Statistics, Office of Occupational Statistics and Employment Projections, 2 Massachusetts Ave. NE., Room 2135, Washington, DC 20212-0001. Telephone: (202) 691-6569. Internet: **http://www.bls.gov/oes**.

Data from the Bureau's National Compensation Survey are available from:

➤ Bureau of Labor Statistics, Office of Compensation Levels and Trends, 2 Massachusetts Ave. NE., Room 4175, Washington, DC 20212-0001. Telephone: (202) 691-6199. Internet: **http://www.bls.gov/ncs**.

You should also look for additional information, specifically tailored to your job offer and circumstances. Try to find family, friends, or acquaintances who recently were hired in similar jobs. Ask your teachers and the staff in placement offices about starting pay for graduates with your qualifications. Help-wanted ads in newspapers sometimes give salary ranges for similar positions. Check the library or your school's career center for salary surveys such as those conducted by the National Association of Colleges and Employers or various professional associations.

If you are considering the salary and benefits for a job in another geographic area, make allowances for differences in the cost of living, which may be significantly higher in a large metropolitan area than in a smaller city, town, or rural area.

You also should learn the organization's policy regarding overtime. Depending on the job, you may or may not be exempt from laws requiring the employer to compensate you for overtime. Find out how many hours you will be expected to work each week and whether you receive overtime pay or compensatory time off for working more than the specified number of hours in a week.

Also take into account that the starting salary is just that—the start. Your salary should be reviewed on a regular basis; many organizations do it every year. How much can you expect to earn after 1, 2, or 3 or more years? An employer cannot be specific about the amount of pay if it includes commissions and bonuses.

Benefits also can add a lot to your base pay, but they vary widely. Find out exactly what the benefit package includes and how much of the cost you must bear.

For more information

To learn more about finding and applying for jobs, visit your local library and career center. You can find career centers that are part of the U.S. Department of Labor One-Stop Career system by calling toll free (877) 348-0502.

The *Occupational Outlook Quarterly*, a career magazine published by the Bureau of Labor Statistics, is one of the resources available at many libraries and career centers. The magazine includes many articles about finding, applying for, and choosing jobs. See, for example:

➤ "Employment interviewing: Seizing the opportunity and the job," online at **http://www.bls.gov/opub/ooq/2000/summer/art02.pdf**.

➤ "Getting back to work: Returning to the labor force after an absence," online at **http://www.bls.gov/opub/ooq/2004/winter/art03.pdf.**

➤ "How to get a job in the Federal Government," online at **http://www.bls.gov/opub/ooq/2004/summer/art01.pdf.**

➤ "Internships: Previewing a profession," online at **http://www.bls.gov/opub/ooq/2006/summer/art02.pdf**.

➤ "Resumes, applications, and cover letters," online at **http://www.bls.gov/opub/ooq/1999/summer/art01.pdf.**

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Occupational Information Included in the Handbook

The *Occupational Outlook Handbook* is a career guidance resource that provides information on hundreds of occupations that comprise 9 out of 10 jobs in the United States. Each occupation is presented in its own chapter, or "statement," that discusses the type of work that is performed, the work environment, the education and training requirements, the possibilities for advancement, and the typical earnings. Each statement is presented in a standard format, making it easy to compare occupations.

Because the *Handbook* covers so many occupations, it is best used as a reference, and is not meant to be read from cover to cover. Readers should begin by looking at the table of contents, in which similar occupations are grouped in clusters, or by looking at the index, in which occupations are listed alphabetically.

About those numbers at the beginning of each statement

The numbers in parentheses that appear just below the title of every detailed occupational statement are from the Occupational Information Network (O*NET)—a system used by State employment service offices to classify applicants and job openings, and by some career information centers and libraries to file occupational information.

You can use O*NET to search for occupations that match your skills, or you may search by keyword or O*NET code. For each occupation, O*NET reports information about different aspects of the job, including tasks performed, knowledge, skills, abilities, and work activities. It also lists interests, work styles, such as independence, and work values, such as achievement, that are well suited to the occupation. O*NET ranks and scores the descriptors in each category by their importance to the occupation.

Occupational Information Network Coverage, a section beginning on page 859, cross-references O*NET codes to occupations covered in the *Handbook*. O*NET codes are based on the 2000 Standard Occupational Classification (SOC) system. You can access O*NET on the Internet at **http://www.online.onetcenter.org**.

Sections of Occupational Statements

Significant Points

This section highlights key occupational characteristics discussed in the statement.

Nature of the Work

What workers do on the job, what tools and equipment they use, and how closely they are supervised is discussed in this section. The statement on fire fighting occupations, for example, gives a detailed account of the responsibilities of a firefighter, which include operating the fire hose, providing emergency medical care, and cleaning and maintaining equipment. Some statements mention common alternative job titles or occupational specialties. The statement on accountants and auditors, for example, discusses several specialties, including public accountants, management accountants, and internal auditors.

The *Handbook* is revised every 2 years. This section may be revised for several reasons. One is the emergence of occupational specialties. For instance, webmasters—who are responsible for the technical aspects of operating a Web site—constitute a specialty within computer scientists and database administrators. Another reason for revision is a change in technology that affects the way in which a job is performed. The Internet, for example, allows purchasers to acquire supplies with a click of the mouse, saving time and money. Furthermore, job duties may be affected by modifications to business practices, such as organizational restructuring or changes in response to new government regulations. An example is paralegals and legal assistants, who are increasingly being used by law firms in order to lower costs and increase the efficiency of legal services.

Work environment. This subsection discuses the workplace, physical activities, and typical hours of workers in the occupation. It also describes opportunities for part-time work, the extent of travel required, any special equipment that is used, and the risk of injury that workers may face.

In many occupations, people work regular business hours—40 hours a week, Monday through Friday—but many do not. Waiters and waitresses, for example, often work evenings and weekends. The work setting can range from a hospital, to a mall, to an offshore oil rig. Truck drivers might be susceptible to injury, while paramedics have high job-related stress. Semiconductor processors may wear protective clothing or equipment, some construction laborers do physically demanding work, and top executives may travel frequently.

Information on various worker characteristics, such as the average number of hours worked per week, is obtained from the Current Population Survey (CPS)—a survey of households conducted by the U.S. Census Bureau for the Bureau of Labor Statistics (BLS).

Economists in BLS consult many sources before making changes to the nature of the work section, or any other section, of a *Handbook* statement. Usual sources include articles from newspapers, magazines, and professional journals, as well as the Web sites of professional associations, unions, and trade groups. Information found on the Internet or in periodicals is verified through interviews with individuals employed in the occupation, professional associations, unions, and others with occupational knowledge, such as university professors and career counselors.

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Training, Other qualifications, and Advancement

After gathering your initial impressions of what a job is all about, it is important to understand how to prepare for it. The training, other qualifications, and advancement section explains all of the steps necessary to enter and advance in an occupation.

Education and training. This subsection describes the most significant sources of education and training, the type education or training preferred by employers, and the typical length of training. Some common forms of training include a high school diploma, informal on-the-job training, previous work experience, and a college degree. Other types of training include, but are not limited to, formal training (including internships), the U.S. Armed Forces, and graduate or professional degrees. The type of education or training required for each occupation in the *Handbook* varies, and two similar occupations can have very different requirements. For example, sales experience is particularly important for many sales jobs, but other sales jobs require formal postsecondary education, such as a bachelor's degree.

Licensure. The kinds of mandatory licenses or certifications associated with an occupation are described in this subsection. To be certified or licensed, a worker usually is required to complete one or more training courses and pass one or more examinations. Most occupations do not have mandatory licensure or certification requirements, but those that do, for example, include lawyers, pharmacists, and social workers. Some occupations have numerous professional credentials granted by different organizations, in which case the most widely recognized organizations are listed in the *Handbook*.

Other qualifications. Any additional qualifications that are not included in the previous subsections, such as the desirable skills, aptitudes, and personal characteristics that employers look for would be discussed in this section. For example, meeting and convention planners must have excellent interpersonal and organizational skills, the ability to work under pressure, and must pay attention to detail. For some entry-level jobs, personal characteristics are more important than formal training. Employers generally seek people who read, write, and speak well; compute accurately; think logically; learn quickly; get along with others; and demonstrate dependability. This subsection also includes information about voluntary, entry-level certifications.

Advancement. This subsection details possible advancement opportunities after gaining experience in an occupation. Advancement can come in several forms, including advancement within the occupation, such as promotion to a management position; advancement into other occupations, such as leaving a job as a lawyer to become a judge; and advancement to self-employment, such as an automotive technician opening his or her own repair shop.

Certain types of certification can also serve as a form of advancement. Voluntary certification often demonstrates a level of competency to employers, and can result in more responsibility, higher pay, or a new job. Accountants, for example, generally begin their careers without the Certified Public Accountant (CPA) designation. Many choose to pursue a CPA, however, because it increases their chances for advancement.

Information in the training, other qualifications, and advancement section comes from personal interviews with individuals employed in the occupation, Web sites, published training materials, and interviews with the organizations that grant degrees, certifications, or licenses, or are otherwise associated with the occupation.

Employment

This section reports the number of jobs that the occupation provided in 2006, the key industries in which those jobs were found, and, if significant, the number or proportion of self-employed workers in the occupation.

The source of estimated employment in a particular occupation in the *Handbook* is the Bureau's National Employment Matrix, which presents current and projected employment for 311 detailed industries and 754 detailed occupations over the 2006-2016 period. Data in the matrix come primarily from the establishment-based Occupational Employment Statistics (OES) Survey, which reports employment of wage and salary workers only for each occupation in every industry except agriculture and private households. Matrix data also come from the household-based Current Population Survey (CPS), which provides estimates of the number of self-employed and unpaid family workers in each occupation. The matrix also incorporates CPS data on total employment—wage and salary, self-employed, and unpaid family workers—in the agriculture and private household industries.

The estimate of total employment in each *Handbook* occupation combines data from several different sources. Furthermore, some *Handbook* occupations combine several matrix occupations. For these reasons, employment numbers cited in the *Handbook* often differ from employment data provided by the OES, CPS, and other employment surveys.

When significant, the geographic distribution of jobs is mentioned, reflecting CPS data. On the basis of OES survey data, some *Handbook* statements, such as textile, apparel, and furnishings occupations, list States that employ substantial numbers of workers in the occupation.

Job Outlook

In planning for the future, it is important to consider potential job growth and job opportunities. This section describes the factors that affect employment growth or decline, and in some instances, describes the relationship between the number of job seekers and the number of job openings.

Employment change. This subsection reflects the occupational projections in the National Employment Matrix. Each occupation is assigned a descriptive phrase based on its projected percent change in employment over the 2006-2016 period. This phrase describes the occupation's projected employment change relative to the projected average employment change for all occupations combined. (These phrases are listed at the end of *Occupational Information Included in the Handbook*.)

Many factors are examined in projecting the employment change for each occupation. One such factor is changes in technology. New technology can either create new job opportunities or eliminate jobs by making workers obsolete. The Internet has increased the demand for workers in the computer and information technology fields, such as computer support specialists

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and systems administrators. However, the Internet also has adversely affected travel agents, because many people now book tickets, hotels, and rental cars online.

Another factor that influences employment trends is demographic change. By affecting the services demanded, demographic change can influence occupational growth or decline. For example, an aging population will demand more health care services, leading to occupational growth in health care occupations.

Another factor affecting job growth or decline is changes in business practices, such as restructuring businesses or outsourcing (contracting out) work. Corporate restructuring has made many organizations "flatter," resulting in fewer middle management positions. Also, in the past few years, insurance carriers have been outsourcing sales and claims adjuster jobs to large, 24-hour call centers in order to reduce costs. Jobs in some occupations, such as computer programmers and customer service representatives, have been "offshored"—moved to low-wage foreign countries.

The substitution of one product or service for another can also affect employment projections. For example, consumption of plastic products has grown as they have been substituted for metal goods in consumer and manufactured products in recent years. The process is likely to continue and should result in stronger demand for machine operators in plastics than in metal.

Competition from foreign trade usually has a negative affect on employment. Often, foreign manufacturers can produce goods more cheaply than they can be produced in the United States, and the cost savings can be passed on in the form of lower prices with which U.S. manufacturers cannot compete. Increased international competition is a major reason for the decline in employment among textile, apparel, and furnishings workers.

Another factor is job growth or decline in key industries. If an occupation is concentrated in an industry that is growing rapidly, it is likely that that occupation will grow rapidly as well. For example, the growing need for business expertise is fueling demand for consulting services. This is expected to cause rapid growth in the management, scientific, and technical consulting services industry, which, in turn, will lead to rapid growth in the employment of management analysts.

Job prospects. In some cases, the *Handbook* mentions that an occupation is likely to provide numerous job openings or, in others, that an occupation likely will have relatively few openings. This information reflects the projected change in employment, as well as replacement needs. Large occupations in which workers frequently enter and leave, such as food and beverage serving occupations, generally provide the most job openings—reflecting the need to replace workers who transfer to other occupations or who stop working.

Some *Handbook* statements discuss the relationship between the number of job seekers and the number of job openings. (The phrases used to describe that relationship appear at the end of *Occupational Information Included in the Handbook*.) Job opportunities are affected by several factors, including the creation of new jobs, the number of people who apply for jobs, and the number of people who leave the occupation. In some occupations, there is a rough balance between job seekers and job openings, resulting in *good* opportunities. In other occupations, employers may report difficulty finding qualified applicants, resulting in *excellent* job opportunities. Still other occupations are characterized by a surplus of applicants, leading to *keen* competition for jobs. Variation in job opportunities by industry, educational attainment, size of firm, or geographic location also may be discussed. Even in crowded occupations, job openings do exist. Good students or highly qualified individuals should not be deterred from undertaking training for, or seeking entry into, those occupations.

Employment projections table. The employment projections table lists employment statistics from the National Employment Matrix. It includes 2006 employment, projected 2016 employment, and the 2006-2016 change in employment in both numerical and percent forms. Numbers below ten thousand are rounded to the nearest hundred, numbers above ten thousand are rounded to the nearest thousand, and percents are rounded to the nearest whole number. Numerical and percent changes are calculated using non-rounded 2006 and 2016 employment figures, and then are rounded for presentation in the employment projections table.

Earnings

This section discusses typical earnings and how workers are compensated—by means of annual salaries, hourly wages, commissions, piece rates, tips, or bonuses. Within every occupation, earnings vary by experience, responsibility, performance, tenure, and geographic area. Almost every statement in the *Handbook* contains 2006 OES-survey earnings data for wage and salary workers. Information on earnings in the major industries in which the occupation is employed, also supplied by the OES survey, may be given as well.

In addition to presenting earnings data from the OES survey, some statements contain additional earnings data from non-BLS sources. Starting and average salaries of Federal workers are based on 2007 data from the U.S. Office of Personnel Management. The National Association of Colleges and Employers supplies information on average salary offers in 2007 for students graduating with a bachelor's, master's, or Ph.D. degree in certain fields. A few statements contain additional earnings information from other sources, such as unions, professional associations, and private companies. These data sources are cited in the text.

Benefits account for a significant portion of total compensation costs to employers. Benefits such as paid vacation, health insurance, and sick leave may not be mentioned, because they are widespread. In some occupational statements, the absence of these traditional benefits is pointed out. Although not as common as traditional benefits, flexible hours and profit-sharing plans may be offered to attract and retain highly qualified workers. Less common benefits also include childcare, tuition for dependents, housing assistance, summers off, and free or discounted merchandise or services. For certain occupations, the percentage of workers affiliated with a union is listed. These data come from the CPS survey.

Unless otherwise noted, the source of employment and earnings data presented in the *Handbook* is the Bureau of

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Labor Statistics. Nearly all *Handbook* statements cite employment and wage data from the OES survey, and some include data from outside sources. OES data may be used to compare wages among occupations; outside data, however, may not be used in this manner, because characteristics of these data vary widely.

Related occupations

Occupations involving similar duties, skills, interests, education, and training are listed.

Sources of additional information

No single publication can describe all aspects of an occupation. Thus, the *Handbook* lists the mailing addresses of associations, government agencies, unions, and other organizations that can provide occupational information. In some cases, toll free telephone numbers and Internet addresses also are listed. Free or relatively inexpensive publications offering more information may be mentioned; some of these publications also may be available in libraries, in school career centers, in guidance offices, or on the Internet. Most of the organizations listed in this section were sources of information on the nature of the work, training, and job outlook discussed in the *Handbook*.

For additional sources of information, also read the earlier chapters, "Sources of Career Information" and "Sources of Education, Training, and Financial Aid."

Key phrases in the *Handbook*

This box explains how to interpret the key phrases used to describe projected changes in employment. It also explains the terms used to describe the relationship between the number of job openings and the number of job seekers. The description of this relationship in a particular occupation reflects the knowledge and judgment of economists in the BLS Office of Occupational Statistics and Employment Projections.

Changing employment between 2006 and 2016

If the statement reads:	Employment is projected to:
Grow much faster than average	increase 21 percent or more
Grow faster than average	increase 14 to 20 percent
Grow about as fast as average	increase 7 to 13 percent
Grow more slowly than average	increase 3 to 6 percent
Little or no change	decrease 2 percent to increase 2 percent
Decline slowly or moderately	decrease 3 to 9 percent
Decline rapidly	decrease 10 percent or more

Opportunities and competition for jobs

If the statement reads:	Job openings compared with job seekers may be:
Very good to excellent opportunities	More numerous
Good or favorable opportunities	In rough balance
May face, or can expect, keen competition	Fewer

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Management, Business, and Financial Occupations

Management Occupations

Administrative Services Managers

(O*NET 11-3011.00)

Significant Points

- Applicants will face keen competition for the limited number of top-level management jobs, but competition should be less severe for lower-level management jobs; demand should be strong for facility managers.
- Administrative services managers work throughout private industry and government and have a wide range of responsibilities, experience, earnings, and education.
- Like other managers, administrative services managers should be analytical, detail-oriented, flexible, decisive, and have good leadership and communication skills.

Nature of the Work

Administrative services managers coordinate and direct the many support services that allow organizations to operate efficiently. They perform a broad range of duties. They might, for example, oversee secretarial and reception services, administration, payroll, conference planning and travel, information and data processing, mail, materials scheduling and distribution, printing and reproduction, records management, telecommunications management, security, parking, energy consumption, and personal property procurement, supply, recycling, and disposal. They manage support services for organizations as diverse as insurance companies, computer manufacturers, and government offices.

Specific duties for these managers vary by degree of responsibility and authority. First-line administrative services managers directly supervise a staff that performs various support services. Mid-level managers, on the other hand, develop departmental plans, set goals and deadlines, implement procedures to improve productivity and customer service, and define the responsibilities of supervisory-level managers. Some mid-level administrative services managers oversee first-line supervisors from various departments, including the clerical staff. Mid-level managers also may be involved in the hiring and dismissal of employees, but they generally have no role in the formulation of personnel policy. Some of these managers advance to upper level positions, such as vice president of administrative services, which are discussed in the *Handbook* statement on top executives.

In small organizations, a single administrative services manager may oversee all support services. In larger ones, however, first-line administrative services managers often report to mid-level managers who, in turn, report to owners or top-level managers, sometimes called director of administration, or vice president of administration.

The nature of managerial jobs varies as significantly as the range of administrative services required by organizations. For example, *administrative services managers* who work as contract administrators oversee the preparation, analysis, negotiation, and review of contracts related to the purchase or sale of equipment, materials, supplies, products, or services. In addition, some administrative services managers acquire, distribute,



Administrative services managers coordinate and direct support services that allow organizations to operate efficiently.

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and store supplies, while others dispose of surplus property or oversee the disposal of unclaimed property.

Administrative services managers who work as *facility managers* plan, design, and manage buildings, grounds, equipment, and supplies, in addition to people. This task requires integrating the principles of business administration, information technology, architecture, engineering, and behavioral science. Although the specific tasks assigned to facility managers vary substantially depending on the organization, the duties fall into several categories, relating to operations and maintenance, real estate, project planning and management, leadership and communication, finance, quality assessment, facility function, technology integration, and management of human and environmental factors. Tasks within these broad categories may include space and workplace planning, budgeting, purchase and sale of real estate, lease management, renovations, or architectural planning and design. Facility managers may suggest and oversee renovation projects for a variety of reasons, ranging from improving efficiency to ensuring that facilities meet government regulations and environmental, health, and security standards. For example, they may influence a building renovation project toward a greater use of "green" energy–electricity generated from alternative and cost efficient energy sources, such as solar panels or fuel cells. Additionally, facility managers continually monitor the facility to ensure that it remains safe, secure, and well-maintained. Often, the facility manager is responsible for directing staff, including maintenance, grounds, and custodial workers.

Work environment. Administrative services managers generally work in comfortable offices. Managers involved in contract administration and personal property procurement, use, and disposal may travel between their home office, branch offices, vendors' offices, and property sales sites. Also, facility managers who are responsible for the design of workspaces may spend time at construction sites and may travel between different facilities while monitoring the work of maintenance and custodial staffs. However, new technology has increased the number of managers who telecommute from home or other offices, and teleconferencing has reduced the need for travel. Facility managers also may spend time outdoors, supervising and handling a variety of issues related to groundskeeping, landscaping, construction, security, and parking.

Most administrative services managers work a standard 40-hour week. However, uncompensated overtime frequently is required to resolve problems and meet deadlines. Facility managers often are "on call" to address a variety of problems that can arise in a facility during nonwork hours.

Training, Other Qualifications, and Advancement

Education and experience requirements for these managers vary widely, depending on the size and complexity of the organization. In small organizations, experience may be the only requirement needed to enter a position as an office manager. When an opening in administrative services management occurs, the office manager may be promoted to the position based on past performance. In large organizations, however, administrative services managers normally are hired from outside and each position has formal education and experience requirements. Some administrative services managers have advanced degrees.

Education and training. Specific requirements vary by job responsibility. For first-line administrative services managers of secretarial, mailroom, and related support activities, many employers prefer to hire people who have an associate degree in business or management, although a high school diploma may suffice when combined with appropriate experience.

For managers of audiovisual, graphics, and other technical activities, postsecondary technical school training is preferred. Managers of highly complex services, such as contract administration, generally need at least a bachelor's degree in business, human resources, or finance. Regardless of major, the curriculum should include courses in office technology, accounting, business mathematics, computer applications, human resources, and business law.

Most facility managers have an undergraduate or graduate degree in engineering, architecture, construction management, business administration, or facility management. Many have a background in real estate, construction, or interior design, in addition to managerial experience.

Whatever the manager's educational background, it must be accompanied by related work experience reflecting their ability. For this reason, many administrative services managers have advanced through the ranks of their organization, acquiring work experience in various administrative positions before assuming first-line supervisory duties. All managers who oversee departmental supervisors should be familiar with office procedures and equipment. Managers of personal property acquisition and disposal need experience in purchasing and sales, and knowledge of a variety of supplies, machinery, and equipment. Managers concerned with supply, inventory, and distribution should be experienced in receiving, warehousing, packaging, shipping, transportation, and related operations. Contract administrators may have worked as contract specialists, cost analysts, or procurement specialists. Managers of unclaimed property often have experience in insurance claims analysis and records management.

Other qualifications. Persons interested in becoming administrative services managers should have good leadership and communication skills and be able to establish effective working relationships with many different people, ranging from managers, supervisors, and professionals, to clerks and blue-collar workers. They should be analytical, detail-oriented, flexible, and decisive. They must be able to coordinate several activities at once, quickly analyze and resolve specific problems, and cope with deadlines.

Certification and advancement. Most administrative services managers in small organizations advance by moving to other management positions or to a larger organization. Advancement is easier in large firms that employ several levels of administrative services managers. Attainment of the Certified Manager (CM) designation offered by the Institute of Certified Professional Managers (ICPM), through education, work experience, and successful completion of examinations, can enhance a manager's advancement potential. In addition, a master's degree in business administration or a related field enhances a first-level manager's opportunities to advance to a

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mid-level management position, such as director of administrative services, and eventually to a top-level management position, such as executive vice president for administrative services. Those with enough money and experience can establish their own management consulting firm.

Advancement of facility managers is based on the practices and size of individual companies. Some facility managers transfer from other departments within the organization or work their way up from technical positions. Others advance through a progression of facility management positions that offer additional responsibilities. Completion of the competency-based professional certification program offered by the International Facility Management Association can give prospective candidates an advantage. In order to qualify for this Certified Facility Manager (CFM) designation, applicants must meet certain educational and experience requirements. People entering the profession also may obtain the Facility Management Professional (FMP) credential, a stepping stone to the CFM.

Employment

Administrative services managers held about 247,000 jobs in 2006. About 65 percent worked in service-providing industries, including Federal, State, and local government; health care; finance and insurance; professional, scientific, and technical services; administrative and support services; and educational services, public and private. Most of the remaining managers worked in wholesale and retail trade, in management of companies and enterprises, or in manufacturing.

Job Outlook

The number of jobs is projected to grow as fast as average for all occupations. Applicants will face keen competition for the limited number of top-level management jobs through 2016. Better opportunities are expected for lower-level management jobs. Demand should be strong for facility managers.

Employment change. Employment of administrative services managers is projected to grow 12 percent over the 2006-16 decade, about as fast as the average for all occupations. Demand should be strong for facility managers because businesses increasingly realize the importance of maintaining, securing, and efficiently operating their facilities, which are very large investments for most organizations. Cost-cutting measures to improve profitability, streamline operations, and compete globally will continue to be addressed by many public and private organizations, resulting in more firms outsourcing facility management services or hiring qualified facility managers who are capable achieving these goals in-house.

Administrative services managers employed in management services and management consulting should be in demand. The proliferation of facility management outsourcing should result in employment growth in facilities management firms as companies increasingly look to outside specialists to handle the myriad of tasks that have become increasingly complex and expensive. Some of the services outsourced include food service, space planning and design, janitorial, power plant, grounds, office, safety, property, video surveillance, maintenance and repairs, and parking management.

Job prospects. Applicants will face keen competition for the limited number of top-level management jobs; competition should be less severe for lower-level management jobs.

Despite average job growth, continuing corporate restructuring and increasing use of office technology may result in a more streamlined organizational structure with fewer levels of management, reducing the need for some middle management positions. This should adversely affect administrative services managers who oversee first-line managers. However, the effects of these changes on employment should be less severe for facility managers and other administrative services managers who have a wide range of responsibilities, than for other middle managers who specialize in certain functions. In addition to new administrative services management jobs created over the 2006-16 projection period, many job openings will stem from the need to replace workers who transfer to other jobs, retire, or leave the occupation for other reasons.

Job opportunities may vary from year to year because the strength of the economy affects demand for administrative services managers. Industries least likely to be affected by economic fluctuations tend to be the most stable places for employment.

Earnings

Earnings of administrative services managers vary greatly depending on the employer, the specialty, and the geographic area. In general, however, median annual earnings of wage and salary administrative services managers in May 2006 were $67,690. The middle 50 percent earned between $48,200 and $90,350. The lowest 10 percent earned less than $34,970, and the highest 10 percent earned more than $117,610. Median annual earnings in the industries employing the largest numbers of these managers were:

Management of companies and enterprises	$77,040
General medical and surgical hospitals	72,210
State government	68,410
Local government	67,050
Colleges, universities, and professional schools	64,810

In the Federal Government, industrial specialists averaged $74,042 a year in 2007. Corresponding averages were $73,455 for facility operations services managers, $72,730 for industrial property managers, $65,351 for property disposal specialists,

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Administrative services managers	11-3011	247,000	276,000	29,000	12

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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$71,948 for administrative officers, and $63,756 for support services administrators.

Related Occupations

Administrative services managers direct and coordinate support services and oversee the purchase, use, and disposal of personal property. Occupations with similar functions include office and administrative support worker supervisors and managers; cost estimators; property, real estate, and community association managers; purchasing managers, buyers, and purchasing agents; and top executives.

Sources of Additional Information

For information about careers and education and degree programs in facility management, as well as the Certified Facility Manager designation, contact:

➤ International Facility Management Association, 1 East Greenway Plaza, Suite 1100, Houston, TX 77046-0194. Internet: **http://www.ifma.org**

For information about the Certified Manager (CM) designation, contact:

➤ Institute of Certified Professional Managers, James Madison University, MSC 5504, Harrisonburg, VA 22807.

For information on training and classes for professional office management personnel, contact:

➤ Association of Professional Office Managers, 1 Research Court, Suite #450, Rockville, MD 20850.
Internet: **http://www.apomonline.org**

Advertising, Marketing, Promotions, Public Relations, and Sales Managers

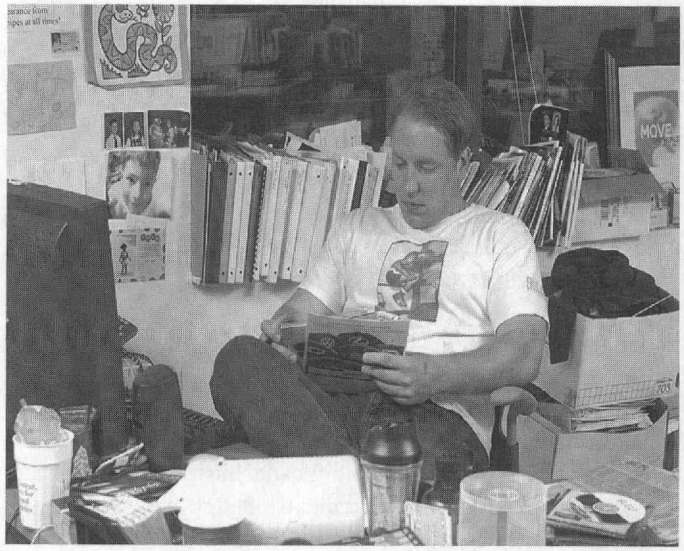
(O*NET 11-2011.00, 11-2021.00, 11-2022.00, 11-2031.00)

Significant Points

- Keen competition is expected for these highly coveted jobs.
- College graduates with related experience, a high level of creativity, strong communication skills, and computer skills should have the best job opportunities.
- High earnings, substantial travel, and long hours, including evenings and weekends, are common.
- Because of the importance and high visibility of their jobs, these managers often are prime candidates for advancement to the highest ranks.

Nature of the Work

Advertising, marketing, promotions, public relations, and sales managers coordinate their companies' market research, marketing strategy, sales, advertising, promotion, pricing, product development, and public relations activities. In small firms, the owner or chief executive officer might assume all advertising, promotions, marketing, sales, and public relations responsibilities. In large firms, which may offer numerous products and services nationally or even worldwide, an executive vice president directs overall advertising, marketing, promotions, sales, and public relations policies. (Executive vice presidents are included in the *Handbook* statement on top executives.)



These managers have a wide range of educational backgrounds.

Advertising managers. Advertising managers oversee advertising and promotion staffs, which usually are small, except in the largest firms. In a small firm, managers may serve as liaisons between the firm and the advertising or promotion agency to which many advertising or promotional functions are contracted out. In larger firms, advertising managers oversee in-house account, creative, and media services departments. The *account executive manages* the account services department, assesses the need for advertising and, in advertising agencies, maintains the accounts of clients. The creative services department develops the subject matter and presentation of advertising. The *creative director* oversees the copy chief, art director, and associated staff. The *media director* oversees planning groups that select the communication media—for example, radio, television, newspapers, magazines, the Internet, or outdoor signs—to disseminate the advertising.

Marketing managers. Marketing managers develop the firm's marketing strategy in detail. With the help of subordinates, including *product development managers* and *market research managers*, they estimate the demand for products and services offered by the firm and its competitors. In addition, they identify potential markets—for example, business firms, wholesalers, retailers, government, or the general public. Marketing managers develop pricing strategy to help firms maximize profits and market share while ensuring that the firm's customers are satisfied. In collaboration with sales, product development, and other managers, they monitor trends that indicate the need for new products and services, and they oversee product development. Marketing managers work with advertising and promotion managers to promote the firm's products and services and to attract potential users.

Promotions managers. Promotions managers supervise staffs of promotions specialists. These managers direct promotions programs that combine advertising with purchase incentives to increase sales. In an effort to establish closer contact

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with purchasers—dealers, distributors, or consumers—promotions programs may use direct mail, telemarketing, television or radio advertising, catalogs, exhibits, inserts in newspapers, Internet advertisements or Web sites, in-store displays or product endorsements, and special events. Purchasing incentives may include discounts, samples, gifts, rebates, coupons, sweepstakes, and contests.

Public relations managers. Public relations managers supervise public relations specialists. (See the *Handbook* statement on public relations specialists.) These managers direct publicity programs to a targeted audience. They often specialize in a specific area, such as crisis management, or in a specific industry, such as health care. They use every available communication medium to maintain the support of the specific group upon whom their organization's success depends, such as consumers, stockholders, or the general public. For example, public relations managers may clarify or justify the firm's point of view on health or environmental issues to community or special-interest groups.

Public relations managers also evaluate advertising and promotions programs for compatibility with public relations efforts and serve as the eyes and ears of top management. They observe social, economic, and political trends that might ultimately affect the firm, and they make recommendations to enhance the firm's image on the basis of those trends.

Public relations managers may confer with labor relations managers to produce internal company communications—such as newsletters about employee-management relations—and with financial managers to produce company reports. They assist company executives in drafting speeches, arranging interviews, and maintaining other forms of public contact; oversee company archives; and respond to requests for information. In addition, some of these managers handle special events, such as the sponsorship of races, parties introducing new products, or other activities that the firm supports in order to gain public attention through the press without advertising directly.

Sales managers. Sales managers direct the firm's sales program. They assign sales territories, set goals, and establish training programs for the sales representatives. (See the *Handbook* statement on sales representatives, wholesale and manufacturing). Sales managers advise the sales representatives on ways to improve their sales performance. In large, multi-product firms, they oversee regional and local sales managers and their staffs. Sales managers maintain contact with dealers and distributors. They analyze sales statistics gathered by their staffs to determine sales potential and inventory requirements and to monitor customers' preferences. Such information is vital in the development of products and the maximization of profits.

Work environment. Advertising, marketing, promotions, public relations, and sales managers work in offices close to those of top managers. Working under pressure is unavoidable when schedules change and problems arise, but deadlines and goals must still be met.

Substantial travel may be involved. For example, attendance at meetings sponsored by associations or industries often is mandatory. Sales managers travel to national, regional, and local offices and to the offices of various dealers and distributors. Advertising and promotions managers may travel to meet with clients or representatives of communications media. At times, public relations managers travel to meet with special-interest groups or government officials. Job transfers between headquarters and regional offices are common, particularly among sales managers.

Long hours, including evenings and weekends are common. In 2006, about two-thirds of advertising, marketing, and public relations managers worked more than 40 hours a week.

Training, Other Qualifications, and Advancement

A wide range of educational backgrounds is suitable for entry into advertising, marketing, promotions, public relations, and sales managerial jobs, but many employers prefer those with experience in related occupations.

Education and training. For marketing, sales, and promotions management positions, some employers prefer a bachelor's or master's degree in business administration with an emphasis on marketing. Courses in business law, management, economics, accounting, finance, mathematics, and statistics are advantageous. Additionally, the completion of an internship while the candidate is in school is highly recommended. In highly technical industries, such as computer and electronics manufacturing, a bachelor's degree in engineering or science, combined with a master's degree in business administration, is preferred.

For advertising management positions, some employers prefer a bachelor's degree in advertising or journalism. A course of study should include, for example, marketing, consumer behavior, market research, sales, communication methods and technology, and visual arts, and art history and photography.

For public relations management positions, some employers prefer a bachelor's or master's degree in public relations or journalism. The applicant's curriculum should include courses in advertising, business administration, public affairs, public speaking, political science, and creative and technical writing.

Most advertising, marketing, promotions, public relations, and sales management positions are filled by promoting experienced staff or related professional personnel. For example, many managers are former sales representatives, purchasing agents, buyers, or product, advertising, promotions, or public relations specialists. In small firms, where the number of positions is limited, advancement to a management position usually comes slowly. In large firms, promotion may occur more quickly.

Other qualifications. Familiarity with word-processing and database applications is important for most positions. Computer skills are vital because marketing, product promotion, and advertising on the Internet are increasingly common. Also, the ability to communicate in a foreign language may open up employment opportunities in many rapidly growing areas around the country, especially cities with large Spanish-speaking populations.

Persons interested in becoming advertising, marketing, promotions, public relations, and sales managers should be mature, creative, highly motivated, resistant to stress, flexible, and decisive. The ability to communicate persuasively, both orally and in writing, with other managers, staff, and the public is vital. These managers also need tact, good judgment, and exceptional

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ability to establish and maintain effective personal relationships with supervisory and professional staff members and client firms.

Certification and advancement. Some associations offer certification programs for these managers. Certification—an indication of competence and achievement—is particularly important in a competitive job market. While relatively few advertising, marketing, promotions, public relations, and sales managers currently are certified, the number of managers who seek certification is expected to grow. Today, there are numerous management certification programs based on education and job performance. In addition, The Public Relations Society of America offers a certification program for public relations practitioners based on years of experience and performance on an examination.

Although experience, ability, and leadership are emphasized for promotion, advancement can be accelerated by participation in management training programs conducted by larger firms. Many firms also provide their employees with continuing education opportunities—either in-house or at local colleges and universities—and encourage employee participation in seminars and conferences, often held by professional societies. In collaboration with colleges and universities, numerous marketing and related associations sponsor national or local management training programs. Course subjects include brand and product management, international marketing, sales management evaluation, telemarketing and direct sales, interactive marketing, promotion, marketing communication, market research, organizational communication, and data-processing systems procedures and management. Many firms pay all or part of the cost for employees who successfully complete courses.

Because of the importance and high visibility of their jobs, advertising, marketing, promotions, public relations, and sales managers often are prime candidates for advancement to the highest ranks. Well-trained, experienced, and successful managers may be promoted to higher positions in their own or another firm; some become top executives. Managers with extensive experience and sufficient capital may open their own businesses.

Employment

Advertising, marketing, promotions, public relations, and sales managers held about 583,000 jobs in 2006. The following tabulation shows the distribution of jobs by occupational specialty:

Sales managers	318,000
Marketing managers	167,000
Public relations managers	50,000
Advertising and promotions managers	47,000

These managers were found in virtually every industry. Sales managers held more than half of the jobs; most were employed in wholesale trade, retail trade, manufacturing, and finance and insurance industries. Marketing managers held more than a fourth of the jobs; the professional, scientific, and technical services, and the finance and insurance industries employed almost one-third of marketing managers. About one-fourth of advertising and promotions managers worked in the professional, scientific, and technical services industries and the wholesale trade. Most public relations managers were employed in service-providing industries, such as professional, scientific, and technical services; educational services, public and private; finance and insurance; and health care and social assistance.

Job Outlook

Average job growth is projected, but keen competition is expected for these highly coveted jobs.

Employment change. Employment of advertising, marketing, promotions, public relations, and sales managers is expected to increase by 12 percent through 2016—about as fast as the average for all occupations. Job growth will be spurred by intense domestic and global competition in products and services offered to consumers and increasing activity in television, radio, and outdoor advertising.

Projected employment growth varies by industry. For example, employment is projected to grow much faster than average in scientific, professional, and related services—such as computer systems design and related services, and advertising and related services—as businesses increasingly hire contractors for these services instead of additional full-time staff. By contrast, a decline in employment is expected in many manufacturing industries.

Job prospects. Advertising, marketing, promotions, public relations, and sales manager jobs are highly coveted and will be sought by other managers or highly experienced professionals, resulting in keen competition. College graduates with related experience, a high level of creativity, and strong communication skills should have the best job opportunities. In particular, employers will seek those who have the computer skills to con-

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16 Number	Change, 2006-16 Percent
Advertising, marketing, promotions, public relations, and sales managers	11-2000	583,000	651,000	68,000	12
Advertising and promotions managers	11-2011	47,000	50,000	3,000	6
Marketing and sales managers	11-2020	486,000	542,000	57,000	12
Marketing managers	11-2021	167,000	192,000	24,000	14
Sales managers	11-2022	318,000	351,000	33,000	10
Public relations managers	11-2031	50,000	58,000	8,400	17

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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duct advertising, marketing, promotions, public relations, and sales activities on the Internet.

Earnings

Median annual earnings in May 2006 were $73,060 for advertising and promotions managers, $98,720 for marketing managers, $91,560 for sales managers, and $82,180 for public relations managers.

Median annual earnings of wage and salary advertising and promotions managers in May 2006 in the advertising and related services industry were $97,540.

Median annual earnings in the industries employing the largest numbers of marketing managers were:

Computer systems design and related services	$119,540
Management of companies and enterprises	103,070
Management, scientific, and technical consulting services	100,200
Architectural, engineering, and related services	92,480
Depository credit intermediation	91,420

Median annual earnings in the industries employing the largest numbers of sales managers were:

Professional and commercial equipment and supplies merchant wholesalers	$112,810
Wholesale electronic markets and agents and brokers	107,420
Automobile dealers	101,110
Management of companies and enterprises	98,240
Machinery, equipment, and supplies merchant wholesalers	93,450

Salary levels vary substantially, depending upon the level of managerial responsibility, length of service, education, size of firm, location, and industry. For example, manufacturing firms usually pay these managers higher salaries than nonmanufacturing firms. For sales managers, the size of their sales territory is another important determinant of salary. Many managers earn bonuses equal to 10 percent or more of their salaries.

According to a survey by the National Association of Colleges and Employers, starting salaries for marketing majors graduating in 2007 averaged $40,161 and those for advertising majors averaged $33,831.

Related Occupations

Advertising, marketing, promotions, public relations, and sales managers direct the sale of products and services offered by their firms and the communication of information about their firms' activities. Other workers involved with advertising, marketing, promotions, public relations, and sales include actors, producers, and directors; advertising sales agents; artists and related workers; demonstrators, product promoters, and models; market and survey researchers; public relations specialists; sales representatives, wholesale and manufacturing; and writers and editors.

Sources of Additional Information

For information about careers in advertising management, contact:

➤ American Association of Advertising Agencies, 405 Lexington Ave., New York, NY 10174-1801. Internet: **http://www.aaaa.org**

Information about careers and professional certification in public relations management is available from:

➤ Public Relations Society of America, 33 Maiden LaNE., New York, NY 10038-5150. Internet: **http://www.prsa.org**

Computer and Information Systems Managers

(O*NET 11-3021.00)

Significant Points

- Employment of computer and information systems managers is expected to grow faster than the average for all occupations through the year 2016.
- Many managers possess advanced technical knowledge gained from working in a computer occupation.
- Job opportunities will be best for applicants with a strong understanding of business and good communication skills.

Nature of the Work

In the modern workplace, it is imperative that technology works both effectively and reliably. Computer and information systems managers play a vital role in the implementation of technology within their organizations. They do everything from helping to construct a business plan to overseeing network security to directing Internet operations.

Computer and information systems managers plan, coordinate, and direct research and facilitate the computer-related activities of firms. They help determine both technical and business goals in consultation with top management and make detailed plans for the accomplishment of these goals. This requires a strong understanding of both technology and business practices.

Computer and information systems managers direct the work of systems analysts, computer programmers, support specialists, and other computer-related workers. They plan and coordinate activities such as installation and upgrading of hardware and software, programming and systems design, development of computer networks, and implementation of Internet and intranet sites. They are increasingly involved with the upkeep, maintenance, and security of networks. They analyze the computer and information needs of their organizations from an operational and strategic perspective and determine immediate and long-range personnel and equipment requirements. They assign and review the work of their subordinates and stay abreast of the latest technology to ensure the organization does not lag behind competitors.

The duties of computer and information systems managers vary greatly. *Chief technology officers (CTOs)*, for example, evaluate the newest and most innovative technologies and determine how these can help their organizations. The chief tech-

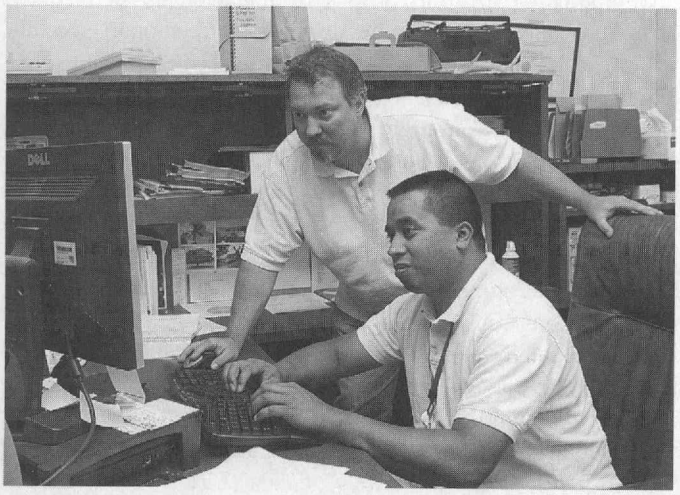
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nology officer often reports to the organization's chief information officer, manages and plans technical standards, and tends to the daily information technology issues of the firm. (Chief information officers are covered in a separate *Handbook* statement on top executives.) Because of the rapid pace of technological change, chief technology officers must constantly be on the lookout for developments that could benefit their organizations. Once a useful tool has been identified, the CTO must determine an implementation strategy and sell that strategy to management.

Management information systems (MIS) directors or *information technology (IT) directors* manage computing resources for their organizations. They often work under the chief information officer and plan and direct the work of subordinate information technology employees. These managers ensure the availability, continuity, and security of data and information technology services in their organizations. In this capacity, they oversee a variety of user services such as an organization's help desk, which employees can call with questions or problems. MIS directors also may make hardware and software upgrade recommendations based on their experience with an organization's technology.

Project managers develop requirements, budgets, and schedules for their firms' information technology projects. They coordinate such projects from development through implementation, working with internal and external clients, vendors, consultants, and computer specialists. These managers are increasingly involved in projects that upgrade the information security of an organization.

Work environment. Computer and information systems managers spend most of their time in offices. Most work at least 40 hours a week and some may have to work evenings and weekends to meet deadlines or solve unexpected problems. Some computer and information systems managers may experience considerable pressure in meeting technical goals with short deadlines or tight budgets. As networks continue to expand and more work is done remotely, computer and information systems managers have to communicate with and oversee offsite employees using modems, laptops, e-mail, and the Internet.



Computer and information systems managers supervise other information technology employees.

Like other workers who spend most of their time using computers, computer and information systems managers are susceptible to eyestrain, back discomfort, and hand and wrist problems such as carpal tunnel syndrome.

Training, Other Qualifications, and Advancement

Computer and information systems managers are generally experienced workers who have both technical expertise and an understanding of business and management principles. A strong educational background and experience in a variety of technical fields is needed.

Education and training. A bachelor's degree usually is required for management positions, although employers often prefer a graduate degree, especially an MBA with technology as a core component. This degree differs from a traditional MBA in that there is a heavy emphasis on information technology in addition to the standard business curriculum. This preparation is becoming important because more computer and information systems managers are making important technology decisions as well as business decisions for their organizations.

Some universities offer degrees in management information systems. These degrees blend technical subjects with business, accounting, and communications courses. A few computer and information systems managers attain their positions with only an associate or trade school degree, but they must have sufficient experience and must have acquired additional skills on the job. To aid their professional advancement, many managers with an associate degree eventually earn a bachelor's or master's degree while working.

Certification and other qualifications. Computer and information systems managers need a broad range of skills. Employers look for managers who have experience with the specific software or technology used on the job, as well as a background in either consulting or business management. The expansion of electronic commerce has elevated the importance of business insight and, consequently, many computer and information systems managers are called on to make important business decisions. Managers need a keen understanding of people, management processes, and customers' needs.

Advanced technical knowledge is essential for computer and information systems managers, who must understand and guide the work of their subordinates yet also explain the work in nontechnical terms to senior managers and potential customers. Therefore, many computer and information systems managers have worked as a systems analyst, for example, or as a computer support specialist, programmer, or other information technology professional.

Although certification is not necessarily required for most computer and information systems manager positions, there is a wide variety of certifications available that may be helpful in getting a job. These certifications are often product-specific, and are generally administered by software or hardware companies rather than independent organizations.

As computer systems become more closely connected with day-to-day operations of businesses, computer and information systems managers are also expected to be aware of business practices. They must possess strong interpersonal, communication, and leadership skills because they are required to interact

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not only with staff members, but also with other people inside and outside their organizations. They must possess team skills to work on group projects and other collaborative efforts. They also must have an understanding of how a business functions, how it earns revenue, and how technology relates to the core competencies of the business. As a result, many firms now prefer to give these positions to people who have spent time outside purely technical fields.

Advancement. Computer and information systems managers may advance to progressively higher leadership positions in the information technology department. A project manager might, for instance, move up to the chief technology officer position and then to chief information officer. On occasion, some may become managers in non-technical areas such as marketing, human resources, or sales because in high technology firms an understanding of technical issues is helpful in those areas.

Employment

Computer and information systems managers held about 264,000 jobs in 2006. About 1 in 4 computer managers worked in service-providing industries, mainly in computer systems design and related services. This industry provides services related to the commercial use of computers on a contract basis, including custom computer programming services; computer systems integration design services; computer facilities management services, including computer systems or data-processing facilities support services; and other computer-related services, such as disaster recovery services and software installation. Other large employers include insurance and financial firms, government agencies, and manufacturers.

Job Outlook

The increasing use of technology in the workplace is projected to lead to faster than average growth in this occupation. Due to employment increases and because of the high demand for technical workers, prospects should be excellent for qualified job candidates.

Employment change. Employment of computer and information systems managers is expected to grow 16 percent over the 2006-16 decade, which is faster than the average for all occupations. New applications of technology in the workplace will continue to drive demand for workers, fueling the need for more managers.

Despite the downturn in the technology sector in the early part of the decade, the outlook for computer and information systems managers remains strong. To remain competitive, firms will continue to install sophisticated computer networks and set up more complex intranets and websites. Keeping a computer network running smoothly is essential to almost every organization.

Because so much business is carried out over computer networks, security will continue to be an important issue for businesses and other organizations. Although software developers continue to improve their products to remove vulnerabilities, attackers are becoming ever more complex in their methods. Organizations need to understand how their systems are vulnerable and how to protect their infrastructure and Internet sites from hackers, viruses, and other attacks. The emergence of security as a key concern for businesses should lead to strong growth for computer managers. Firms will increasingly hire security experts to fill key leadership roles in their information technology departments because the integrity of their computing environments is of utmost importance. As a result, there will be a high demand for managers proficient in computer security issues.

With the explosive growth of electronic commerce and the capacity of the Internet to create new relationships with customers, the role of computer and information systems managers will continue to evolve. Workers who have experience in web applications and Internet technologies will become increasingly vital to their companies.

Opportunities for those who wish to become computer and information systems managers should be closely related to the growth of the occupations they supervise and the industries in which they are found. (See the statements on computer programmers, computer software engineers, computer support specialists and systems administrators, computer systems analysts, and computer scientists and database administrators elsewhere in the *Handbook*.)

Job prospects. Prospects for qualified computer and information systems managers should be excellent. Fast-paced occupational growth and the limited supply of technical workers will lead to a wealth of opportunities for qualified individuals. While technical workers remain relatively scarce in the United States, the demand for them continues to rise. This situation was exacerbated by the economic downturn in the early 2000s, when many technical professionals lost their jobs. Since then, many workers have chosen to avoid this work since it is perceived to have poor prospects.

Workers with specialized technical knowledge and strong communications skills will have the best prospects. People with management skills and an understanding of business practices and principles will have excellent opportunities, as companies are increasingly looking to technology to drive their revenue.

Earnings

Earnings for computer and information systems managers vary by specialty and level of responsibility. Median annual earnings of these managers in May 2006 were $101,580. The middle 50 percent earned between $79,240 and $129,250. Median

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Computer and information systems managers	11-3021	264,000	307,000	43,000	16

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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annual earnings in the industries employing the largest numbers of computer and information systems managers in May 2006 were as follows:

Computer systems design and related services	$109,130
Management of companies and enterprises	105,980
Data processing, hosting, and related services	105,200
Insurance carriers	102,180
Colleges, universities, and professional schools	83,280

The Robert Half Technology 2007 Salary Guide lists the following annual salary ranges for various computer and information systems manager positions: Chief Technology Officer (CTO), $101,000-$157,750; Chief Security Officer, $97,500-$141,000; Vice President of Information Technology, $107,500-$157,750; Information Technology Manager, Technical Services Manager, $62,500-$88,250.

In addition, computer and information systems managers, especially those at higher levels, often receive employment-related benefits, such as expense accounts, stock option plans, and bonuses.

Related Occupations

The work of computer and information systems managers is closely related to that of computer programmers, computer software engineers, computer systems analysts, computer scientists and database administrators, and computer support specialists and systems administrators. Computer and information systems managers also have some high-level responsibilities similar to those of top executives.

Sources of Additional Information

For information about a career as a computer and information systems manager, contact:

➤ Association of Information Technology Professionals, 401 North Michigan Ave., Suite 2400, Chicago, IL 60611. Internet: **http://www.aitp.org**

Construction Managers

(O*NET 11-9021.00)

Significant Points

- Construction managers must be available—often 24 hours a day—to deal with delays, bad weather, or emergencies at the jobsite.
- Employers prefer jobseekers who combine construction industry work experience with a bachelor's degree in construction science, construction management, or civil engineering.
- Although certification is not required, there is a growing movement toward certification of construction managers.
- Excellent job opportunities are expected.

Nature of the Work

Construction managers plan, direct, and coordinate a wide variety of construction projects, including the building of all types of residential, commercial, and industrial structures, roads, bridges, wastewater treatment plants, and schools and hospitals. Construction managers may oversee an entire project or just part of one. They schedule and coordinate all design and construction processes, including the selection, hiring, and oversight of specialty trade contractors, but they usually do not do any actual construction of the structure.

Construction managers are salaried or self-employed managers who oversee construction supervisors and workers. They are often called project managers, constructors, construction superintendents, project engineers, program managers, construction supervisors, or general contractors. Construction managers may be owners or salaried employees of a construction management or contracting firm, or may work under contract or as a salaried employee of the property owner, developer, or contracting firm overseeing the construction project.

These managers coordinate and supervise the construction process from the conceptual development stage through final construction, making sure that the project gets done on time and within budget. They often work with owners, engineers, architects, and others who are involved in the construction process. Given the designs for buildings, roads, bridges, or other projects, construction managers oversee the planning, scheduling, and implementation of those designs.

Large construction projects, such as an office building or industrial complex, are often too complicated for one person to manage. These projects are divided into many segments: site preparation, including land clearing and earth moving; sewage systems; landscaping and road construction; building construction, including excavation and laying of foundations and erection of the structural framework, floors, walls, and roofs; and building systems, including fire-protection, electrical, plumbing, air-conditioning, and heating. Construction managers may be in charge of one or more of these activities.

Construction managers determine the best way to get materials to the building site and the most cost-effective plan and schedule for completing the project. They divide all required construc-



Construction managers must be available—often 24 hours a day—to deal with delays, bad weather, or emergencies at the job site.

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tion site activities into logical steps, budgeting the time required to meet established deadlines. This may require sophisticated estimating and scheduling techniques and use of computers with specialized software. (See the section on cost estimators elsewhere in the *Handbook*.)

They also oversee the selection of general contractors and trade contractors to complete specific pieces of the project—which could include everything from structural metalworking and plumbing to painting and carpet installation. Construction managers determine the labor requirements and, in some cases, supervise or monitor the hiring and dismissal of workers. They oversee the performance of all trade contractors and are responsible for ensuring that all work is completed on schedule.

Construction managers direct and monitor the progress of construction activities, sometimes through construction supervisors or other construction managers. They oversee the delivery and use of materials, tools, and equipment; worker productivity and safety; and the quality of construction. They are responsible for obtaining all necessary permits and licenses and, depending upon the contractual arrangements, direct or monitor compliance with building and safety codes, other regulations, and requirements set by the project's insurers.

Work environment. Working out of a main office or out of a field office at the construction site, construction managers monitor the overall construction project. Decisions regarding daily construction activities generally are made at the jobsite. Managers may travel extensively when the construction site is not close to their main office or when they are responsible for activities at two or more sites. Management of overseas construction projects usually entails temporary residence in another country.

Often "on call" 24 hours a day, construction managers deal with delays, the effects of bad weather, or emergencies at the site. Most work more than a standard 40-hour week because construction may proceed around-the-clock. They may need to work this type of schedule for days or weeks to meet special project deadlines, especially if there are delays.

Although the work usually is not considered inherently dangerous, construction managers must be careful while performing onsite services.

Training, Other Qualifications, and Advancement

Employers increasingly prefer to hire construction managers with a bachelor's degree in construction science, construction management, building science, or civil engineering, although it is also possible for experienced construction workers to move up to become construction managers. In addition to having education and experience, construction mangers must understand contracts, plans, specifications, and regulations.

Education and training. For construction manager jobs, employers increasingly prefer to hire individuals who have a bachelor's degree in construction science, construction management, building science, or civil engineering, plus work experience. Practical construction experience is very important, whether gained through an internship, a cooperative education program, a job in the construction trades, or another job in the industry. Traditionally, people advanced to construction management positions after having substantial experience as construction craftworkers—carpenters, masons, plumbers, or electricians, for example—or after having worked as construction supervisors or as owners of independent specialty contracting firms. However, as construction processes become increasingly complex, employers are placing more importance on specialized education after high school.

About 105 colleges and universities offer bachelor's degree programs in construction science, building science, and construction engineering. These programs include courses in project control and development, site planning, design, construction methods, construction materials, value analysis, cost estimating, scheduling, contract administration, accounting, business and financial management, safety, building codes and standards, inspection procedures, engineering and architectural sciences, mathematics, statistics, and information technology. Graduates from 4-year degree programs usually are hired as assistants to project managers, field engineers, schedulers, or cost estimators. An increasing number of graduates in related fields—engineering or architecture, for example—also enter construction management, often after acquiring substantial experience on construction projects.

About 60 colleges and universities offer a master's degree program in construction management or construction science. Master's degree recipients, especially those with work experience in construction, typically become construction managers in very large construction or construction management companies. Often, individuals who hold a bachelor's degree in an unrelated field seek a master's degree in construction management or construction science to work in the construction industry. Some construction managers obtain a master's degree in business administration or finance to further their career prospects. Doctoral degree recipients usually become college professors or conduct research.

A number of 2-year colleges throughout the country offer construction management or construction technology programs. Many individuals also attend training and educational programs sponsored by industry associations, often in collaboration with postsecondary institutions.

Other qualifications. Construction managers should be flexible and work effectively in a fast-paced environment. They should be decisive and work well under pressure, particularly when faced with unexpected occurrences or delays. The ability to coordinate several major activities at once, while analyzing and resolving specific problems, is essential, as is an understanding of engineering, architectural, and other construction drawings. Familiarity with computers and software programs for job costing, online collaboration, scheduling, and estimating also is important.

Good oral and written communication skills also are important, as are leadership skills. Managers must be able to establish a good working relationship with many different people, including owners, other managers, designers, supervisors, and craftworkers. The ability to converse fluently in Spanish is increasingly an asset because Spanish is the first language of many workers in the construction industry.

Certification and advancement. There is a growing movement toward certification of construction managers. Although certification is not required to work in the construction industry, it can be valuable because it provides evidence of competence and experience. Both the American Institute of Constructors and the Construction Management Association of America have es-

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16 Number	Change, 2006-16 Percent
Construction managers	11-9021	487,000	564,000	77,000	16

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

tablished voluntary certification programs for construction managers. Requirements combine written examinations with verification of education and professional experience. The American Institute of Constructors awards the Associate Constructor (AC) and Certified Professional Constructor (CPC) designations to candidates who meet its requirements and pass the appropriate construction examinations. The Construction Management Association of America awards the Certified Construction Manager (CCM) designation to workers who have the required experience and who pass a technical examination. Applicants for this designation also must complete a self-study course that covers the professional role of a construction manager, legal issues, allocation of risk, and other topics related to construction management.

Advancement opportunities for construction managers vary depending upon an individual's performance and the size and type of company for which they work. Within large firms, managers may eventually become top-level managers or executives. Highly experienced individuals may become independent consultants; some serve as expert witnesses in court or as arbitrators in disputes. Those with the required capital may establish their own construction management services, specialty contracting, or general contracting firm.

Employment

Construction managers held 487,000 jobs in 2006. About 57 percent were self-employed, many as owners of general or specialty trade construction firms. Most salaried construction managers were employed in the construction industry, 13 percent by specialty trade contractor businesses—for example, plumbing, heating, air-conditioning, and electrical contractors—9 percent in residential building construction; and 9 percent in nonresidential building construction. Others were employed by architectural, engineering, and related services firms and by local governments.

Job Outlook

Faster than average employment growth is expected. Additionally, excellent job opportunities will exist as the number of job openings exceeds the number of qualified applicants.

Employment change. Employment of construction managers is projected to increase by 16 percent during the 2006-16 decade, faster than the average for all occupations. More construction managers will be needed as the level of construction activity continues to grow. Population and business growth will result in more construction of residential homes, office buildings, shopping malls, hospitals, schools, restaurants, and other structures that require construction managers.

The increasing complexity of construction projects will also boost demand for specialized management-level personnel within the construction industry. Sophisticated technology and the proliferation of laws setting standards for buildings and construction materials, worker safety, energy efficiency, environmental protection, and the potential for adverse litigation have further complicated the construction process. Advances in building materials and construction methods; the need to replace portions of the Nation's infrastructure; and the growing number of multipurpose buildings and energy-efficient structures will further add to the demand for more construction managers.

Job prospects. Excellent employment opportunities for construction managers are expected through 2016 because the number of job openings will exceed the number of qualified individuals seeking to enter the occupation. This situation is expected to continue even as college construction management programs expand to meet the current high demand for graduates. The construction industry often does not attract sufficient numbers of qualified job seekers because working conditions are considered poor.

In addition to job openings arising from employment growth, many additional openings should result annually from the need to replace workers who transfer to other occupations or leave the labor force for other reasons. A substantial number of seasoned managers are also expected to retire over the next decade, likely resulting in a large number of openings.

Prospects for individuals seeking construction manager jobs in construction management, architectural and engineering services, and construction contracting firms should be best for people who have a bachelor's or higher degree in construction science, construction management, or civil engineering plus practical experience working in construction. Employers will increasingly prefer applicants with college degrees, internships, and a strong background in building technology. Construction managers will also have many opportunities to start their own firms.

Employment of construction managers, like that of many other construction workers, is sensitive to the fluctuations of the economy. Workers in these trades may experience periods of unemployment when the overall level of construction falls. On the other hand, shortages of these workers may occur in some areas during peak periods of building activity.

Earnings

Earnings of salaried construction managers and self-employed independent construction contractors vary depending upon the size and nature of the construction project, its geographic location, and economic conditions. In addition to typical benefits, many salaried construction managers receive bonuses and use of company motor vehicles.

Median annual earnings of wage and salary construction managers in May 2006 were $73,700. The middle 50 percent earned between $56,090 and $98,350. The lowest paid 10 percent earned less than $43,210, and the highest paid 10 percent earned more than $135,780. Median annual earnings in the industries employing the largest numbers of construction managers were as follows:

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Building equipment contractors	$75,200
Electrical contractors	74,380
Nonresidential building construction	74,080
Foundation, structure, and building exterior contractors	71,640
Residential building construction	69,400

The earnings of self-employed workers are not included in these numbers.

According to a July 2007 salary survey by the National Association of Colleges and Employers, people with a bachelor's degree in construction science/management received job offers averaging $46,930 a year.

Related Occupations

Construction managers participate in the conceptual development of a construction project and oversee its organization, scheduling, and implementation. Other workers who perform similar functions include architects, except landscape and naval; civil engineers; cost estimators; landscape architects; and engineering and natural sciences managers.

Sources of Additional Information

For information about constructor certification, contact:

➤ American Institute of Constructors, 717 Princess St., Alexandria, VA 22314. Internet: **http://www.aicnet.org**

For information about construction management and construction manager certification, contact:

➤ Construction Management Association of America, 7918 Jones Branch Dr., Suite 540, McLean, VA 22102.
Internet: **http://www.cmaanet.org**

Information on accredited construction science and management educational programs and accreditation requirements is available from:

➤ American Council for Construction Education, 1717 North Loop 1604 E, Suite 320, San Antonio, TX 78232.
Internet: **http://www.acce-hq.org**

➤ National Center for Construction Education and Research, P.O. Box 141104, Gainesville, FL 32614.
Internet: **http://www.nccer.org**

Education Administrators

(O*NET 11-9031.00, 11-9032.00, 11-9033.00, 11-9039.99)

Significant Points

- Many jobs require a master's or doctoral degree and experience in a related occupation, such as teaching or admissions counseling.
- Strong interpersonal and communication skills are essential because much of an administrator's job involves working and collaborating with others.
- Excellent opportunities are expected since a large proportion of education administrators is expected to retire over the next 10 years.

Nature of the Work

Successful operation of an educational institution requires competent administrators. Education administrators provide instructional leadership and manage the day-to-day activities in schools, preschools, day care centers, and colleges and universities. They also direct the educational programs of businesses, correctional institutions, museums, and job training and community service organizations. (College presidents and school superintendents are covered in the *Handbook* statement on general managers and top executives.)

Education administrators set educational standards and goals and establish the policies and procedures to achieve them. They also supervise managers, support staff, teachers, counselors, librarians, coaches, and other employees. They develop academic programs, monitor students' educational progress, train and motivate teachers and other staff, manage career counseling and other student services, administer recordkeeping, prepare budgets, and perform many other duties. They also handle relations with parents, prospective and current students, employers, and the community. In an organization such as a small day care center, one administrator may handle all these functions. In universities or large school systems, responsibilities are divided among many administrators, each with a specific function.

Educational administrators who manage elementary, middle, and secondary schools are called *principals*. They set the academic tone and actively work with teachers to develop and maintain high curriculum standards, develop mission statements, and set performance goals and objectives. Principals confer with staff to advise, explain, or answer procedural questions. They hire, evaluate, and help improve the skills of teachers and other staff. They visit classrooms, observe teaching methods, review instructional objectives, and examine learning materials. Principals must use clear, objective guidelines for teacher appraisals, because pay often is based on performance ratings.

Principals also meet and interact with other administrators, students, parents, and representatives of community organizations. Decision-making authority has increasingly shifted from school district central offices to individual schools. School principals have greater flexibility in setting school policies and goals, but when making administrative decisions they must pay attention to the concerns of parents, teachers, and other members of the community.

Preparing budgets and reports on various subjects, including finances and attendance, and overseeing the requisition and allocation of supplies also is an important responsibility of principals. As school budgets become tighter, many principals have become more involved in public relations and fundraising to secure financial support for their schools from local businesses and the community.

Principals must take an active role to ensure that students meet national, State, and local academic standards. Many principals develop partnerships with local businesses and school-to-work transition programs for students. Increasingly, principals must be sensitive to the needs of the rising number of non-English speaking and culturally diverse student body. In some areas, growing enrollments also are a cause for concern because they lead to overcrowding at many schools. When addressing prob-

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lems of inadequate resources, administrators serve as advocates for the building of new schools or the repair of existing ones. During summer months, principals are responsible for planning for the upcoming year, overseeing summer school, participating in workshops for teachers and administrators, supervising building repairs and improvements, and working to make sure the school has adequate staff for the school year.

Schools continue to be involved with students' emotional welfare as well as their academic achievement. As a result, principals face responsibilities outside the academic realm. For example, many schools have growing numbers of students from dual-income and single-parent families or students who are themselves teenage parents. To support these students and their families, some schools have established before- and after-school childcare programs or family resource centers, which also may offer parenting classes and social service referrals. With the help of community organizations, some principals have established programs to combat increases in crime, drug and alcohol abuse, and sexually transmitted diseases among students.

Assistant principals aid the principal in the overall administration of the school. Some assistant principals hold this position for several years, during which time they prepare for advancement to principal; others are assistant principals throughout their careers. They are primarily responsible for scheduling student classes, ordering textbooks and supplies, and coordinating transportation, custodial, cafeteria, and other support services. They usually handle student discipline and attendance problems, social and recreational programs, and health and safety matters. They also may counsel students on personal, educational, or vocational matters. With the advent of site-based management, assistant principals are playing a greater role in ensuring the academic success of students by helping to develop new curriculums, evaluating teachers, and dealing with school-community relations—responsibilities previously assumed solely by the principal. The number of assistant principals that a school employs may vary, depending on the number of students.



Most education administrators begin their careers as teachers.

Administrators in school district central offices oversee public schools under their jurisdiction. This group includes those who direct subject-area programs such as English, music, vocational education, special education, and mathematics. They supervise instructional coordinators and curriculum specialists, and work with them to evaluate curriculums and teaching techniques and improve them. (Instructional coordinators are covered elsewhere in the *Handbook*.) Administrators also may oversee career counseling programs and testing that measures students' abilities and helps to place them in appropriate classes. Others may also direct programs such as school psychology, athletics, curriculum and instruction, and professional development. With site-based management, administrators have transferred primary responsibility for many of these programs to the principals, assistant principals, teachers, instructional coordinators, and other staff in the schools.

In preschools and childcare centers, which are usually much smaller than other educational institutions, the director or supervisor of the school or center often serves as the sole administrator. Their job is similar to that of other school administrators in that they oversee daily activities and operation of the schools, hire and develop staff, and make sure that the school meets required regulations and educational standards.

In colleges and universities, *provosts*, also known as *chief academic officers*, assist presidents, make faculty appointments and tenure decisions, develop budgets, and establish academic policies and programs. With the assistance of *academic deans* and *deans of faculty*, they also direct and coordinate the activities of deans of individual colleges and chairpersons of academic departments. Fundraising is the chief responsibility of the *director of development* and also is becoming an essential part of the job for all administrators.

College or university department heads or *chairpersons* are in charge of departments that specialize in particular fields of study, such as English, biological science, or mathematics. In addition to teaching, they coordinate schedules of classes and teaching assignments; propose budgets; recruit, interview, and hire applicants for teaching positions; evaluate faculty members; encourage faculty development; serve on committees; and perform other administrative duties. In overseeing their departments, chairpersons must consider and balance the concerns of faculty, administrators, and students.

Higher education administrators also direct and coordinate the provision of student services. *Vice presidents of student affairs or student life, deans of students*, and *directors of student services* may direct and coordinate admissions, foreign student services, health and counseling services, career services, financial aid, and housing and residential life, as well as social, recreational, and related programs. In small colleges, they may counsel students. In larger colleges and universities, separate administrators may handle each of these services. *Registrars* are custodians of students' records. They register students, record grades, prepare student transcripts, evaluate academic records, assess and collect tuition and fees, plan and implement commencement, oversee the preparation of college catalogs and schedules of classes, and analyze enrollment and demo-

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graphic statistics. *Directors of admissions* manage the process of recruiting, evaluating, and admitting students, and work closely with *financial aid directors*, who oversee scholarship, fellowship, and loan programs. Registrars and admissions officers at most institutions need computer skills because they use electronic student information systems. For example, for those whose institutions present college catalogs, schedules, and other information on the Internet, knowledge of online resources, imaging, and other computer skills is important. *Athletic directors* plan and direct intramural and intercollegiate athletic activities, seeing to publicity for athletic events, preparation of budgets, and supervision of coaches. Other increasingly important administrators direct public relations, distance learning, and technology.

Work environment. Education administrators hold leadership positions with significant responsibility. Most find working with students extremely rewarding, but as the responsibilities of administrators have increased in recent years, so has the stress. Coordinating and interacting with faculty, parents, students, community members, business leaders, and State and local policymakers can be fast-paced and stimulating, but also stressful and demanding. Principals and assistant principals, whose varied duties include discipline, may find working with difficult students to be challenging. They are also increasingly being held accountable for ensuring that their schools meet recently imposed State and Federal guidelines for student performance and teacher qualifications.

About 1 in 3 education administrators work more than 40 hours a week and often supervise school activities at night and on weekends. Most administrators work year round, although some work only during the academic year.

Training, Other Qualifications, and Advancement

Most education administrators begin their careers as teachers and prepare for advancement into education administration by completing a master's or doctoral degree. Because of the diversity of duties and levels of responsibility, educational backgrounds and experience vary considerably among these workers.

Education and training. Principals, assistant principals, central office administrators, academic deans, and preschool directors usually have held teaching positions before moving into administration. Some teachers move directly into principal positions; others first become assistant principals, or gain experience in other administrative jobs at either the school or district level in positions such as department head, curriculum specialist, or subject matter advisor. In some cases, administrators move up from related staff jobs such as recruiter, school counselor, librarian, residence hall director, or financial aid or admissions counselor.

In most public schools, principals, assistant principals, and school district administrators need a master's degree in education administration or educational leadership. Some principals and central office administrators have a doctorate or specialized degree in education administration. In private schools, some principals and assistant principals hold only a bachelor's degree, but the majority have a master's or doctoral degree.

Educational requirements for administrators of preschools and childcare centers vary depending on the setting of the program and the State of employment. Administrators who oversee preschool programs in public schools are often required to have at least a bachelor's degree. Child care directors who supervise private programs are usually not required to have a degree; however, most States require a preschool education credential, which often includes some postsecondary coursework.

College and university academic deans and chairpersons usually advance from professorships in their departments, for which they need a master's or doctoral degree; further education is not typically necessary. Admissions, student affairs, and financial aid directors and registrars sometimes start in related staff jobs with bachelor's degrees—any field usually is acceptable—and obtain advanced degrees in college student affairs, counseling, or higher education administration. A Ph.D. or Ed.D. usually is necessary for top student affairs positions. Computer literacy and a background in accounting or statistics may be assets in admissions, records, and financial work.

Advanced degrees in higher education administration, educational leadership, and college student affairs are offered in many colleges and universities. Education administration degree programs include courses in school leadership, school law, school finance and budgeting, curriculum development and evaluation, research design and data analysis, community relations, politics in education, and counseling. The National Council for Accreditation of Teacher Education (NCATE) and the Educational Leadership Constituent Council (ELCC) accredit programs designed for elementary and secondary school administrators. Although completion of an accredited program is not required, it may assist in fulfilling licensure requirements.

Licensure and certification. Most States require principals to be licensed as school administrators. License requirements vary by State, but nearly all States require either a master's degree or some other graduate-level training. Some States also require candidates for licensure to pass a test. On-the-job training, often with a mentor, is increasingly required or recommended for new school leaders. Some States require administrators to take continuing education courses to keep their license, thus ensuring that administrators have the most up-to-date skills. The number and types of courses required to maintain licensure vary by State. Principals in private schools are not subject to State licensure requirements.

Nearly all States require child care and preschool center directors to be licensed. Licensing usually requires a number of years of experience or hours of coursework or both. Sometimes, it requires a college degree. Often, directors are also required to earn a general preschool education credential, such as the Child Development Associate credential (CDA) sponsored by the Council for Professional Recognition, or some other credential designed specifically for directors.

One credential specifically for directors is the National Administration Credential, offered by the National Child Care Association. The credential requires experience and training in child care center management.

There are usually no licensing requirements for administrators at postsecondary institutions.

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Other qualifications. To be considered for education administrator positions, workers must first prove themselves in their current jobs. In evaluating candidates, supervisors look for leadership, determination, confidence, innovativeness, and motivation. The ability to make sound decisions and to organize and coordinate work efficiently is essential. Because much of an administrator's job involves interacting with others—such as students, parents, teachers, and the community—a person in such a position must have strong interpersonal skills and be an effective communicator and motivator. Knowledge of leadership principles and practices, gained through work experience and formal education, is important. A familiarity with computer technology is a necessity for principals, who are required to gather information and coordinate technical resources for their students, teachers, and classrooms.

Advancement. Education administrators advance through promotion to higher level administrative positions or by transferring to comparable positions at larger schools or systems. They also may become superintendents of school systems or presidents of educational institutions.

Employment

Education administrators held about 443,000 jobs in 2006. Of these, 56,000 were preschool or child care administrators, 226,000 were elementary or secondary school administrators, and 131,000 were postsecondary administrators. The great majority—over 80 percent—worked in public or private educational institutions. Most of the remainder worked in child daycare centers, religious organizations, job training centers, and businesses and other organizations that provided training for their employees.

Job Outlook

Employment of education administrators is projected to grow about as fast as average, as education and training take on greater importance in everyone's lives. Job opportunities for many of these positions should be excellent because a large proportion of education administrators are expected to retire over the next 10 years.

Employment change. Employment of education administrators is expected to grow by 12 percent between 2006 and 2016, about as fast as the average for all occupations, primarily due to growth in enrollments of school-age children. Enrollment of students in elementary and secondary schools is expected to grow slowly over the next decade, which will limit the growth of principals and other administrators in these schools. However, the number of administrative positions will continue to increase as more administrative responsibilities are placed on individual schools, particularly related to monitoring student achievement. Preschool and childcare center administrators are expected to experience substantial growth due to increasing enrollments in formal child care programs as fewer young children are cared for in private homes. Additionally, as more States implement or expand public preschool programs, more preschool directors will be needed.

The number of students at the postsecondary level is projected to grow more rapidly than other student populations, creating significant demand for administrators at that level. A significant portion of the growth will occur in the private and for-profit segments of higher education. Many of these schools cater to working adults who might not ordinarily participate in postsecondary education. These schools allow students to earn a degree, receive job-specific training, or update their skills in a convenient manner, such as through part-time programs or distance learning. As the number of these schools continues to grow, more administrators will be needed to oversee them.

Job prospects. Principals and assistant principals should have very favorable job prospects. A sharp increase in responsibilities in recent years has made the job more stressful and has discouraged some teachers from taking positions in administration. Principals are now being held more accountable for the performance of students and teachers, while at the same time they are required to adhere to a growing number of government regulations. In addition, overcrowded classrooms, safety issues, budgetary concerns, and teacher shortages in some areas all are creating additional stress for administrators. Many teachers feel that the increase in pay for becoming an administrator is not high enough to compensate for the greater responsibilities.

Opportunities may vary by region of the country. Enrollments are expected to increase the fastest in the West and South, where the population is growing faster, and to decline or remain stable in the Northeast and the Midwest. School administrators also are in greater demand in rural and urban areas, where pay is generally lower than in the suburbs.

Although competition among faculty for prestigious positions as academic deans and department heads is likely to remain keen, fewer applicants are expected for nonacademic administrative jobs, such as director of admissions or student affairs. Furthermore, many people are discouraged from seeking administrator jobs by the requirement that they have a master's or doctoral degree in education administration—as well as by the opportunity to earn higher salaries in other occupations.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Education administrators	11-9030	443,000	496,000	53,000	12
Education administrators, preschool and child care center/ program	11-9031	56,000	69,000	13,000	24
Education administrators, elementary and secondary school	11-9032	226,000	243,000	17,000	8
Education administrators, postsecondary	11-9033	131,000	150,000	19,000	14
Education administrators, all other	11-9039	30,000	33,000	3,700	13

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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Earnings

In May 2006, elementary and secondary school administrators had median annual earnings of $77,740; postsecondary school administrators had median annual earnings of $73,990, while administrators in preschool and childcare centers earned a median of $37,740 per year. Salaries of education administrators depend on several factors, including the location and enrollment level in the school or school district.

According to a survey of public schools, conducted by the Educational Research Service, average salaries for principals and assistant principals in the 2006-07 school year were as follows:

Principals:	
Senior high school	$92,965
Jr. high/middle school	87,866
Elementary school	82,414
Assistant principals:	
Senior high school	$75,121
Jr. high/middle school	73,020
Elementary school	67,735

According to the College and University Professional Association for Human Resources, median annual salaries for selected administrators in higher education in 2006-07 were as follows:

Chief academic officer	$140,595
Academic deans:	
Business	$135,080
Arts and sciences	121,942
Graduate programs	120,120
Education	117,450
Nursing	112,497
Health-related professions	110,346
Continuing education	99,595
Occupational studies/vocational education	83,108
Other administrators:	
Chief development officer	$125,000
Dean of students	80,012
Director, student financial aid	68,000
Registrar	66,008
Director, student activities	50,000

Benefits for education administrators are generally very good. Many get 4 or 5 weeks of vacation every year and have generous health and pension packages. Many colleges and universities offer free tuition to employees and their families.

Related Occupations

Education administrators apply organizational and leadership skills to provide services to individuals. Workers in related occupations include administrative services managers; office and administrative support worker supervisors and managers; and human resource, training, and labor relations managers and specialists. Education administrators also work with students and have backgrounds similar to those of counselors; librarians; instructional coordinators; teachers—preschool, kindergarten, elementary, middle, and secondary; and teachers—postsecondary.

Sources of Additional Information

For information on principals, contact:

➤ The National Association of Elementary School Principals, 1615 Duke St., Alexandria, VA 22314-3483.
Internet: **http://www.naesp.org**

➤ The National Association of Secondary School Principals, 1904 Association Drive, Reston, VA 20191-1537.
Internet: **http://www.nassp.org**

For a list of nationally recognized programs in elementary and secondary educational administration, contact:

➤ The Educational Leadership Constituent Council, 1904 Association Drive, Reston, VA 20191.
Internet: **http://www.npbea.org/ELCC/index.html**

For information on collegiate registrars and admissions officers, contact:

➤ American Association of Collegiate Registrars and Admissions Officers, One Dupont Circle NW., Suite 520, Washington, DC 20036-1171. Internet: **http://www.aacrao.org**

For information on professional development and graduate programs for college student affairs administrators, contact:

➤ NASPA, Student Affairs Administrators in Higher Education, 1875 Connecticut Ave. NW., Suite 418, Washington, DC 20009.
Internet: **http://www.naspa.org**

For information on the National Administrator Credential for child care directors, contact:

➤ National Child Care Association, 2025 M St NW., Suite 800, Washington, DC 20036. Internet: **http://www.nccanet.org**

For information on the Child Development Associate Credential, contact:

➤ Council for Professional Recognition, 2460 16th St., NW., Washington, DC 20009. Internet: **http://www.cdacouncil.org**

Engineering and Natural Sciences Managers

(O*NET 11-9041.00, 11-9121.00)

Significant Points

- Most engineering and natural sciences managers have formal education and work experience as engineers, scientists, or mathematicians.
- Projected employment growth for engineering and natural sciences managers is closely related to growth in employment of the engineers and scientists they supervise and the industries in which they work.
- Opportunities will be best for workers with strong communication and business management skills.

Nature of the Work

Engineering and natural sciences managers plan, coordinate, and direct research, design, and production activities. They

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may supervise engineers, scientists, and technicians, along with support personnel. These managers use their knowledge of engineering and natural sciences to oversee a variety of activities. They determine scientific and technical goals within broad outlines provided by top executives, who are discussed elsewhere in the *Handbook*. These goals may include improving manufacturing processes, advancing scientific research, or developing new products. Managers make detailed plans to accomplish these goals. For example, they may develop the overall concepts of a new product or identify technical problems preventing the completion of a project.

To perform effectively, these managers also must apply knowledge of administrative procedures, such as budgeting, hiring, and supervision. They propose budgets for projects and programs and determine staff, training, and equipment needs. They hire and assign scientists, engineers, and support personnel to carry out specific parts of each project. They also supervise the work of these employees, check the technical accuracy of their work and the soundness of their methods, review their output, and establish administrative procedures and policies—including environmental standards, for example.

In addition, these managers use communication skills extensively. They spend a great deal of time coordinating the activities of their unit with those of other units or organizations. They confer with higher levels of management; with financial, production, marketing, and other managers; and with contractors and equipment and materials suppliers.

Engineering managers may supervise people who design and develop machinery, products, systems, and processes. They might also direct and coordinate production, operations, quality assurance, testing, or maintenance in industrial plants. Many are plant engineers, who direct and coordinate the design, installation, operation, and maintenance of equipment and machinery in industrial plants. Others manage research and development teams that produce new products and processes or improve existing ones.

Natural sciences managers oversee the work of life and physical scientists, including agricultural scientists, chemists, biologists, geologists, medical scientists, and physicists. These managers direct research and development projects and coordinate activities such as testing, quality control, and production. They may work on basic research projects or on commercial activities. Science managers sometimes conduct their own research in addition to managing the work of others.



Engineering and science managers must have well-developed business and communication skills.

Work environment. Engineering and natural sciences managers spend most of their time in an office. Some managers, however, also may work in laboratories, where they may be exposed to the same conditions as research scientists, or in industrial plants, where they may be exposed to the same conditions as production workers. Most managers work at least 40 hours a week and may work much longer on occasion to meet project deadlines. Some may experience considerable pressure to meet technical or scientific goals on a short deadline or within a tight budget.

Training, Other Qualifications, and Advancement

Strong technical knowledge is essential for engineering and natural sciences managers, who must understand and guide the work of their subordinates and explain the work in nontechnical terms to senior management and potential customers. Therefore, most managers have formal education and work experience as an engineer, scientist, or mathematician.

Education and training. These managers usually have education similar to that of the workers they supervise. Most engineering managers, for example, begin their careers as engineers, after completing a bachelor's degree in the field. Many engineers gain business management skills by completing a master's degree in engineering management (MEM) or business administration (MBA). Employers often pay for such training. In large firms, some courses required in these degree programs may be offered onsite. Typically, engineers who prefer to manage in technical areas pursue an MEM, and those interested in less technical management earn an MBA.

Similarly, many science managers begin their careers as scientists, such as chemists, biologists, geologists, or mathematicians. Most scientists and mathematicians engaged in basic research have a Ph.D. degree; some who work in applied research and other activities may have a bachelor's or master's degree. Graduate programs allow scientists to augment their undergraduate training with instruction in other fields, such as management or computer technology. Natural science managers interested in more technical management may earn traditional master's or Ph.D. degrees in natural sciences or master's degrees in science that incorporate business management skills. Those interested in more general management may pursue an MBA. Given the rapid pace of scientific developments, science managers must continuously upgrade their knowledge.

Other qualifications. Engineering and natural sciences managers must be specialists in the work they supervise. To advance to these positions, engineers and scientists generally must gain experience and assume management responsibility. To fill management positions, employers seek engineers and scientists who possess administrative and communication skills in addition to technical knowledge in their specialty. In fact, because engineering and natural sciences managers must effectively lead groups and coordinate projects, they usually need excellent communication and administrative skills.

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Advancement. Engineering and natural sciences managers may advance to progressively higher leadership positions within their disciplines. Some may become managers in nontechnical areas such as marketing, human resources, or sales. In high technology firms, managers in nontechnical areas often must possess the same specialized knowledge as do managers in technical areas. For example, employers in an engineering firm may prefer to hire experienced engineers as sales workers because the complex services offered by the firm can be marketed only by someone with specialized engineering knowledge. Such sales workers could eventually advance to jobs as sales managers.

Employment

Engineering and natural sciences managers held about 228,000 jobs in 2006. Manufacturing industries employed 38 percent of engineering and natural sciences managers. Manufacturing industries with the largest employment are those which produce computer and electronic equipment and those which produce transportation equipment, including aerospace products and parts. Another 31 percent worked in professional, scientific, and technical services industries, primarily for firms providing architectural, engineering, and related services and firms providing scientific research and development services. Other large employers include Federal, State, and local government agencies.

Job Outlook

Employment of engineering and natural sciences managers is projected to grow about as fast as the average for all occupations, similar to the growth rate of engineers and life and physical scientists. Opportunities will be best for workers with strong communication and business management skills.

Employment change. Employment of engineering and natural sciences managers is expected to grow 8 percent over the 2006-16 decade, about as fast as the average for all occupations. Projected employment growth for engineering and natural sciences managers should be in line with growth of the engineers and scientists they supervise and the industries in which they work. Because many employers find it more efficient to contract engineering and science work to specialty firms, there should be strong demand for engineering managers in the scientific research and development services industry and for both engineering and natural science managers in the architectural, engineering, and related services industry.

Job prospects. Opportunities for engineering managers should be better in rapidly growing areas of engineering—such as environmental and biomedical engineering—than in more slowly growing areas—such as electronics and materials engineering. Opportunities for natural sciences managers should likewise be best in the rapidly growing medical and environmental sciences. (See the statements on engineers and life and physical scientists elsewhere in the *Handbook*.) Engineers and scientists with advanced technical knowledge and strong communication skills will be in the best position to become managers. Because engineering and natural sciences managers are involved in the financial, production, and marketing activities of their firm, business management skills are also advantageous for those seeking management positions. In addition to those openings resulting from employment growth, job openings will result from the need to replace managers who retire or move into other occupations.

Earnings

Earnings for engineering and natural sciences managers vary by specialty and by level of responsibility. Median annual earnings of wage and salary engineering managers were $105,430 in May 2006. The middle 50 percent earned between $84,090 and $130,170. Median annual earnings in the industries employing the largest numbers of engineering managers were:

Semiconductor and other electronic component manufacturing	$120,740
Federal executive branch	116,140
Navigational, measuring, electromedical, and control instruments manufacturing	115,150
Aerospace product and parts manufacturing	111,020
Engineering services	103,570

Median annual earnings of wage and salary natural sciences managers were $100,080 in May 2006. The middle 50 percent earned between $77,320 and $130,900. Median annual earnings in the industries employing the largest numbers of natural sciences managers were:

Research and development in the physical, engineering, and life sciences	$120,780
Pharmaceutical and medicine manufacturing	111,070
Federal executive branch	96,100
Architectural, engineering, and related services	88,990
State government	65,570

In addition, engineering and natural sciences managers, especially those at higher levels, often receive more benefits—such as expense accounts, stock option plans, and bonuses—than do nonmanagerial workers in their organizations.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Engineering and natural sciences managers	—	228,000	246,000	18,000	8
Engineering managers	11-9041	187,000	201,000	14,000	7
Natural sciences managers	11-9121	41,000	45,000	4,600	11

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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Related Occupations

The work of engineering and natural sciences managers is closely related to that of engineers; mathematicians; and physical and life scientists, including agricultural and food scientists, atmospheric scientists, biological scientists, conservation scientists and foresters, chemists and materials scientists, environmental scientists and hydrologists, geoscientists, medical scientists, and physicists and astronomers. It also is related to the work of other managers, especially top executives.

Sources of Additional Information

For information about a career as an engineering and natural sciences manager, contact the sources of additional information for engineers, life scientists, and physical scientists that are listed at the end of statements on these occupations elsewhere in the *Handbook*.

Additional information on science and engineering master's degrees is available from:

➤ Commission on Professionals in Science and Technology, 1200 New York Ave. NW., Suite 113, Washington, DC 20005. Internet: **http://www.sciencemasters.org**

To learn more about managing scientists and engineers in research and development, see the *Occupational Outlook Quarterly* article, "Careers for scientists—and others—in scientific research and development," in print at many libraries and career centers. and online at:
http://www.bls.gov/opub/ooq/2005/summer/art04.htm

Farmers, Ranchers, and Agricultural Managers

(O*NET 11-9011.00 11–9011.01, 11–9011.02, 11–9011.03, 11–9012.00)

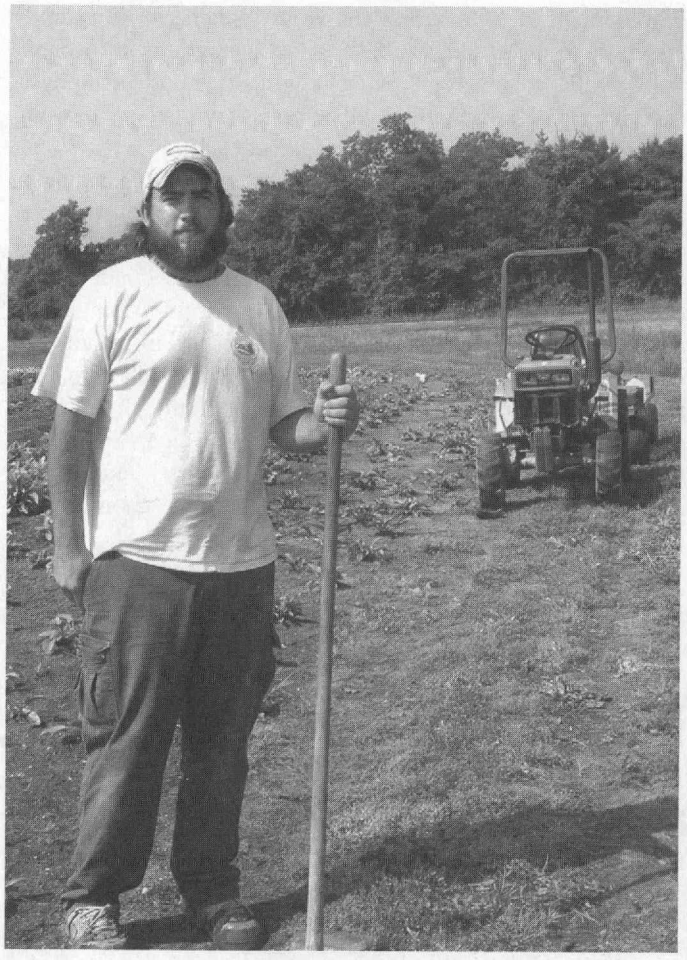
Significant Points

- Modern farming requires knowledge of new developments in agriculture, as well as work experience often gained through growing up on a farm or through postsecondary education.
- Overall employment is projected to decline because of increasing productivity and consolidation of farms.
- Horticulture and organic farming will provide better employment opportunities.
- Small-scale farming is a major growth area and offers the best opportunity for entering the occupation.

Nature of the Work

American farmers, ranchers, and agricultural managers direct the activities of one of the world's largest and most productive agricultural sectors. They produce enough food and fiber to meet the needs of the United States and for export. *Farmers and ranchers* own and operate mainly family-owned farms. They also may lease land from a landowner and operate it as a working farm. *Agricultural managers* manage the day-to-day activities of one or more farms, ranches, nurseries, timber tracts, greenhouses, or other agricultural establishments for farmers, absentee landowners, or corporations. Their duties and responsibilities vary widely but focus on the business aspects of running a farm. On small farms, they may oversee the entire operation; on larger farms, they may oversee a single activity, such as marketing.

Farmers, ranchers, and agricultural managers make many managerial decisions. Farm output and income are strongly influenced by the weather, disease, fluctuations in prices of domestic and foreign farm products, and Federal farm programs. In crop-production operations, farmers and managers usually determine the best time to plant seed, apply fertilizer and chemicals, and harvest and market the crops. Many carefully plan the combination of crops they grow, so that if the price of one crop drops, they will have sufficient income from another crop to make up the loss. Farmers, ranchers, and managers monitor the constantly changing prices for their products. They use different strategies to protect themselves from unpredictable changes in the markets for agricultural products. If they plan ahead, they may be able to store their crops or keep their livestock to take advantage of higher prices later in the year. Those who participate in the risky futures market buy contracts on future production of agricultural goods. These contracts can minimize the risk of sudden price changes by guaranteeing a certain price for farmers' and ranchers' agricultural goods when they are ready to sell.



Farmers need in-depth knowledge of many kinds of crops.

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While most farm output is sold directly to food-processing companies, some farmers—particularly operators of smaller farms—may choose to sell their goods directly to consumers through farmers' markets. Some use cooperatives to reduce their financial risk and to gain a larger share of the prices consumers pay. For example, in community-supported agriculture, cooperatives sell shares of a harvest to consumers prior to the planting season, thus freeing the farmer from having to bear all the financial risks and ensuring the farmer a market for the produce of the coming season. Farmers, ranchers, and agricultural managers also negotiate with banks and other credit lenders to get the best financing deals for their equipment, livestock, and seed.

Like other businesses, farming operations have become more complex in recent years, so many farmers use computers to keep financial and inventory records. They also use computer databases and spreadsheets to manage breeding, dairy, and other farm operations.

The type of farm farmers, ranchers, and agricultural managers operate determines their specific tasks. On crop farms—farms growing grain, cotton, other fibers, fruit, and vegetables—farmers are responsible for preparing, tilling, planting, fertilizing, cultivating, spraying, and harvesting. After the harvest, they make sure that the crops are properly packaged, stored, and marketed. Livestock, dairy, and poultry farmers and ranchers feed and care for animals and keep barns, pens, coops, and other farm buildings clean and in good condition. They also plan and oversee breeding and marketing activities. Both farmers and ranchers operate machinery and maintain equipment and facilities, and both track technological improvements in animal breeding and seeds, and choose new or existing products.

The size of the farm or ranch often determines which of these tasks farmers and ranchers handle themselves. Operators of small farms usually perform all tasks, physical and administrative. They keep records for management and tax purposes, service machinery, maintain buildings, and grow vegetables and raise animals. Operators of large farms, by contrast, have employees who help with the physical work that small-farm operators do themselves. Although employment on most farms is limited to the farmer and 1 or 2 family workers or hired employees, some large farms have 100 or more full-time and seasonal workers. Some of these employees are in nonfarm occupations, working as truck drivers, sales representatives, bookkeepers, and computer specialists.

Agricultural managers usually do not plant, harvest, or perform other production activities; instead, they hire and supervise farm and livestock workers, who perform most daily production tasks. Managers may establish output goals; determine financial constraints; monitor production and marketing; hire, assign, and supervise workers; determine crop transportation and storage requirements; and oversee maintenance of the property and equipment.

Two types of farmers that are growing in importance are horticultural specialty farmers and aquaculture farmers. *Horticultural specialty farmers* oversee the production of fruits, vegetables, flowers, and ornamental plants used in landscaping, including turf. They also grow nuts, berries, and grapes for wine. *Aquaculture farmers* raise fish and shellfish in marine, brackish, or fresh water, usually in ponds, floating net pens, raceways, or recirculating systems. They stock, feed, protect, and otherwise manage aquatic life sold for consumption or used for recreational fishing.

Work environment. The work of full-time farmers, ranchers, and agricultural managers is often strenuous; work hours are frequently long; and these workers rarely have days off during the planting, growing, and harvesting seasons. Nevertheless, for those who enter farming or ranching, the hard work is counterbalanced by their enjoyment of living in a rural area, working outdoors, being self-employed, and making a living off the land.

Farmers and farm managers on crop farms usually work from sunrise to sunset during the planting and harvesting seasons. The rest of the year, they plan next season's crops, market their output, and repair machinery.

On livestock-producing farms and ranches, work goes on throughout the year. Animals, unless they are grazing, must be fed and watered every day, and dairy cows must be milked two or three times a day. Many livestock and dairy farmers monitor and attend to the health of their herds, which may include assisting in the birthing of animals. Such farmers and farm managers rarely get the chance to get away, unless they hire an assistant or arrange for a temporary substitute.

Farmers and farm managers who grow produce and perishables have different demands on their time depending on the crop grown and the season. They may work very long hours during planting and harvesting season, but shorter hours at other times. Some farmers maintain cover crops during the cold months, which keep them busy beyond the typical growing season.

On very large farms, farmers and farm managers spend substantial time meeting farm supervisors in charge of various activities. Professional farm managers overseeing several farms may divide their time between traveling to meet farmers or landowners and planning the farm operations in their offices. As farming practices and agricultural technology become more sophisticated, farmers and farm managers are spending more time in offices and at computers, where they electronically manage many aspects of their businesses. Some farmers also attend conferences exchanging information, particularly during the winter months.

Farm work can be hazardous. Tractors and other farm machinery can cause serious injury, and workers must be constantly alert on the job. The proper operation of equipment and handling of chemicals are necessary to avoid accidents, safeguard health, and protect the environment.

Training, Other Qualifications, and Advancement

Experience gained from growing up on or working on a family farm is the most common way farmers learn their trade. However, modern farming requires increasingly complex scientific, business, and financial decisions, so postsecondary education in agriculture is important even for people who were raised on farms.

Education and training. Most farmers receive their training on the job, often by being raised on a farm. However, the

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completion of a 2-year associate degree or a 4-year bachelor's degree at a college of agriculture is becoming increasingly important for farm managers and for farmers and ranchers who expect to make a living at farming. A degree in farm management or in business with a concentration in agriculture is important.

Students should select the college most appropriate to their interests and location. All State university systems have at least one land-grant college or university with a school of agriculture. Common programs of study include agronomy, dairy science, agricultural economics and business, horticulture, crop and fruit science, and animal science. For students interested in aquaculture, formal programs are available and include coursework in fisheries biology, fish culture, hatchery management and maintenance, and hydrology.

Agricultural colleges teach technical knowledge of crops, growing conditions, and plant diseases. They also teach prospective ranchers and dairy farmers the basics of veterinary science and animal husbandry. Students also study how the environment is affected by farm operations, for example, how the various pesticides affect local animals.

New farmers, ranchers, and agricultural managers often spend time working under an experienced farmer to learn how to apply the skills learned through academic training. Those without academic training often take many years to learn how weather, fertilizers, seed, feeding or breeding affect the growth of crops or the raising of animals in addition to other aspects of farming. A small number of farms offer formal apprenticeships to help young people learn the practical skills of farming and ranching.

Other qualifications. Farmers, ranchers, and agricultural managers need managerial skills to organize and operate a business. A basic knowledge of accounting and bookkeeping is essential in keeping financial records, and knowledge of credit sources is vital for buying seed, fertilizer, and other needed inputs. Workers must also be familiar with complex safety regulations and requirements of governmental agricultural support programs. Computer skills are becoming increasingly important, especially on large farms, where computers are widely used for recordkeeping and business analysis. In addition, skills in personnel management, communication, and conflict resolution are important in the operation of a farm or ranch business.

Mechanical aptitude and the ability to work with tools of all kinds also are valuable skills for a small-farm operator, who often maintains and repairs machinery or farm structures.

Certification and advancement. Because of rapid changes in the industry, farmers, ranchers, and agricultural managers need to stay informed about continuing advances in agricultural methods, both in the United States and abroad. They need to monitor changes in governmental regulations that may affect production methods or markets for particular crops. Besides print journals that inform the agricultural community, farmers and managers use the Internet for quick access to the latest developments in areas such as agricultural marketing, legal arrangements, and growing crops, vegetables, and livestock.

Agricultural managers can enhance their professional status through voluntary certification as an Accredited Farm Manager (AFM) by the American Society of Farm Managers and Rural Appraisers. Accreditation requires several years of farm management experience, the appropriate academic background—a bachelor's degree or, preferably, a master's degree in a field of agricultural science—and the passing of courses and examinations related to the business, financial, and legal aspects of farm and ranch management.

Employment

Farmers, ranchers, and agricultural managers held nearly 1.3 million jobs in 2006. About 80 percent are self-employed farmers and ranchers, and the remainder is agricultural managers. Most farmers, ranchers, and agricultural managers oversee crop-production activities, while others manage livestock and dairy production. Most farmers and ranchers operate small farms on a part-time basis.

The soil, topography of the land, and climate often determine the type of farming and ranching done in a particular area. California, Texas, Iowa, Nebraska, and Kansas are the leading agricultural States in terms of agricultural output measured in dollars. Texas, Missouri, Iowa, Kentucky, and Tennessee are the leading agricultural States in terms of numbers of farms.

Job Outlook

The long-term trend toward the consolidation of farms into fewer and larger ones is expected to continue over the 2006–16 decade and to result in a continued, moderate decline in employment of self-employed farmers and ranchers and little or no change in employment of salaried agricultural managers. Nevertheless, a number of jobs will be available due to the need to replace the large number of farmers expected to retire or leave the profession over the next decade.

Employment change. Employment of self-employed farmers is expected to decline moderately by 8 percent over the 2006–2016 decade. The continuing ability of the agriculture sector to produce more with fewer workers will cause some farmers to go out of business as market pressures leave little room for the marginally successful farmer. As land, machin-

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Agricultural managers	11-9010	1,317,000	1,230,000	-87,000	-7
Farm, ranch, and other agricultural managers	11-9011	258,000	261,000	2,900	1
Farmers and ranchers	11-9012	1,058,000	969,000	-90,000	-8

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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ery, seed, and chemicals become more expensive, only well-capitalized farmers and corporations will be able to buy many of the farms that become available. These larger, more productive farms are better able to withstand the adverse effects of climate and price fluctuations on farm output and income. Larger farms also have advantages in obtaining government subsidies and payments because these payments are usually based on acreage owned and per-unit production.

In contrast, agricultural managers are projected to gain jobs, growing by 1 percent—effectively little or no change in the occupation. Owners of large tracts of land, who often do not live on the property they own, increasingly will seek the expertise of agricultural managers to run their farms and ranches in a business-like manner.

Despite the expected continued consolidation of farmland and the projected decline in overall employment of this occupation, an increasing number of small-scale farmers have developed successful market niches that involve personalized, direct contact with their customers. Many are finding opportunities in organic food production, which is the fastest growing segment in agriculture. Others use farmers' markets that cater directly to urban and suburban consumers, allowing the farmers to capture a greater share of consumers' food dollars. Some small-scale farmers belong to collectively owned marketing cooperatives that process and sell their product. Other farmers participate in community-supported agriculture cooperatives that allow consumers to directly buy a share of the farmer's harvest.

Aquaculture may continue to provide some new employment opportunities over the 2006–16 decade. Concerns about overfishing and the depletion of the stock of some wild fish species will likely lead to more restrictions on deep-sea fishing, even as public demand for the consumption of seafood continues to grow. This has spurred the growth of aquaculture farms that raise selected aquatic species—such as shrimp, salmon, trout, and catfish—in pens or ponds. Aquaculture has increased even in landlocked States, as farmers attempt to diversify.

Job prospects. Job prospects are expected to be favorable for those who want to go into farming. With fewer people wanting to become farmers and a large number of farmers expected to retire or give up their farms in the next decade, there will be some opportunities to own or lease a farm. The market for agricultural products is projected to be good for most products over the next decade, and thus many farmers who retire will need to be replaced. Farmers who produce corn used to produce ethanol will be in particular demand as ethanol plays a greater role in energy production as fuel for automobiles. Farmers who grow crops used in landscaping, such as trees, shrubs, turf, and other ornamentals, also will have better job prospects, as people put more money into landscaping their homes and businesses.

Earnings

Incomes of farmers and ranchers vary greatly from year to year, because prices of farm products fluctuate with weather conditions and the other factors that influence the quantity and quality of farm output and the demand for those products. A farm that shows a large profit one year may show a loss the following year. According to the U.S. Department of Agriculture, the average net cash farm business income for farm operator households in 2005 was $15,603. This figure, however, does not reflect that farmers often receive government subsidies or other payments that supplement their incomes and reduce some of the risk of farming. Additionally, most farmers—primarily operators of small farms—have income from off-farm business activities or careers, often greater than that of their farm income.

Full-time, salaried farm managers had median weekly earnings of $1,001 in May 2006. The middle half earned between $766 and $1,382. The highest paid 10 percent earned more than $1,924, and the lowest paid 10 percent earned less than $572.

Self-employed farmers must procure their own health and life insurance. As members of farm organizations, they may receive group discounts on health and life insurance premiums.

Related Occupations

Farmers, ranchers, and agricultural managers strive to improve the quality of agricultural products and the efficiency of farms. Others whose work relates to agriculture include agricultural engineers, agricultural and food scientists, agricultural workers, and purchasing agents and buyers of farm products.

Sources of Additional Information

For general information about farming and agricultural occupations, contact either of the following organizations:

➤ Center for Rural Affairs, P.O. Box 406, Walthill, NE 68067. Internet: **http://www.cfra.org**

➤ National FFA Organization, The National FFA Center, Attention Career Information Requests, P.O. Box 68690, Indianapolis, IN 46268. Internet: **http://www.ffa.org**

For information about certification as an accredited farm manager, contact:

➤ American Society of Farm Managers and Rural Appraisers, 950 Cherry St., Suite 508, Denver, CO 80222. Internet: **http://www.asfmra.org**

For information on the USDA's program to help small farmers get started, contact:

➤ Small Farm Program, U.S. Department of Agriculture, Cooperative State, Research, Education, and Extension Service, Stop 2220, Washington, DC 20250. Internet: **http://www.csrees.usda.gov/smallfarms.cfm**

For information about organic farming, horticulture, and internships, contact:

➤ Alternative Farming System Information Center, NAL, 10301 Baltimore Ave., Room 132, Beltsville, MD 20705. Internet: **http://www.nal.usda.gov**

➤ ATTRA, National Sustainable Agriculture Information Service, P.O. Box 3657, Fayetteville, AR 72702. Internet: **http://www.attra.ncat.org**

To learn more about how technological and other changes are affecting agricultural careers, see the *Occupational Outlook Quarterly* article "Farming in the 21st century: A modern business in the modern world," in print at many libraries and career centers and online at:

http://www.bls.gov/opub/ooq/2005/spring/art02.pdf

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Financial Managers

(O*NET 11-3031.00, 11-3031.01, 11-3031.02)

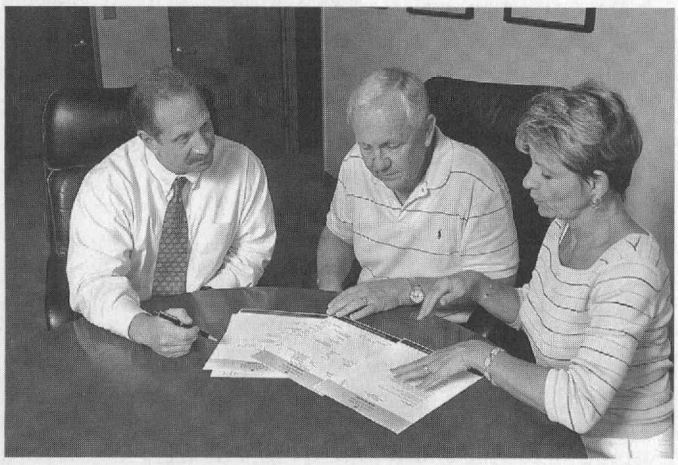
Significant Points

- Jobseekers are likely to face competition.
- About 3 out of 10 work in finance and insurance industries.
- A bachelor's degree in finance, accounting, or a related field is the minimum academic preparation, but employers increasingly seek graduates with a master's degree in business administration, economics, finance, or risk management.
- Experience may be more important than formal education for some financial manager positions—most notably, branch managers in banks.

Nature of the Work

Almost every firm, government agency, and other type of organization has one or more financial managers. Financial managers oversee the preparation of financial reports, direct investment activities, and implement cash management strategies. Managers also develop strategies and implement the long-term goals of their organization.

The duties of financial managers vary with their specific titles, which include controller, treasurer or finance officer, credit manager, cash manager, risk and insurance manager, and manager of international banking. *Controllers* direct the preparation of financial reports, such as income statements, balance sheets, and analyses of future earnings or expenses, that summarize and forecast the organization's financial position. Controllers also are in charge of preparing special reports required by regulatory authorities. Often, controllers oversee the accounting, audit, and budget departments. *Treasurers* and *finance officers* direct the organization's budgets to meet its financial goals. They oversee the investment of funds, manage associated risks, supervise cash management activities, execute capital-raising strategies to support a firm's expansion, and deal with mergers and acquisitions. *Credit managers* oversee the firm's issuance of credit, establishing credit-rating criteria, determining credit ceilings, and monitoring the collections of past-due accounts.



Financial managers develop strategies for achieving the long-term goals of their organization.

Cash managers monitor and control the flow of cash receipts and disbursements to meet the business and investment needs of the firm. For example, cash flow projections are needed to determine whether loans must be obtained to meet cash requirements or whether surplus cash should be invested in interest-bearing instruments. *Risk* and *insurance managers* oversee programs to minimize risks and losses that might arise from financial transactions and business operations. They also manage the organization's insurance budget. Managers specializing in international finance develop financial and accounting systems for the banking transactions of multinational organizations. (Chief financial officers and other executives are included with top executives elsewhere in the *Handbook*.)

Financial institutions—such as commercial banks, savings and loan associations, credit unions, and mortgage and finance companies—employ additional financial managers who oversee various functions, such as lending, trusts, mortgages, and investments, or programs, including sales, operations, or electronic financial services. These managers may solicit business, authorize loans, and direct the investment of funds, always adhering to Federal and State laws and regulations.

Branch managers of financial institutions administer and manage all of the functions of a branch office. Job duties may include hiring personnel, approving loans and lines of credit, establishing a rapport with the community to attract business, and assisting customers with account problems. Branch mangers also are becoming more oriented toward sales and marketing. As a result, it is important that they have substantial knowledge about all types of products that the bank sells. Financial managers who work for financial institutions must keep abreast of the rapidly growing array of financial services and products.

In addition to the preceding duties, all financial managers perform tasks unique to their organization or industry. For example, government financial managers must be experts on the government appropriations and budgeting processes, whereas health care financial managers must be knowledgeable about issues surrounding health care financing. Moreover, financial managers must be aware of special tax laws and regulations that affect their industry.

Financial managers play an increasingly important role in mergers and consolidations and in global expansion and related financing. These areas require extensive, specialized knowledge to reduce risks and maximize profit. Financial managers increasingly are hired on a temporary basis to advise senior managers on these and other matters. In fact, some small firms contract out all their accounting and financial functions to companies that provide such services.

The role of the financial manager, particularly in business, is changing in response to technological advances that have significantly reduced the amount of time it takes to produce financial reports. Financial managers now perform more data analysis and use it to offer senior managers ideas on how to maximize profits. They often work on teams, acting as business advisors to top management. Financial managers need to keep abreast

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of the latest computer technology to increase the efficiency of their firm's financial operations.

Work environment. Working in comfortable offices, often close to top managers and to departments that develop the financial data those managers need, financial managers typically have direct access to state-of-the-art computer systems and information services. They commonly work long hours, often up to 50 or 60 per week. Financial managers generally are required to attend meetings of financial and economic associations and may travel to visit subsidiary firms or to meet customers.

Training, Other Qualifications, and Advancement

Most financial managers need a bachelor's degree, and many have a master's degree or professional certification. Bank managers often have experience as loan officers. Financial managers also need strong interpersonal and business skills.

Education and training. A bachelor's degree in finance, accounting, economics, or business administration is the minimum academic preparation for financial managers. However, many employers now seek graduates with a master's degree, preferably in business administration, economics, finance, or risk management. These academic programs develop analytical skills and teach the latest financial analysis methods and technology.

Experience may be more important than formal education for some financial manager positions—most notably, branch managers in banks. Banks typically fill branch manager positions by promoting experienced loan officers and other professionals who excel at their jobs. Other financial managers may enter the profession through formal management training programs offered by the company. The American Institute of Banking, which is affiliated with the American Bankers Association, sponsors educational and training programs for bank officers at banking schools and educational conferences.

Other qualifications. Candidates for financial management positions need many different skills. Interpersonal skills are important because these jobs involve managing people and working as part of a team to solve problems. Financial managers must have excellent communication skills to explain complex financial data. Because financial managers work extensively with various departments in their firm, a broad understanding of business is essential.

Financial managers should be creative thinkers and problem-solvers, applying their analytical skills to business. They must be comfortable with the latest computer technology. Financial managers must have knowledge of international finance because financial operations are increasingly being affected by the global economy. Proficiency in a foreign language also may be important. In addition, a good knowledge of compliance procedures is essential because of the many recent regulatory changes.

Certification and advancement. Financial managers may broaden their skills and exhibit their competency by attaining professional certification. Many associations offer professional certification programs. For example, the CFA Institute confers the Chartered Financial Analyst designation on investment professionals who have a bachelor's degree, pass three sequential examinations, and meet work experience requirements. The Association for Financial Professionals confers the Certified Treasury Professional credentials to those who pass a computer-based exam and have a minimum of 2 years of relevant experience. Continuing education is required to maintain these credentials. Also, financial managers who specialize in accounting sometimes earn the Certified Public Accountant (CPA) or the Certified Management Accountant (CMA) designation. The CMA is offered by the Institute of Management Accountants to its members who have a bachelor's degree and at least 2 years of work experience and who pass the institute's four-part examination and fulfill continuing education requirements. (See accountants and auditors elsewhere in the *Handbook* for additional information on CPA and CMA designations.)

Continuing education is vital to financial managers, who must cope with the growing complexity of global trade, changes in Federal and State laws and regulations, and the proliferation of new and complex financial instruments. Firms often provide opportunities for workers to broaden their knowledge and skills by encouraging them to take graduate courses at colleges and universities or attend conferences related to their specialty. Financial management, banking, and credit union associations, often in cooperation with colleges and universities, sponsor numerous national and local training programs. Trainees prepare extensively at home and then attend sessions on subjects such as accounting management, budget management, corporate cash management, financial analysis, international banking, and information systems. Many firms pay all or part of the costs for employees who successfully complete the courses. Although experience, ability, and leadership are emphasized for promotion, advancement may be accelerated by this type of special study.

Because financial management is so important to efficient business operations, well-trained, experienced financial managers who display a strong grasp of the operations of various departments within their organization are prime candidates for promotion to top management positions. Some financial managers transfer to closely related positions in other industries. Those with extensive experience and access to sufficient capital may start their own consulting firms.

Employment

Financial managers held about 506,000 jobs in 2006. Although they can be found in every industry, approximately 3 out of 10 were employed by finance and insurance establishments, such

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Financial managers	11-3031	506,000	570,000	64,000	13

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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as banks, savings institutions, finance companies, credit unions, insurance carriers, and securities dealers. About 8 percent worked for Federal, State, or local government.

Job Outlook

Employment growth for financial managers is expected is to be about as fast as the average for all occupations. However, applicants will likely face strong competition for jobs. Those with a masters' degree and a certification will have the best opportunities.

Employment change. Employment of financial managers over the 2006-16 decade is expected to grow by 13 percent, which is about as fast as the average for all occupations. Regulatory reforms and the expansion and globalization of the economy will increase the need for financial expertise and drive job growth. As the economy expands, both the growth of established companies and the creation of new businesses will spur demand for financial managers. Employment of bank branch managers is expected to increase because banks are refocusing on the importance of their existing branches and are creating new branches to service a growing population. However, mergers, acquisitions, and corporate downsizing are likely to restrict the employment growth of financial managers to some extent.

The long-run prospects for financial managers in the securities and commodities industry should be favorable, because more people will be needed to handle increasingly complex financial transactions and manage a growing amount of investments. Financial managers also will be needed to handle mergers and acquisitions, raise capital, and assess global financial transactions. Risk managers, who assess risks for insurance and investment purposes, also will be in demand.

Some companies may hire financial managers on a temporary basis, to see the organization through a short-term crisis or to offer suggestions for boosting profits. Other companies may contract out all accounting and financial operations. Even in these cases, however, financial managers may be needed to oversee the contracts.

Job prospects. As with other managerial occupations, jobseekers are likely to face competition because the number of job openings is expected to be less than the number of applicants. Candidates with expertise in accounting and finance—particularly those with a master's degree and or certification—should enjoy the best job prospects. Strong computer skills and knowledge of international finance are important; as are excellent communication skills because financial management involves working on strategic planning teams.

As banks expand the range of products and services they offer to include insurance and investment products, branch managers with knowledge in these areas will be needed. As a result, candidates who are licensed to sell insurance or securities will have the most favorable prospects. (See the *Handbook* statements on insurance sales agents; and securities, commodities, and financial services sales agents.)

Earnings

Median annual earnings of wage and salary financial managers were $90,970 in May 2006. The middle 50 percent earned between $66,690 and $125,180. The lowest 10 percent earned less than $50,290 while the top 10 percent earned more than $145,600. Median annual earnings in the industries employing the largest numbers of financial managers were:

Securities and commodity contracts intermediation	$131,730
Management of companies and enterprises	105,410
Nondepository credit intermediation	86,340
Local government	72,790
Depository credit intermediation	72,580

According to a survey by Robert Half International, a staffing services firm specializing in accounting and finance professionals, directors of finance earned between $79,000 and $184,000 in 2007, and corporate controllers earned between $61,250 and $149,250.

Large organizations often pay more than small ones, and salary levels also can depend on the type of industry and location. Many financial managers in both public and private industry receive additional compensation in the form of bonuses, which, like salaries, vary substantially by size of firm. Deferred compensation in the form of stock options is becoming more common, especially for senior-level executives.

Related Occupations

Financial managers combine formal education with experience in one or more areas of finance, such as asset management, lending, credit operations, securities investment, or insurance risk and loss control. Workers in other occupations requiring similar training and skills include accountants and auditors; budget analysts; financial analysts and personal financial advisors; insurance sales agents; insurance underwriters; loan officers; securities, commodities, and financial services sales agents; and real estate brokers and sales agents.

Sources of Additional Information

For information about careers and certification in financial management, contact:

➤ Financial Management Association International, College of Business Administration, University of South Florida, Tampa, FL 33620. Internet: **http://www.fma.org**

For information about careers in financial and treasury management and the Certified Treasury Professional program, contact:

➤ Association for Financial Professionals, 7315 Wisconsin Ave., Suite 600 West, Bethesda, MD 20814.
Internet: **http://www.afponline.org**

For information about the Chartered Financial Analyst program, contact:

➤ CFA Institute, P.O. Box 3668, 560 Ray Hunt Dr., Charlottesville, VA 22903. Internet: **http://www.cfainstitute.org**

For information on The American Institute of Banking and its programs, contact:

➤ American Bankers Association, 1120 Connecticut Ave. NW., Washington, DC 20036.

For information about the Certified in Management Accounting designation, contact:

➤ Institute of Management Accountants, 10 Paragon Dr., Montvale, NJ,07645. Internet: **http://www.imanet.org**

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Food Service Managers

(O*NET 11-9051.00)

Significant Points

- Experience in food and beverage preparation and serving jobs is necessary for most food service manager positions.
- Food service managers coordinate a wide range of activities, but their most difficult task may be dealing with irate customers and uncooperative employees.
- Job opportunities for food service managers should be good as the number of outlets of restaurant chains increases to meet customer demand for convenience and value.

Nature of the Work

Food service managers are responsible for the daily operations of restaurants and other establishments that prepare and serve meals and beverages to customers. Besides coordinating activities among various departments, such as kitchen, dining room, and banquet operations, food service managers ensure that customers are satisfied with their dining experience. In addition, they oversee the inventory and ordering of food, equipment, and supplies and arrange for the routine maintenance and upkeep of the restaurant's equipment and facilities. Managers generally are responsible for all of the administrative and human-resource functions of running the business, including recruiting new employees and monitoring employee performance and training.

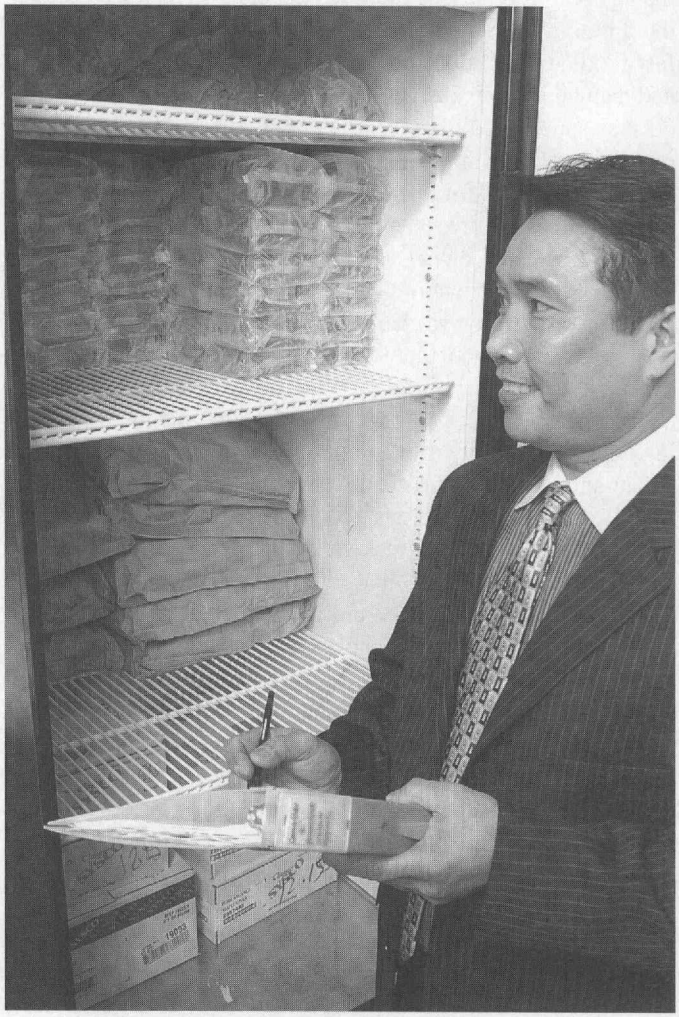
Managers interview, hire, train, and when necessary, fire employees. Retaining good employees is a major challenge facing food service managers. Managers recruit employees at career fairs, contact schools that offer academic programs in hospitality or culinary arts, and arrange for newspaper advertising to attract additional applicants. Managers oversee the training of new employees and explain the establishment's policies and practices. They schedule work hours, making sure that enough workers are present to cover each shift. If employees are unable to work, managers may have to call in alternates to cover for them or fill in themselves when needed. Some managers may help with cooking, clearing tables, or other tasks when the restaurant becomes extremely busy.

Food service managers ensure that diners are served properly and in a timely manner. They investigate and resolve customers' complaints about food quality or service. They monitor orders in the kitchen to determine where backups may occur, and they work with the chef to remedy any delays in service. Managers direct the cleaning of the dining areas and the washing of tableware, kitchen utensils, and equipment to comply with company and government sanitation standards. Managers also monitor the actions of their employees and patrons on a continual basis to ensure the personal safety of everyone. They make sure that health and safety standards and local liquor regulations are obeyed.

In addition to their regular duties, food service managers perform a variety of administrative assignments, such as keeping employee work records, preparing the payroll, and completing paperwork to comply with licensing laws and tax, wage and hour, unemployment compensation, and Social Security laws. Some of this work may be delegated to an assistant manager or bookkeeper, or it may be contracted out, but most general managers retain responsibility for the accuracy of business records. Managers also maintain records of supply and equipment purchases and ensure that accounts with suppliers are paid.

Managers tally the cash and charge receipts received and balance them against the record of sales. They are responsible for depositing the day's receipts at the bank or securing them in a safe place. Finally, managers are responsible for locking up the establishment, checking that ovens, grills, and lights are off, and switching on alarm systems.

Technology influences the jobs of food service managers in many ways, enhancing efficiency and productivity. Many restaurants use computers to track orders, inventory, and the seating of patrons. Point-of-service (POS) systems allow servers to key in a customer's order, either at the table using a hand-held device, or from a computer terminal in the dining room, and send the order to the kitchen instantaneously so preparation can begin. The same system totals and prints checks, functions like a cash register, connects to credit card authorizers, and tracks sales. To minimize food costs and spoilage, many managers



Food service managers keep an inventory of food and supplies and perform other bookkeeping functions.

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use inventory-tracking software to compare sales records with a record of the current inventory. Some establishments enter an inventory of standard ingredients and suppliers into their POS system. When supplies of particular ingredients run low, they can be ordered directly from the supplier using preprogrammed information. Computers also allow restaurant and food service managers to keep track of employee schedules and paychecks more efficiently.

Food service managers use the Internet to track industry news, find recipes, conduct market research, purchase supplies or equipment, recruit employees, and train staff. Internet access also makes service to customers more efficient. Many restaurants maintain Web sites that include menus and online promotions, provide information about the restaurant's location, and offer patrons the option of making a reservation.

In most full-service restaurants and institutional food service facilities, the management team consists of a *general manager*, one or more *assistant managers*, and an *executive chef*. The executive chef is responsible for all food preparation activities, including running kitchen operations, planning menus, and maintaining quality standards for food service. In limited-service eating places, such as sandwich shops, coffee bars, or fast-food establishments, managers, not executive chefs, are responsible for supervising routine food preparation operations. Assistant managers in full-service facilities generally oversee service in the dining rooms and banquet areas. In larger restaurants and fast-food or other food service facilities that serve meals daily and maintain longer business hours, individual assistant managers may supervise different shifts of workers. In smaller restaurants, formal titles may be less important, and one person may undertake the work of one or more food service positions. For example, the executive chef also may be the general manager or even sometimes an owner. (For additional information on these other workers, see material on top executives and chefs, cooks, and food preparation workers elsewhere in the *Handbook*.)

In restaurants where there are both food service managers and executive chefs, the managers often help the chefs select successful menu items. This task varies by establishment depending on the seasonality of menu items, the frequency with which restaurants change their menus, and the introduction of daily, weekly, or seasonal specials. Many restaurants rarely change their menus while others make frequent alterations. Managers or executive chefs select menu items, taking into account the likely number of customers and the past popularity of dishes. Other issues considered when planning a menu include whether there was any food left over from prior meals that should not be wasted, the need for variety, and the seasonal availability of foods. Managers or executive chefs analyze the recipes of the dishes to determine food, labor, and overhead costs, work out the portion size and nutritional content of each plate, and assign prices to various menu items. Menus must be developed far enough in advance that supplies can be ordered and received in time.

Managers or executive chefs estimate food needs, place orders with distributors, and schedule the delivery of fresh food and supplies. They plan for routine services or deliveries, such as linen services or the heavy cleaning of dining rooms or kitchen equipment, to occur during slow times or when the dining room is closed. Managers also arrange for equipment maintenance and repairs, and coordinate a variety of services such as waste removal and pest control. Managers or executive chefs receive deliveries and check the contents against order records. They inspect the quality of fresh meats, poultry, fish, fruits, vegetables, and baked goods to ensure that expectations are met. They meet with representatives from restaurant supply companies and place orders to replenish stocks of tableware, linens, paper products, cleaning supplies, cooking utensils, and furniture and fixtures.

Work environment. Food service managers are among the first to arrive in the morning and the last to leave at night. Long hours—12 to 15 per day, 50 or more per week, and sometimes 7 days a week—are common. Managers of institutional food service facilities, such as school, factory, or office cafeterias, work more regular hours because the operating hours of these establishments usually conform to the operating hours of the business or facility they serve. However, hours for many managers are unpredictable.

Managers should be calm, flexible, and able to work through emergencies, such as a fire or flood, to ensure everyone's safety. They also should be able to fill in for absent workers on short notice. Managers often experience the pressures of simultaneously coordinating a wide range of activities. When problems occur, it is the manager's responsibility to resolve them with minimal disruption to customers. The job can be hectic, and dealing with irate customers or uncooperative employees can be stressful.

Managers also may experience the typical minor injuries of other restaurant workers, such as muscle aches, cuts, or burns. They might endure physical discomfort from moving tables or chairs to accommodate large parties, receiving and storing daily supplies from vendors, or making minor repairs to furniture or equipment.

Training, Other Qualifications, and Advancement

Experience in the food services industry, whether as a cook, waiter or waitress, or counter attendant, is the most common training for food service managers. Many restaurant and food service manager positions, particularly self-service and fast-food, are filled by promoting experienced food and beverage preparation and service workers.

Education and training. Experience as a waiter or waitress, cook, or counter help is the most common way to enter the occupation. Executive chefs, in particular, need extensive experience working as chefs. Many food service management companies and national or regional restaurant chains recruit management trainees from 2- and 4-year college hospitality management programs, which require internships and real-life experience to graduate. Some restaurant chains prefer to hire people with degrees in restaurant and institutional food service management, but they often hire graduates with degrees in other fields who have demonstrated experience, interest, and aptitude.

Postsecondary education is preferred for many food service manager positions, but it is not a significant qualification for many others: More than 40 percent of food service managers have a high school diploma or less; less than one-quarter have

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a bachelor's or graduate degree. However, a postsecondary degree is preferred by higher end full-service restaurants and for many corporate positions, such as managing a regional or national restaurant chain or franchise or overseeing contract food service operations at sports and entertainment complexes, school campuses, and institutional facilities. A college degree also is beneficial for those who want to own or manage their own restaurant.

Almost 1,000 colleges and universities offer 4-year programs in restaurant and hospitality management or institutional food service management; a growing number of university programs offer graduate degrees in hospitality management or similar fields. For those not interested in pursuing a 4-year degree, community and junior colleges, technical institutes, and other institutions offer programs in the field leading to an associate degree or other formal certification.

Both 2- and 4-year programs provide instruction in subjects such as nutrition, sanitation, and food planning and preparation, as well as accounting, business law and management, and computer science. Some programs combine classroom and laboratory study with internships providing on-the-job experience. In addition, many educational institutions offer culinary programs in food preparation. Such training can lead to careers as cooks or chefs and provide a foundation for advancement to executive chef positions.

Many larger food service operations will provide, or offer to pay for, technical training, such as computer or business courses, so that employees can acquire the business skills necessary to read spreadsheets or understand the concepts and practices of running a business. Generally, this requires a long-term commitment on the employee's part to both the employer and to the profession.

Most restaurant chains and food service management companies have rigorous training programs for management positions. Through a combination of classroom and on-the-job training, trainees receive instruction and gain work experience in all aspects of the operation of a restaurant or institutional food service facility. Areas include food preparation, nutrition, sanitation, security, company policies and procedures, personnel management, recordkeeping, and preparation of reports. Training on use of the restaurant's computer system is increasingly important as well. Usually, after 6 months or a year, trainees receive their first permanent assignment as an assistant manager.

Other qualifications. Most employers emphasize personal qualities when hiring managers. Workers who are reliable, show initiative, and have leadership qualities are highly sought after for promotion. Other qualities that managers look for are good problem-solving skills and the ability to concentrate on details. A neat and clean appearance is important, because food service managers must convey self-confidence and show respect in dealing with the public. Because food service management can be physically demanding, good health and stamina are important.

Managers must be good communicators as they deal with customers, employees, and suppliers for most of the day. They must be able to motivate employees to work as a team, to ensure that food and service meet appropriate standards. Additionally, the ability to speak multiple languages is helpful to communicate with staff and patrons.

Certification and advancement. The certified Foodservice Management Professional (FMP) designation is a measure of professional achievement for food service managers, and although not a requirement for employment or necessary for advancement, voluntary certification can provide recognition of professional competence, particularly for managers who acquired their skills largely on the job. The National Restaurant Association Educational Foundation awards the FMP designation to managers who achieve a qualifying score on a written examination, complete a series of courses that cover a range of food service management topics, and meet standards of work experience in the field.

Willingness to relocate often is essential for advancement to positions with greater responsibility. Managers typically advance to larger or more prominent establishments or regional management positions within restaurant chains. Some may open their own food service establishments or franchise operation.

Employment

Food service managers held about 350,000 jobs in 2006. The majority of managers are salaried, but 45 percent are self-employed as owners of independent restaurants or other small food service establishments. Thirty-eight percent of all salaried jobs for food service managers are in full-service restaurants or limited-service eating places, such as fast-food restaurants and cafeterias. Other salaried jobs are in special food services—an industry that includes food service contractors who supply food services at institutional, governmental, commercial, or industrial locations, and educational services, primarily in elementary and secondary schools. A smaller number of salaried jobs are in hotels; amusement, gambling, and recreation industries; nursing care facilities; and hospitals. Jobs are located throughout the country, with large cities and resort areas providing more opportunities for full-service dining positions.

Job Outlook

Food service manager jobs are expected to grow 5 percent, or more slowly than the average for all occupations through 2016. However, job opportunities should be good because, in addition

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Food service managers	11-9051	350,000	368,000	18,000	5

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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to job growth, many more openings will arise from the need to replace managers who leave the occupation.

Employment change. Employment of food service managers is expected to grow 5 percent, or more slowly than the average for all occupations, during the 2006-16 decade. New eating and drinking places will open to meet the growing demand for convenience and value from a growing population, generating new employment opportunities for food service managers. Employment growth is projected to vary by industry. Most new jobs will be in full-service restaurants, but they are expected to decline among limited service restaurants. Manager jobs will also increase in special food services, an industry that includes food service contractors that provide food for schools, health care facilities, and other commercial businesses and in nursing and residential care for the elderly. Self-employment of these workers will generate nearly 30 percent of new jobs.

Job prospects. In addition to job openings from employment growth, the need to replace managers who transfer to other occupations or stop working will create good job opportunities. Although practical experience is an integral part of finding a food service management position, applicants with a degree in restaurant, hospitality or institutional food service management will have an edge when competing for jobs at upscale restaurants and for advancement in a restaurant chain or into corporate management.

Earnings

Median annual earnings of salaried food service managers were $43,020 in May 2006. The middle 50 percent earned between $34,210 and $55,100. The lowest 10 percent earned less than $27,400, and the highest 10 percent earned more than $70,810. Median annual earnings in the industries employing the largest numbers of food service managers were as follows:

Traveler accommodation	$48,890
Special food services	48,710
Full-service restaurants	45,650
Elementary and secondary schools	39,650
Limited-service eating places	39,070

In addition to receiving typical benefits, most salaried food service managers are provided free meals and the opportunity for additional training, depending on their length of service. Some food service managers, especially those in full-service restaurants, may earn bonuses depending on sales volume or revenue.

Related Occupations

Food service managers direct the activities of a hospitality-industry business and provide a service to customers. Other managers and supervisors in hospitality-oriented businesses include gaming managers, lodging managers, sales worker supervisors, and first-line supervisors or managers of food preparation and serving workers.

Sources of Additional Information

Information about a career as a food service manager, 2- and 4-year college programs in restaurant and food service management, and certification as a Foodservice Management Professional is available from:

➤ National Restaurant Association Educational Foundation, 175 West Jackson Blvd., Suite 1500, Chicago, IL 60604-2702. Internet: **http://www.nraef.org**

Career information about food service managers, as well as a directory of 2- and 4-year colleges that offer courses or programs that prepare persons for food service careers is available from:

➤ National Restaurant Association, 1200 17th St.NW., Washington, DC 20036-3097.
Internet: **http://www.restaurant.org**

General information on hospitality careers may be obtained from:

➤ The International Council on Hotel, Restaurant, and Institutional Education, 2810 North Parham Rd., Suite 230, Richmond, VA 23294. Internet: **http://www.chrie.org**

Additional information about job opportunities in food service management may be obtained from local employers and from local offices of State employment services agencies.

Funeral Directors

(O*NET 11-9061.00)

Significant Points

- Job opportunities should be good, particularly for those who also embalm.
- Some mortuary science graduates relocate to get a job.
- Funeral directors are licensed by the State in which they practice.
- Funeral directors need the ability to communicate easily and compassionately and to comfort people in a time of sorrow.

Nature of the Work

Funeral practices and rites vary greatly among cultures and religions. However, 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 carrying out final disposition of the deceased. 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 comforting and appropriate services.

Funeral directors arrange the details and handle the logistics of funerals. They interview the family to learn their wishes about the funeral, the clergy or other people 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.

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They arrange for a hearse to carry the body to the funeral home or mortuary. They also comfort the family and friends of the deceased.

Funeral directors 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 deceased, mourners, and flowers between sites. They also direct preparation and shipment of the body 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 elapse between death and interment, State laws usually require that the remains be refrigerated or embalmed.

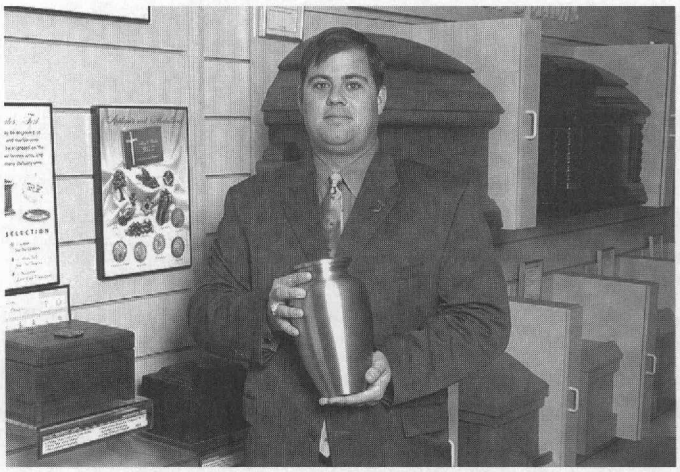
When embalming a body, funeral directors wash the body with germicidal soap and replace the blood with embalming fluid to preserve the tissues. They may reshape and reconstruct bodies using materials such as clay, cotton, plaster of Paris, and wax. They also may apply cosmetics to provide a natural appearance, 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, funeral home, or at the gravesite or crematory. Some services are not religious, but many are, reflecting the religion of the family. 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 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, in part because memorial services can be held anywhere, and at any time, sometimes months later when all relatives and friends can come together. 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, including submitting papers to State authorities so that a formal death certificate may be issued and copies distributed to the heirs. They may help family members apply for veterans' burial benefits, and they 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 work with those who want to plan their own funerals in advance. This provides peace of mind by ensuring that the client's wishes will be taken care of in a way that is satisfying to the client and to the client's survivors.



Funeral directors explain various details of burial options and arrange funerals.

Most funeral homes are small, family-run businesses, and many funeral directors are owner-operators or employees with managerial responsibilities. 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 use computers for billing, bookkeeping, and marketing. Some are beginning to use the Internet to communicate with clients who are planning their funerals in advance or to assist them by developing electronic obituaries and guest books. Directors strive to foster a cooperative spirit and friendly attitude among employees and a compassionate demeanor toward the families. Increasingly, funeral directors also are helping individuals adapt to changes in their lives following a death through aftercare services and support groups.

Most funeral homes have a chapel, one or more viewing rooms, a casket-selection room, and a preparation room. Many 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.

Work environment. Funeral directors occasionally come into contact with bodies that had contagious diseases, but the possibility of infection is remote if health regulations are followed.

Funeral directors often work long, irregular hours, and the occupation can be highly stressful. Many are on call at all hours 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 establishments, employees usually work 8 hours a day, 5 or 6 days a week.

Training, Other Qualifications, and Advancement

Funeral directors are licensed in all States. State licensing laws vary, but most require applicants to be 21 years old, have 2

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years of formal education, serve a 1-year apprenticeship, and pass an examination.

Education and training. 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 few 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 in 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 to maintain their licenses.

Apprenticeships must be completed under the direction of an experienced and licensed funeral director. Some States require apprenticeships. 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.

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 also provide good experience. These jobs consist mostly of maintenance and cleanup tasks, such as washing and polishing limousines and hearses, but they can help students become familiar with the operation of funeral homes.

Licensure. All States require funeral directors to be licensed. Licensing laws vary by 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.

Some States require all funeral directors to be licensed in embalming. Others have separate licenses for directors and embalmers, but in those States funeral directors who embalm need to be licensed in embalming, and most workers obtain both licenses.

State board licensing examinations vary, but they usually consist of written and oral parts and include a demonstration of practical skills. People 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. People interested in a career as a funeral director should contact their State licensing board for specific requirements.

Other qualifications. Funeral directors need composure, tact, and the ability to communicate easily and compassionately with the public. Funeral directors also should have the desire and ability to comfort people in a time of sorrow.

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

Advancement. Advancement opportunities generally 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.

Employment

Funeral directors held about 29,000 jobs in 2006. About 20 percent were self-employed. Nearly all worked in the death care services industry.

Job Outlook

Job opportunities are expected to be good, particularly for those who also embalm. Some mortuary science graduates relocate to get a job.

Employment change. Employment of funeral directors is expected to increase by 12 percent during the 2006-16 decade, about as fast as the average for all occupations. Projected job growth reflects growth in the death care services industry, where funeral directors are employed.

Job prospects. In addition to employment growth, the need to replace funeral directors who retire or leave the occupation for other reasons will provide a number of job opportunities. Funeral directors are older, on average, than workers in most other occupations and are expected to retire in greater numbers over the coming decade. In addition, some funeral directors leave the profession because of the long and irregular hours. Some mortuary science graduates relocate to get a job.

Earnings

Median annual earnings for wage and salary funeral directors were $49,620 in May 2006. The middle 50 percent earned between $37,200 and $65,260. The lowest 10 percent earned less than $28,410 and the top 10 percent earned more than $91,800.

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 coun-

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Funeral directors	11-9061	29,000	32,000	3,600	12

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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try, and the director's level of formal education. Funeral directors in large cities usually earn more than their counterparts in small towns and rural areas.

Related Occupations

The job of a funeral director requires tact, discretion, and compassion when dealing with grieving people. Others who need these qualities include social workers, psychologists, physicians and surgeons, and other health practitioners involved in diagnosis and treatment.

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, 3432 Ashland Ave., Suite U, St.Joseph, MO 64506.
Internet: **http://www.abfse.org**

For information on specific State licensing requirements, contact the State's licensing board.

For more information about funeral directors and their work, see the *Occupational Outlook Quarterly* article, "Jobs in weddings and funerals: Working with the betrothed and the bereaved," available in many libraries and career centers and online at:
http://www.bls.gov/opub/ooq/2006/winter/art03.pdf

Human Resources, Training, and Labor Relations Managers and Specialists

(O*NET 11-3041.00, 11-3042.00, 11-3049.99, 13-1071.00, 13-1071.01, 13-1071.02, 13-1072.00, 13-1073.00, 13-1079.99)

Significant Points

- The educational backgrounds of these workers vary considerably, reflecting the diversity of duties and levels of responsibility.
- Certification and previous experience are assets for most specialties, and are essential for more advanced positions, including managers, arbitrators, and mediators.
- College graduates who have earned certification should have the best job opportunities.

Nature of the Work

Every organization wants to attract the most qualified employees and match them to jobs for which they are best suited. However, many enterprises are too large to permit close contact between top management and employees. Human resources, training, and labor relations managers and specialists provide this connection. In the past, these workers performed the administrative function of an organization, such as handling employee benefits questions or recruiting, interviewing, and hiring new staff in accordance with policies established by top management. Today's human resources workers manage these tasks, but, increasingly, they also consult with top executives regarding strategic planning. They have moved from behind-the-scenes staff work to leading the company in suggesting and changing policies.

In an effort to enhance morale and productivity, limit job turnover, and help organizations increase performance and improve business results, these workers also help their firms effectively use employee skills, provide training and development opportunities to improve those skills, and increase employees' satisfaction with their jobs and working conditions. Although some jobs in the human resources field require only limited contact with people outside the human resources office, dealing with people is an important part of the job.

There are many types of human resources, training, and labor relations managers and specialists. In a small organization, a *human resources generalist* may handle all aspects of human resources work, and thus require an extensive range of knowledge. The responsibilities of human resources generalists can vary widely, depending on their employer's needs.

In a large corporation, the *director of human resources* may supervise several departments, each headed by an experienced manager who most likely specializes in one human resources activity, such as employment and placement; compensation, and benefits; training and development; or labor relations. The director may report to a top human resources executive. (Executives are included in the *Handbook* statement on top executives.)

Employment and placement. Employment and placement managers supervise the hiring and separation of employees. They also supervise employment, recruitment, and placement specialists, including recruitment specialists and employment interviewers. Employment, recruitment, and placement specialists recruit and place workers.

Recruiters maintain contacts within the community and may travel considerably, often to college campuses, to search for promising job applicants. Recruiters screen, interview, and occasionally test applicants. They also may check references and extend job offers. These workers must be thoroughly familiar with the organization and its human resources policies in order to discuss wages, working conditions, and promotional opportunities with prospective employees. They also must stay informed about equal employment opportunity (EEO) and affirmative action guidelines and laws, such as the Americans with Disabilities Act.

Employment interviewers—whose many job titles include *human resources consultants*, *human resources development specialists*, and *human resources coordinators*—help to match employers with qualified jobseekers. Similarly, employer relations representatives, who usually work in government agencies, maintain working relationships with local employers and promote the use of public employment programs and services.

Compensation, benefits, and job analysis. Compensation, benefits, and job analysis specialists conduct compensation

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College graduates with certification should have the best opportunities for jobs as human resources, training, and labor relations managers and specialists.

programs for employers and may specialize in specific areas such as pensions or position classifications. For example, *job analysts*, occasionally called *position classifiers*, collect and examine detailed information about job duties in order to prepare job descriptions. These descriptions explain the duties, training, and skills that each job requires. Whenever a large organization introduces a new job or reviews existing jobs, it calls upon the expert knowledge of the job analyst.

Occupational analysts conduct research, usually in large firms. They are concerned with occupational classification systems and study the effects of industry and occupational trends on worker relationships. They may serve as technical liaison between the firm and other firms, government, and labor unions.

Establishing and maintaining a firm's pay system is the principal job of the *compensation manager*. Assisted by staff specialists, compensation managers devise ways to ensure fair and equitable pay rates. They may conduct surveys to see how their firm's rates compare with others, and they ensure that the firm's pay scale complies with changing laws and regulations. In addition, compensation managers often manage their firm's performance evaluation system, and they may design reward systems such as pay-for-performance plans.

Employee benefits managers and specialists manage the company's employee benefits program, notably its health insurance and pension plans. Expertise in designing and administering benefits programs continues to take on importance as employer-provided benefits account for a growing proportion of overall compensation costs, and as benefit plans increase in number and complexity. For example, pension benefits might include a 401K or thrift savings, profit-sharing, and stock ownership plans; health benefits might include long-term catastrophic illness insurance and dental insurance. Familiarity with health benefits is a top priority for employee benefits managers and specialists, as more firms struggle to cope with the rising cost of health care for employees and retirees. In addition to health insurance and pension coverage, some firms offer employees life and accidental death and dismemberment insurance, disability insurance, and relatively new benefits designed to meet the needs of a changing workforce, such as parental leave, child and elder care, long-term nursing home care insurance, employee assistance and wellness programs, and flexible benefits plans. Benefits managers must keep abreast of changing Federal and State regulations and legislation that may affect employee benefits.

Employee assistance plan managers, also called *employee welfare managers*, are responsible for a wide array of programs. These include occupational safety and health standards and practices; health promotion and physical fitness, medical examinations, and minor health treatment, such as first aid; plant security; publications; food service and recreation activities; carpooling and transportation programs, such as transit subsidies; employee suggestion systems; child care and elder care; and counseling services. Child care and elder care are increasingly significant because of growth in the number of dual-income households and the elderly population. Counseling may help employees deal with emotional disorders, alcoholism, or marital, family, consumer, legal, and financial problems. Some employers offer career counseling as well. In large firms, certain programs, such as those dealing with security and safety, may be in separate departments headed by other managers.

Training and development. *Training and development managers and specialists* conduct and supervise training and development programs for employees. Increasingly, management recognizes that training offers a way of developing skills, enhancing productivity and quality of work, and building worker loyalty to the firm, and most importantly, increasing individual and organizational performance to achieve business results. Training is widely accepted as an employee benefit and a method of improving employee morale, and enhancing employee skills has become a business imperative. Increasingly, managers and leaders realize that the key to business growth and success is through developing the skills and knowledge of its workforce.

Other factors involved in determining whether training is needed include the complexity of the work environment, the rapid pace of organizational and technological change, and the growing number of jobs in fields that constantly generate new knowledge, and thus, require new skills. In addition, advances in learning theory have provided insights into how adults learn, and how training can be organized most effectively for them.

Training managers provide worker training either in the classroom or onsite. This includes setting up teaching materials prior to the class, involving the class, and issuing completion certificates at the end of the class. They have the responsibility for the entire learning process, and its environment, to ensure that the course meets its objectives and is measured and evaluated to understand how learning impacts business results.

Training specialists plan, organize, and direct a wide range of training activities. Trainers respond to corporate and worker service requests. They consult with onsite supervisors regarding available performance improvement services and conduct orientation sessions and arrange on-the-job training for new employees. They help all employees maintain and improve their job skills, and possibly prepare for jobs requiring greater

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skill. They help supervisors improve their interpersonal skills in order to deal effectively with employees. They may set up individualized training plans to strengthen an employee's existing skills or teach new ones. Training specialists in some companies set up leadership or executive development programs among employees in lower level positions. These programs are designed to develop leaders, or "groom" them, to replace those leaving the organization and as part of a succession plan. Trainers also lead programs to assist employees with job transitions as a result of mergers and acquisitions, as well as technological changes. In government-supported training programs, training specialists function as case managers. They first assess the training needs of clients and then guide them through the most appropriate training method. After training, clients may either be referred to employer relations representatives or receive job placement assistance.

Planning and program development is an essential part of the training specialist's job. In order to identify and assess training needs within the firm, trainers may confer with managers and supervisors or conduct surveys. They also evaluate training effectiveness to ensure that the training employees receive helps the organization meet its strategic business goals and achieve results.

Depending on the size, goals, and nature of the organization, trainers may differ considerably in their responsibilities and in the methods they use. Training methods include on-the-job training; operating schools that duplicate shop conditions for trainees prior to putting them on the shop floor; apprenticeship training; classroom training; and electronic learning, which may involve interactive Internet-based training, multimedia programs, distance learning, satellite training, other computer-aided instructional technologies, videos, simulators, conferences, and workshops.

Employee relations. An organization's *director of industrial relations* forms labor policy, oversees industrial labor relations, negotiates collective bargaining agreements, and coordinates grievance procedures to handle complaints resulting from management disputes with unionized employees. The director of industrial relations also advises and collaborates with the director of human resources, other managers, and members of their staff, because all aspects of human resources policy—such as wages, benefits, pensions, and work practices—may be involved in drawing up a new or revised union contract.

Labor relations managers and their staffs implement industrial labor relations programs. Labor relations specialists prepare information for management to use during collective bargaining agreement negotiations, a process that requires the specialist to be familiar with economic and wage data and to have extensive knowledge of labor law and collective bargaining trends. The labor relations staff interprets and administers the contract with respect to grievances, wages and salaries, employee welfare, health care, pensions, union and management practices, and other contractual stipulations. As union membership continues to decline in most industries, industrial relations personnel are working more often with employees who are not members of a labor union.

Dispute resolution—attaining tacit or contractual agreements—has become increasingly significant as parties to a dispute attempt to avoid costly litigation, strikes, or other disruptions. Dispute resolution also has become more complex, involving employees, management, unions, other firms, and government agencies. Specialists involved in dispute resolution must be highly knowledgeable and experienced, and often report to the director of industrial relations. *Conciliators*, or *mediators*, advise and counsel labor and management to prevent and, when necessary, resolve disputes over labor agreements or other labor relations issues. *Arbitrators*, occasionally called umpires or referees, decide disputes that bind both labor and management to specific terms and conditions of labor contracts. Labor relations specialists who work for unions perform many of the same functions on behalf of the union and its members.

EEO officers, representatives, or *affirmative action coordinators* handle EEO matters in large organizations. They investigate and resolve EEO grievances, examine corporate practices for possible violations, and compile and submit EEO statistical reports.

Other emerging specialties in human resources include *international human resources managers*, who handle human resources issues related to a company's foreign operations; and *human resources information system specialists*, who develop and apply computer programs to process human resources information, match job seekers with job openings, and handle other human resources matters.

Work environment. Human resources work usually takes place in clean, pleasant, and comfortable office settings. Arbitrators and mediators may work out of their homes.

Although most human resources, training, and labor relations managers and specialists work in the office, some travel extensively. For example, recruiters regularly attend professional meetings and visit college campuses to interview prospective employees; arbitrators and mediators often must travel to the site chosen for negotiations.

Many human resources, training, and labor relations managers and specialists work a standard 35- to 40-hour week. However, longer hours might be necessary for some workers—for example, labor relations managers and specialists, arbitrators, and mediators—when contract agreements are being prepared and negotiated.

Training, Other Qualifications, and Advancement

The educational backgrounds of human resources, training, and labor relations managers and specialists vary considerably, reflecting the diversity of duties and levels of responsibility. In filling entry-level jobs, many employers seek college graduates who have majored in human resources, human resources administration, or industrial and labor relations. Other employers look for college graduates with a technical or business background or a well-rounded liberal arts education.

Education and training. Many colleges and universities have programs leading to a degree in personnel, human resources, or labor relations. Some offer degree programs in human resources administration or human resources management, training and development, or compensation and ben-

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efits. Depending on the school, courses leading to a career in human resources management may be found in departments of business administration, education, instructional technology, organizational development, human services, communication, or public administration, or within a separate human resources institution or department.

Because an interdisciplinary background is appropriate in this field, a combination of courses in the social sciences, business, and behavioral sciences is useful. Some jobs may require a more technical or specialized background in engineering, science, finance, or law, for example. Most prospective human resources specialists should take courses in compensation, recruitment, training and development, and performance appraisal, as well as courses in principles of management, organizational structure, and industrial psychology. Other relevant courses include business administration, public administration, psychology, sociology, political science, economics, and statistics. Courses in labor law, collective bargaining, labor economics, labor history, and industrial psychology also provide a valuable background for the prospective labor relations specialist. As in many other fields, knowledge of computers and information systems also is useful.

An advanced degree is increasingly important for some jobs. Many labor relations jobs require graduate study in industrial or labor relations. A strong background in industrial relations and law is highly desirable for contract negotiators, mediators, and arbitrators; in fact, many people in these specialties are lawyers. A background in law also is desirable for employee benefits managers and others who must interpret the growing number of laws and regulations. A master's degree in human resources, labor relations, or in business administration with a concentration in human resources management is highly recommended for those seeking general and top management positions.

The duties given to entry-level workers will vary, depending on whether the new workers have a degree in human resource management, have completed an internship, or have some other type of human resources-related experience. Entry-level employees commonly learn the profession by performing administrative duties—helping to enter data into computer systems, compiling employee handbooks, researching information for a supervisor, or answering the phone and handling routine questions. Entry-level workers often enter formal or on-the-job training programs in which they learn how to classify jobs, interview applicants, or administer employee benefits. They then are assigned to specific areas in the human resources department to gain experience. Later, they may advance to a managerial position, supervising a major element of the human resources program—compensation or training, for example.

Other qualifications. Previous experience is an asset for many specialties in the human resources field, and is essential for more advanced positions, including managers, arbitrators, and mediators. Many employers prefer entry-level workers who have gained some experience through an internship or work-study program while in school. Human resources administration and human resources development require the ability to work with individuals as well as a commitment to organizational goals. This field also demands other skills that people may develop elsewhere—using computers, selling, teaching, supervising, and volunteering, among others. The field offers clerical workers opportunities for advancement to professional positions. Responsible positions occasionally are filled by experienced individuals from other fields, including business, government, education, social services administration, and the military.

The human resources field demands a range of personal qualities and skills. Human resources, training, and labor relations managers and specialists must speak and write effectively. The growing diversity of the workforce requires that they work with or supervise people with various cultural backgrounds, levels of education, and experience. They must be able to cope with conflicting points of view, function under pressure, and demonstrate discretion, integrity, fair-mindedness, and a persuasive, congenial personality.

Certification and advancement. Most organizations specializing in human resources offer classes intended to enhance the skills of their members. Some organizations offer certification programs, which are signs of competence and credibility and can enhance one's advancement opportunities. For example, the International Foundation of Employee Benefit Plans confers a designation in three distinct areas of specialization—group benefit, retirement, and compensation—to persons who complete a series of college-level courses and pass exams. Candidates can earn a designation in each of the specialty tracks and, simultaneously, receive credit toward becoming a Certified Employee Benefits Specialist (CEBP). The American Society for Training and Development (ASTD) Certification Institute offers professional certification in the learning and performance field. Addressing nine areas of expertise, it requires passing a knowledge-based exam and successful work experience. In addition, ASTD offers 16 short-term certificate and workshop programs covering a broad range of professional training and development topics. The Society for Human Resource Management offers two levels of certification, including the Professional in Human Resources (PHR) and the Senior Professional in Human Resources (SPHR). Additionally, the organization offers the Global Professional in Human Resources for those with international and cross-border responsibilities and the California Certification in Human Resources for those who plan to work in the State and are unfamiliar with California's labor and human resource laws. All designations require experience and a passing score on a comprehensive exam. World at Work Society of Certified Professionals offers four levels of designations in the areas of compensation, benefits, work life, and total rewards management practices. Through the Society, candidates can obtain the designation of Certified Compensation Professional (CCP), Certified Benefits Professional (CBP), Global Remuneration Professional (GRP), and Work-Life Certified Professional (WLCP).

Exceptional human resources workers may be promoted to director of human resources or industrial relations, which can eventually lead to a top managerial or executive position. Others may join a consulting or outsourcing firm or open their

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own business. A Ph.D. is an asset for teaching, writing, or consulting work.

Employment

Human resources, training, and labor relations managers and specialists held about 868,000 jobs in 2006. The following tabulation shows the distribution of jobs by occupational specialty:

Training and development specialists	210,000
Employment, recruitment, and placement specialists	197,000
Human resources managers	136,000
Compensation, benefits, and job analysis specialists	110,000
Human resources, training, and labor relations specialists, all other	214,000

Human resources, training, and labor relations managers and specialists were employed in virtually every industry. About 17,000 managers and specialists were self-employed, working as consultants to public and private employers.

The private sector accounted for nearly 9 out of 10 salaried jobs, including 13 percent in administrative and support services; 10 percent in professional, scientific, and technical services; 9 percent in health care and social assistance; 9 percent in finance and insurance firms; and 7 percent in manufacturing.

Government employed 13 percent of human resources managers and specialists. They handled the recruitment, interviewing, job classification, training, salary administration, benefits, employee relations, and other matters related to the Nation's public employees.

Job Outlook

Employment of human resources, training, and labor relations managers and specialists is expected to grow faster than the average for all occupations. College graduates who have earned certification should have the best job opportunities.

Employment change. Overall employment is projected to grow by 17 percent between 2006 and 2016, faster than the average for all occupations. Legislation and court rulings setting standards in various areas—occupational safety and health, equal employment opportunity, wages, health care, pensions, and family leave, among others—will increase demand for human resources, training, and labor relations experts. Rising health care costs should continue to spur demand for specialists to develop creative compensation and benefits packages that firms can offer prospective employees.

Employment of labor relations staff, including arbitrators and mediators, should grow as firms become more involved in labor relations and attempt to resolve potentially costly labor-management disputes out of court. Additional job growth may stem from increasing demand for specialists in international human resources management and human resources information systems.

Job growth could be limited by the widespread use of computerized human resources information systems that make workers more productive. Like other workers, employment of human resources, training, and labor relations managers and specialists, particularly in larger firms, may be adversely affected by corporate downsizing, restructuring, and mergers and acquisitions.

Demand may be particularly strong for certain specialists. For example, employers are expected to devote greater resources to job-specific training programs in response to the increasing complexity of many jobs and technological advances that can leave employees with obsolete skills. Additionally, as highly trained and skilled baby boomers retire, there should be strong demand for training and development specialists to impart needed skills to their replacements. In addition, increasing efforts throughout industry to recruit and retain quality employees should create many jobs for employment, recruitment, and placement specialists.

Among industries, firms involved in management, consulting, and employment services should offer many job opportunities, as businesses increasingly contract out human resources functions or hire human resources specialists on a temporary basis in order to deal with the increasing cost and complexity of training and development programs. Demand for specialists also should increase in outsourcing firms that develop and administer complex employee benefits and compensation packages for other organizations.

Job prospects. College graduates who have earned certification should have the best job opportunities. Graduates with a bachelor's degree in human resources, human resources administration, or industrial and labor relations should be in demand; those with a technical or business background or a well-rounded liberal arts education also should find opportunities. Demand for human resources, training, and labor relations managers and specialists is governed by the staffing needs of the firms for which

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16 Number	Change, 2006-16 Percent
Human resources, training, and labor relations managers and specialists	—	868,000	1,015,000	147,000	17
Compensation and benefits managers	11-3041	49,000	55,000	5,900	12
Training and development managers	11-3042	29,000	33,000	4,500	16
Human resources managers, all other	11-3049	58,000	65,000	6,600	11
Employment, recruitment, and placement specialists	13-1071	197,000	233,000	36,000	18
Compensation, benefits, and job analysis specialists	13-1072	110,000	130,000	20,000	18
Training and development specialists	13-1073	210,000	249,000	38,000	18
Human resources, training, and labor relations specialists, all other	13-1079	214,000	250,000	35,000	16

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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they work. A rapidly expanding business is likely to hire additional human resources workers—either as permanent employees or consultants—while a business that has experienced a merger or a reduction in its workforce will require fewer of these workers. Also, as human resources management becomes increasingly important to the success of an organization, some small and medium-size businesses that do not have a human resources department may assign employees various human resources duties together with other unrelated responsibilities.

In addition to human resources management and specialist jobs created over the 2006-2016 projection period, many job openings will arise from the need to replace workers who transfer to other occupations, retire, or leave the labor force for other reasons.

Earnings

Annual salary rates for human resources workers vary according to occupation, level of experience, training, location, and firm size.

Median annual earnings of compensation and benefits managers were $74,750 in May 2006. The middle 50 percent earned between $55,370 and $99,690. The lowest 10 percent earned less than $42,750, and the highest 10 percent earned more than $132,820. In 2006, median annual earnings were $85,330 in the management of companies and enterprises industry.

Median annual earnings of training and development managers were $80,250 in May 2006. The middle 50 percent earned between $58,770 and $107,450. The lowest 10 percent earned less than $43,530, and the highest 10 percent earned more than $141,140.

Median annual earnings of human resources managers, all other were $88,510 in May 2006. The middle 50 percent earned between $67,710 and $114,860. The lowest 10 percent earned less than $51,810, and the highest 10 percent earned more than $145,600. In May 2006, median annual earnings were $98,400 in the management of companies and enterprises industry.

Median annual earnings of employment, recruitment, and placement specialists were $42,420 in May 2006. The middle 50 percent earned between $32,770 and $58,320. The lowest 10 percent earned less than $26,590, and the highest 10 percent earned more than $81,680. Median annual earnings in the industries employing the largest numbers of employment, recruitment, and placement specialists were:

Management, scientific, and technical consulting services	$53,060
Management of companies and enterprises	48,360
Local government	40,660
Employment services	39,720
State government	36,320

Median annual earnings of compensation, benefits, and job analysis specialists were $50,230 in May 2006. The middle 50 percent earned between $39,400 and $63,800. The lowest 10 percent earned less than $32,180, and the highest 10 percent earned more than $80,150. Median annual earnings in the industries employing the largest numbers of compensation, benefits, and job analysis specialists were:

Local government	$53,440
Management of companies and enterprises	52,960
Insurance carriers	50,510
Agencies, brokerages, and other insurance related activities	49,100
State government	46,100

Median annual earnings of training and development specialists were $47,830 in May 2006. The middle 50 percent earned between $35,980 and $63,200. The lowest 10 percent earned less than $27,450, and the highest 10 percent earned more than $80,630. Median annual earnings in the industries employing the largest numbers of training and development specialists were:

Computer systems design and related services	$60,430
Management of companies and enterprises	50,850
Insurance carriers	50,060
State government	49,040
Local government	47,990

The average salary for human resources managers employed by the Federal Government was $76,503 in 2007; for labor-management relations examiners, $94,927; and for manpower development specialists, $86,071. Salaries were slightly higher in areas where the prevailing local pay level was higher. There are no formal entry-level requirements for managerial positions. Applicants must possess a suitable combination of educational attainment, experience, and record of accomplishment.

According to a July 2007 salary survey conducted by the National Association of Colleges and Employers, bachelor's degree candidates majoring in human resources, including labor and industrial relations, received starting offers averaging $41,680 a year.

Related Occupations

All human resources occupations are closely related. Other workers with skills and expertise in interpersonal relations include counselors, education administrators, public relations specialists, lawyers, psychologists, social and human service assistants, and social workers.

Sources of Additional Information

For information about human resource management careers and certification, contact:

➤ Society for Human Resource Management, 1800 Duke St., Alexandria, VA 22314. Internet: **http://www.shrm.org**

For information about careers in employee training and development and certification, contact:

➤ American Society for Training and Development, 1640 King St., Box 1443, Alexandria, VA 22313-2043. Internet: **http://www.astd.org**

For information about careers and certification in employee compensation and benefits, contact:

➤ International Foundation of Employee Benefit Plans, 18700 W. Bluemound Rd., P.O. Box 69, Brookfield, WI 53008-0069. Internet: **http://www.ifebp.org**

➤ World at Work, 14040 N. Northsight Blvd., Scottsdale, AZ 85260. Internet: **http://www.worldatwork.org**

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Industrial Production Managers

(O*NET 11-3051.00)

Significant Points

- Industrial production managers coordinate all the people and equipment involved in the manufacturing process.
- Most employers prefer to hire workers with a college degree; experience in some part of production operations is also usually required.
- Employment is expected to decline as overall employment in manufacturing declines.

Nature of the Work

Industrial production managers plan, direct, and coordinate the production activities required to produce the vast array of goods manufactured every year in the United States. They make sure that production meets output and quality goals while remaining within budget. Depending on the size of the manufacturing plant, industrial production managers may oversee the entire plant or just one area.

Industrial production managers devise methods to use the plant's personnel and capital resources to best meet production goals. They may determine which machines will be used, whether new machines need to be purchased, whether overtime or extra shifts are necessary, and what the sequence of production will be. They monitor the production run to make sure that it stays on schedule and correct any problems that may arise.

Part of an industrial production manager's job is to come up with ways to make the production process more efficient. Traditional factory methods, such as mass assembly lines, have given way to "lean" production techniques, which give managers more flexibility. While in a traditional assembly line, each worker was responsible for only a small portion of the assembly, repeating that task on every product, lean production employs teams to build and assemble products in stations or cells, so rather than specializing in a specific task, workers are capable of performing all jobs within a team. Without the constraints of the traditional assembly line, industrial production managers can more easily change production levels and staffing on different product lines to minimize inventory levels and more quickly react to changing customer demands.

Industrial production managers also monitor product standards and implement quality control programs. They make sure the finished product meets a certain level of quality, and if not, they try to find out what the problem is and find a solution. While traditional quality control programs reacted only to problems that reached a certain significant level, newer management techniques and programs, such as ISO 9000, Total Quality Management (TQM), or Six Sigma, emphasize continuous quality improvement. If the problem relates to the quality of work performed in the plant, the manager may implement better training programs or reorganize the manufacturing process, often based upon the suggestions of employee teams. If the cause is substandard materials or parts from outside suppliers, the industrial production manager may work with the supplier to improve their quality.



Industrial production managers monitor the quantity and quality of goods produced.

Industrial production managers work closely with the other managers of the firm to implement the company's policies and goals. They also must work with the financial departments in order to come up with a budget and spending plan. They work the closest with the heads of sales, procurement, and logistics. Sales managers relay the client's needs and the price the client is willing to pay to the production department, which must then fulfill the order. The logistics or distribution department handles the delivery of the goods, which often needs to be coordinated with the production department. The procurement department orders the supplies that the production department needs to make its products. It is also responsible for making sure that the inventories of supplies are maintained at proper levels so production proceeds without interruption. A breakdown in communications between the production manager and the procurement department can cause slowdowns and a failure to meet production schedules. Just-in-time production techniques have reduced inventory levels, making constant communication among managers, suppliers, and procurement departments even more important.

Work environment. Most industrial production managers divide their time between production areas and their offices. While in the production area, they must follow established health and safety practices and wear the required protective clothing and equipment. The time in the office, which often is located near production areas, usually is spent meeting with subordinates or other department managers, analyzing production data, and writing and reviewing reports.

Many industrial production managers work extended hours, especially when production deadlines must be met. In 2006, about a third of all workers worked more than 50 hours a week, on average. In facilities that operate around-the-clock, managers often work late shifts and may be called at any hour to deal with emergencies. This could mean going to the plant to resolve the problem, regardless of the hour, and staying until the situation is under control. Dealing with production workers as well as superiors when working under the pressure of production deadlines or emergency situations can be stressful.

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Corporate restructuring has eliminated levels of management and support staff, thus shifting more responsibilities to production managers and compounding this stress.

Training, Other Qualifications, and Advancement

Because of the diversity of manufacturing operations and job requirements, there is no standard preparation for this occupation. Most employers prefer to hire workers with a college degree. Experience in some part of production operations is also usually required, although some college graduates are hired directly into management positions.

Education and training. Many industrial production managers have a college degree in business administration, management, industrial technology, or industrial engineering. However, although employers may prefer candidates with a business or engineering background, some companies will hire well-rounded liberal arts graduates who are willing to spend time in a production-related job.

Some industrial production managers enter the occupation after working their way up through the ranks, starting as production workers and then advancing to supervisory positions before being selected for management. These workers already have an intimate knowledge of the production process and the firm's organization. To be selected for promotion, workers can expand their skills by obtaining a college degree, demonstrating leadership qualities, or by taking company-sponsored courses to learn the additional skills needed for management.

As production operations become more sophisticated, an increasing number of employers look for candidates with graduate degrees in industrial management or business administration, particularly for positions at larger plants where managers have more oversight responsibilities. Combined with an undergraduate degree in engineering, either of these graduate degrees is considered particularly good preparation. Managers who do not have graduate degrees often take courses in decision sciences, which provide them with techniques and statistical formulas that can be used to maximize efficiency and improve quality. Those who enter the field directly from college or graduate school often are unfamiliar with the firm's production process. As a result, they may spend their first few months in the company's training program. These programs familiarize trainees with the production process, company policies, and the requirements of the job. In larger companies, they also may include assignments to other departments, such as purchasing and accounting. A number of companies hire college graduates as first-line supervisors and later promote them to management positions.

Other qualifications. Companies are placing greater importance on a candidate's interpersonal skills. Because the job requires the ability to compromise, persuade, and negotiate, successful production managers must be well-rounded and have excellent communication skills. Strong computer skills are also essential.

Industrial production managers must continually keep informed of new production technologies and management practices. Many belong to professional organizations and attend trade shows or industry conferences where new equipment is displayed and new production methods and technologies discussed.

Certification and advancement. Some industrial production managers earn certifications that show their competency in various quality and management systems. Although certification is not required for industrial production manager jobs, it may improve job prospects.

One credential, Certified in Production and Inventory Management (CPIM), is offered by the Association for Operations Management and requires passing a series of exams that cover supply chain management, resource planning, scheduling, production operations, and strategic planning. Certification holders must complete a set number of professional development activities every 3 years to maintain their certification.

The American Society for Quality offers the Certified Manager of Quality/Organizational Excellence (CMQ/OE) credential. This certification is open to managers who pass an exam and who have at least 10 years of experience or education, 5 of which must be in a decision-making position. It is intended for managers who lead process improvement initiatives. To maintain certification, workers must complete a set number of professional development units every 3 years.

Industrial production managers with a proven record of superior performance may advance to plant manager or vice president for manufacturing. Others transfer to jobs with more responsibilities at larger firms. Opportunities also exist for managers to become consultants. (For more information, see the statement on management analysts elsewhere in the *Handbook*.)

Employment

Industrial production managers held about 157,000 jobs in 2006. About 4 out of 5 are employed in manufacturing industries, including the fabricated metal product, transportation equipment, and computer and electronic product manufacturing sectors. Production managers work in all parts of the country, but jobs are most plentiful in areas where manufacturing is concentrated.

Job Outlook

Employment of industrial production managers is expected to decline. Applicants with experience in production occupations along with a college degree in industrial engineering, management, or a related field will enjoy the best job prospects.

Employment change. Employment of industrial production managers is expected to decline moderately by 6 percent over

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Industrial production managers	11-3051	157,000	148,000	-9,200	-6

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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the 2006-2016 decade, mirroring the overall decline in manufacturing employment. Some declines will result from manufacturing plants moving abroad, but domestic production in manufacturing is expected to continue to increase. However, as plants produce more goods with fewer people, there will be less need for industrial production managers.

Efforts to increase efficiency at the management level have led companies to ask production managers to assume more responsibilities, particularly as computers allow managers to more easily coordinate scheduling, planning, and communication among departments. In addition, more emphasis on quality in the production process has redistributed some of the production manager's oversight responsibilities to supervisors and workers on the production line. However, most of the decision making work of production managers cannot be automated, which will limit the declines in employment.

Job prospects. Despite employment declines, a number of jobs are expected to open due to the need to replace workers who retire or transfer to other occupations. Applicants with experience in production occupations along with a college degree in industrial engineering, management, or business administration, and particularly those with an undergraduate engineering degree and a master's degree in business administration or industrial management, will enjoy the best job prospects. Employers also are likely to seek candidates who have excellent communication skills, related work experience, and who are personable, flexible, and eager to enhance their knowledge and skills through ongoing training.

Earnings

Median annual earnings for industrial production managers were $77,670 in May 2006. The middle 50 percent earned between $59,650 and $100,810. The lowest 10 percent earned less than $47,230, and the highest 10 percent earned more than $130,680. Median annual earnings in the manufacturing industries employing the largest numbers of industrial production managers were:

Management of companies and enterprises	$88,820
Aerospace product and parts manufacturing	87,750
Motor vehicle parts manufacturing	79,360
Printing and related support activities	73,350
Plastics product manufacturing	70,180

Related Occupations

Industrial production managers oversee production staff and equipment, ensure that production goals and quality standards are being met, and implement company policies. Other managerial occupations with similar responsibilities are general and operations managers, construction managers, and sales managers. Occupations requiring comparable training and problem-solving skills are engineers, management analysts, and operations research analysts.

Sources of Additional Information

General information on careers in industrial production management is available from local manufacturers and schools with programs in industrial management.

For more information on careers in production management and information on the CPIM certification, contact:

➤ APICS, the Association for Operations Management, 5301 Shawnee Road, Alexandria, VA 22312. Internet: **http://www.apics.org**

For more information on quality management and the CMQ/OE certification, contact:

➤ American Society for Quality, 600 North Plankinton Ave., Milwaukee, WI 53203. Internet: **http://www.asq.org**

Lodging Managers

(O*NET 11-9081.00)

Significant Points

- Long hours, including night and weekend work, are common.
- Employment is projected to grow about as fast as the average for all occupations.
- College graduates with degrees in hotel or hospitality management should have better opportunities for jobs at full-service hotels and for advancement than those without a degree.

Nature of the Work

A comfortable room, good food, and a helpful staff can make being away from home an enjoyable experience for both vacationing families and business travelers. Lodging managers make sure that these conveniences are provided, while also ensuring that the establishments are run efficiently and profitably. Most lodging managers work in traditional hotels and motels, but some work in other lodging establishments, such as recreational camps and RV parks, inns, boardinghouses, and youth hostels.

Lodging establishments can vary significantly in size and in the number of services they provide, which can range from supplying a simple in-room television and continental breakfast to operating a casino and accommodating a convention. These factors affect the number and type of lodging managers employed at each property. However, the one person who oversees all lodging operations at a property is usually called a *general manager*. At larger hotels with several departments and multiple layers of management, one general manager and multiple assistant managers coordinate the activities of separate departments. (See related sections elsewhere in the *Handbook* on supervisors and managers of housekeeping and janitorial workers, human resources, training, and labor relations managers and specialists, financial managers, advertising, marketing, promotions, public relations and sales managers, and food service managers.) In smaller limited-service hotels—mainly those without food and beverage service—one lodging manager may direct all the activities of the property.

Lodging managers have overall responsibility for the operation and profitability of the hotel. Depending on the hotel and the size of its staff, lodging managers may either perform or

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direct housekeeping, personnel, office administration, marketing and sales, purchasing, security, maintenance, oversight of recreation facilities, and other activities. They may hire and train staff, set schedules, and lend a hand when needed.

Within guidelines established by the owners of the hotel or executives of the hotel chain, lodging managers set room rates, allocate funds to departments, approve expenditures, and ensure that standards for guest service, decor, housekeeping, food quality, and banquet operations are met. Increasingly, lodging managers are also responsible for ensuring that the information technology that is common in today's hotels is operational. Some lodging managers work in financial management, monitoring room sales and reservations, overseeing accounting and cash-flow matters at the hotel, projecting occupancy levels, and deciding which rooms to discount and when to offer rate specials.

Front office managers, a category of lodging manager, coordinate reservations and room assignments and train and direct the hotel's front desk staff. They ensure that guests are treated courteously, complaints and problems are resolved, and requests for special services are carried out. Any adjustments to bills often are referred to front office managers for resolution.

Some lodging managers, called *convention services managers*, coordinate the activities of various departments to accommodate meetings, conventions, and special events. They meet with representatives of groups or organizations to plan the number of conference rooms to reserve, the configuration of the meeting space, and determine what other services the group will need, such as catering or banquets and audio, visual, or other electronic requirements. During the meeting or event, they resolve unexpected problems and monitor activities to ensure that hotel operations conform to the group's expectations.

Lodging managers may work with hotel sales and marketing directors and public relations directors to manage and coordinate the advertising and promotion of the hotel. They help develop lodging and dining specials and coordinate special events, such as holiday or seasonal specials. They may direct their staff to purchase advertising and to market their property to organizations or groups seeking a venue for conferences, conventions, business meetings, trade shows, and special events.

Lodging managers who oversee the personnel functions of a hotel or serve as human resource directors ensure that all accounting, payroll, and employee relations matters are handled in compliance with hotel policy and applicable laws. They also oversee hiring practices and standards and ensure that training and promotion programs reflect appropriate employee development guidelines.

Computers are used extensively by lodging managers and their assistants to keep track of guests' bills, reservations, room assignments, meetings, and special events. In addition, computers are used to order food, beverages, and supplies, as well as to prepare reports for hotel owners and top-level managers. Many hotels also provide extensive information technology services for their guests. Managers work with computer specialists and other information technology specialists to ensure that the hotel's computer systems, Internet, and communications networks function properly.



Lodging managers ensure that standards for guest service are met.

Work environment. Because hotels are open around the clock, night and weekend work is common. Many lodging managers work more than 40 hours per week and are often on-call, which means they may be called back to work at any time. In some hotels and resort properties where work is seasonal, managers may have other duties less related to guest services during the off season or they may find work in other hotels or occupations.

The pressures of coordinating a wide range of activities, turning a profit for investors, and dealing with guests who are sometimes angry can be stressful. Managing conferences and working at the front desk during check-in and check-out times can be particularly hectic.

Training, Other Qualifications, and Advancement

Management trainees for larger upscale hotel chains almost always need a bachelor's or master's degree, preferably in hospitality or hotel management. If not coming directly from college, experience working at a hotel is generally required to get a position as a lodging manager.

Education and training. Most large, full-service hotel chains usually hire people who have a bachelor's degree in business, hotel, or hospitality management for management trainee positions; however, a liberal arts degree coupled with experience in the hospitality field may be sufficient. At other hotels, especially those with fewer services, employers look for applicants with an associate degree or certificate in hotel, restaurant, or hospitality management along with experience. Formal internships or part-time or summer work in a hotel are an asset. Most degree programs include work-study opportunities.

Community colleges, junior colleges, and many universities offer certificate or degree programs in hotel, restaurant, or hospitality management leading to an associate, bachelor's, or graduate degree. Technical institutes, vocational and trade schools, and other academic institutions also offer courses leading to formal recognition in hospitality management. More than 800 educational facilities across the United States provide academic training for would-be lodging managers.

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16 Number	Change, 2006-16 Percent
Lodging managers	11-9081	71,000	80,000	8,700	12

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

Hotel management programs include instruction in hotel administration, accounting, economics, marketing, housekeeping, food service management and catering, and hotel maintenance and engineering. Computer training also is an integral part of hotel management training due to the widespread use of computers in reservations, billing, and housekeeping management. Lodging managers also need to know how to generate and read profit-and-loss reports and other business and economic data.

More than 450 high schools in 45 States offer the Lodging Management Program created by the Educational Institute of the American Hotel and Lodging Association. This 2-year program offered to high school juniors and seniors teaches management principles and leads to a professional certification called the "Certified Rooms Division Specialist." Many colleges and universities grant participants in this program credit towards a postsecondary degree in hotel management.

Hotel employees who do not have hospitality training or a college degree but who do demonstrate leadership potential and possess sufficient experience may be invited to participate in a management training program sponsored by the hotel or a hotel chain's corporate parent. Those who already possess the people skills and service orientation needed to succeed in hotel management can usually train for technical expertise in areas such as computer use and accounting principles while on the job. Trainees usually begin as assistant managers and may rotate assignments among the hotel's departments to gain a wide range of experiences. Relocation to another property may be required to help round out the experience and to help a trainee grow into a more responsible management position in a larger or busier hotel.

Other qualifications. Lodging managers must be able to get along with many different types of people, even in stressful situations. They must be able to solve problems quickly and concentrate on details. Initiative, self-discipline, effective communication skills, and the ability to organize and direct the work of others are essential for lodging managers. Managers must have a good knowledge of hotel operations, including safety and security measures, repair and maintenance, and personnel practices. Knowledge of hotel financing is essential to operate a hotel profitably.

Certification and advancement. Large hotel chains may offer better opportunities for advancement than small, independently owned establishments, but relocation every several years often is necessary for advancement. Large chains have more extensive career ladder programs and offer managers the opportunity to transfer to another hotel in the chain or to a regional or central office. Career advancement can be accelerated by the completion of certification programs offered by various hotel and lodging associations. Certification usually requires a combination of course work, examinations, and experience.

Employment

Most lodging managers work in the traveler accommodation industry, including hotels and motels, although they can work for any business that provides room or shelter for people. Companies that manage hotels under contract also employ managers. Lodging managers held about 71,000 jobs in 2006. The majority of lodging managers—54 percent—were self-employed, primarily as owners of small hotels and bed-and-breakfast inns.

Job Outlook

Steady growth in travel will provide average job growth and very good job opportunities for lodging managers. However, those seeking jobs at hotels with the highest level of guest services will face strong competition.

Employment change. Employment of lodging managers is expected to grow 12 percent from 2006 to 2016, which is about as fast as the average for all occupations. Steady business travel and increased domestic and foreign tourism will drive job growth. The many new hotels being planned or built will need lodging managers to run them. In 2007 alone, over 600 new hotels will open. Many of these will be located in suburbs where population and business activity are growing fastest. Most of these new hotels, however, will offer limited services and will not have large staffs or need many managers, somewhat moderating job growth. Some lodging places also do not require a manager to be available 24 hours a day; instead front desk clerks assume some managerial duties at night. Still, there are expected to be a significant number of full-service hotels built, including resort, casino, and luxury hotels, which should generate many additional job openings for experienced managers and management trainees.

Job prospects. In addition to job openings from employment growth, additional job openings are expected to occur as experienced managers leave the labor force or transfer to other occupations, in part because of the long hours and stressful working conditions. Job opportunities are expected to be good for people with good customer service skills and experience in the food service or hospitality industries. People with a college degree in hotel or hospitality management are expected to have the best opportunities at upscale and luxury hotels.

Earnings

Median annual earnings of lodging managers were $42,320 in May 2006. The middle 50 percent earned between $31,870 and $58,380. The lowest 10 percent earned less than $25,120 and the highest 10 percent earned more than $82,510. Median annual earnings for lodging managers in traveler accommodations were $41,880.

Salaries of lodging managers vary greatly according to their responsibilities, location, and the segment of the hotel industry in which they work. Managers may earn bonuses of up to 25

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percent of their basic salary in some hotels and also may be furnished with meals, parking, laundry, and other services. In addition to providing typical benefits, some hotels offer profit-sharing plans and educational assistance to their employees.

Related Occupations

Other workers who organize and direct a business focused on customer service include food service managers, gaming managers, sales worker supervisors, and property, real estate, and community association managers.

Sources of Additional Information

For information on careers and scholarships in hotel management, contact:

➤ American Hotel and Lodging Association, 1201 New York Ave. NW., Suite 600, Washington, DC 20005.
Internet: **http://www.ahla.com**

Information on careers in the lodging industry and professional development and training programs may be obtained from:

➤ Educational Institute of the American Hotel and Lodging Association, 800 N. Magnolia Ave., Suite 1800, Orlando, FL 32853. Internet: **http://www.ei-ahla.org**

For information on educational programs in hotel and restaurant management, including correspondence courses, write to:

➤ International Council on Hotel, Restaurant, and Institutional Education, 2810 North Parham Rd., Suite 230, Richmond, VA 23294. Internet: **http://www.chrie.org**

Medical and Health Services Managers

(O*NET 11-9111.00)

Significant Points

- Job opportunities will be good, especially for applicants with work experience in health care and strong business and management skills.
- A master's degree is the standard credential, although a bachelor's degree is adequate for some entry-level positions.
- Medical and health services managers typically work long hours and may be called at all hours to deal with problems.

Nature of the Work

Health care is a business and, like every business, it needs good management to keep it running smoothly. Medical and health services managers, also referred to as *health care executives* or *health care administrators*, plan, direct, coordinate, and supervise the delivery of health care. These workers are either specialists in charge of a specific clinical department or generalists who manage an entire facility or system.

The structure and financing of health care are changing rapidly. Future medical and health services managers must be prepared to deal with the integration of health care delivery systems, technological innovations, an increasingly complex regulatory environment, restructuring of work, and an increased focus on preventive care. They will be called on to improve efficiency in health care facilities and the quality of the care provided.

Large facilities usually have several assistant administrators who aid the top administrator and handle daily decisions. Assistant administrators direct activities in clinical areas such as nursing, surgery, therapy, medical records, or health information.

In smaller facilities, top administrators handle more of the details of daily operations. For example, many nursing home administrators manage personnel, finances, facility operations, and admissions while also providing resident care.

Clinical managers have training or experience in a specific clinical area and, accordingly, have more specific responsibilities than do generalists. For example, directors of physical therapy are experienced physical therapists, and most health information and medical record administrators have a bachelor's degree in health information or medical record administration. Clinical managers establish and implement policies, objectives, and procedures for their departments; evaluate personnel and work quality; develop reports and budgets; and coordinate activities with other managers.

Health information managers are responsible for the maintenance and security of all patient records. Recent regulations enacted by the Federal Government require that all health care providers maintain electronic patient records and that these records be secure. As a result, health information managers must keep up with current computer and software technology and with legislative requirements. In addition, as patient data become more frequently used for quality management and in medical research, health information managers ensure that databases are complete, accurate, and available only to authorized personnel.

In group medical practices, managers work closely with physicians. Whereas an office manager might handle business affairs in small medical groups, leaving policy decisions to the physicians themselves, larger groups usually employ a full-time administrator to help formulate business strategies and coordinate day-to-day business.

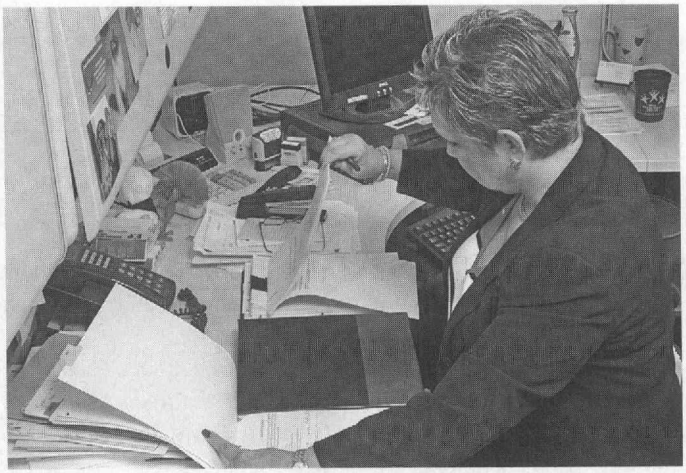
A small group of 10 to 15 physicians might employ 1 administrator to oversee personnel matters, billing and collection, budgeting, planning, equipment outlays, and patient flow. A large practice of 40 to 50 physicians might have a chief administrator and several assistants, each responsible for different areas.

Medical and health services managers in managed care settings perform functions similar to those of their counterparts in large group practices, except that they could have larger staffs to manage. In addition, they might do more community outreach and preventive care than do managers of a group practice.

Some medical and health services managers oversee the activities of a number of facilities in health systems. Such systems might contain both inpatient and outpatient facilities and offer a wide range of patient services.

Work environment. Some managers work in comfortable, private offices; others share space with other staff. Most medi-

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Medical and health services managers may deal with personnel, billing and collection, budget, and procurement issues.

cal and health services managers work long hours. Nursing care facilities and hospitals operate around the clock; administrators and managers be called at all hours to deal with problems. They also travel to attend meetings or inspect satellite facilities.

Training, Other Qualifications, and Advancement

A master's degree in one of a number of fields is the standard credential for most generalist positions as a medical or health care manager. A bachelor's degree is sometimes adequate for entry-level positions in smaller facilities and departments. In physicians' offices and some other facilities, on-the-job experience may substitute for formal education.

Education and training. Medical and health services managers must be familiar with management principles and practices. A master's degree in health services administration, long-term care administration, health sciences, public health, public administration, or business administration is the standard credential for most generalist positions in this field. However, a bachelor's degree is adequate for some entry-level positions in smaller facilities, at the departmental level within health care organizations, and in health information management. Physicians' offices and some other facilities hire those with on-the-job experience instead of formal education.

Bachelor's, master's, and doctoral degree programs in health administration are offered by colleges; universities; and schools of public health, medicine, allied health, public administration, and business administration. In 2007, 72 schools had accredited programs leading to the master's degree in health services administration, according to the Commission on Accreditation of Healthcare Management Education.

For people seeking to become heads of clinical departments, a degree in the appropriate field and work experience may be sufficient early in their career. However, a master's degree in health services administration or a related field might be required to advance. For example, nursing service administrators usually are chosen from among supervisory registered nurses with administrative abilities and graduate degrees in nursing or health services administration.

Health information managers require a bachelor's degree from an accredited program. In 2007, there were 42 accredited bachelor's degree programs and 3 master's degree programs in health information management according to the Commission on Accreditation for Health Informatics and Information Management Education.

Some graduate programs seek students with undergraduate degrees in business or health administration; however, many graduate programs prefer students with a liberal arts or health profession background. Candidates with previous work experience in health care also may have an advantage. Competition for entry into these programs is keen, and applicants need above-average grades to gain admission. Graduate programs usually last between 2 and 3 years. They may include up to 1 year of supervised administrative experience and coursework in areas such as hospital organization and management, marketing, accounting and budgeting, human resources administration, strategic planning, law and ethics, biostatistics or epidemiology, health economics, and health information systems. Some programs allow students to specialize in one type of facility—hospitals, nursing care facilities, mental health facilities, or medical groups. Other programs encourage a generalist approach to health administration education.

Licensure. All States and the District of Columbia require nursing care facility administrators to have a bachelor's degree, pass a licensing examination, complete a State-approved training program, and pursue continuing education. Some States also require licenses for administrators in assisted living facilities. A license is not required in other areas of medical and health services management.

Certification and other qualifications. Medical and health services managers often are responsible for facilities and equipment worth millions of dollars, and for hundreds of employees. To make effective decisions, they need to be open to different opinions and good at analyzing contradictory information. They must understand finance and information systems and be able to interpret data. Motivating others to implement their decisions requires strong leadership abilities. Tact, diplomacy, flexibility, and communication skills are essential because medical and health services managers spend most of their time interacting with others.

Health information managers who have a bachelor's degree or postbaccalaureate from an approved program and who pass an exam can earn certification as a Registered Health Information Administrator from the American Health Information Management Association.

Advancement. Medical and health services managers advance by moving into more responsible and higher paying positions, such as assistant or associate administrator, department head, or chief executive officer, or by moving to larger facilities. Some experienced managers also may become consultants or professors of health care management.

New graduates with master's degrees in health services administration may start as department managers or as supervisory staff. The level of the starting position varies with the experience of the applicant and the size of the organization. Hospitals and other health facilities offer postgraduate residencies and fellowships, which usually are staff positions. Graduates from master's degree programs also take jobs in large medical group practices, clinics, mental health facilities, nursing care corporations, and consulting firms.

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Medical and health services managers	11-9111	262,000	305,000	43,000	16

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

Graduates with bachelor's degrees in health administration usually begin as administrative assistants or assistant department heads in larger hospitals. They also may begin as department heads or assistant administrators in small hospitals or nursing care facilities.

Employment

Medical and health services managers held about 262,000 jobs in 2006. About 37 percent worked in hospitals, and another 22 percent worked in offices of physicians or in nursing and residential care facilities. Most of the remainder worked in home health care services, Federal Government health care facilities, outpatient care centers, insurance carriers, and community care facilities for the elderly.

Job Outlook

Employment of medical and health services managers is expected to grow faster than average. Job opportunities should be good, especially for applicants with work experience in the health care field and strong business management skills.

Employment change. Employment of medical and health services managers is expected to grow 16 percent from 2006 to 2016, faster than the average for all occupations. The health care industry will continue to expand and diversify, requiring managers to help ensure smooth business operations.

Managers in all settings will be needed to improve quality and efficiency of health care while controlling costs, as insurance companies and Medicare demand higher levels of accountability. Managers also will be needed to oversee the computerization of patient records and to ensure their security as required by law. Additional demand for managers will stem from the need to recruit workers and increase employee retention, to comply with changing regulations, to implement new technology, and to help improve the health of their communities by emphasizing preventive care.

Hospitals will continue to employ the most medical and health services managers over the 2006-16 decade. However, the number of new jobs created is expected to increase at a slower rate in hospitals than in many other industries because of the growing use of clinics and other outpatient care sites. Despite relatively slow employment growth, a large number of new jobs will be created because of the industry's large size.

Employment will grow fastest in practitioners' offices and in home health care agencies. Many services previously provided in hospitals will continue to shift to these settings, especially as medical technologies improve. Demand in medical group practice management will grow as medical group practices become larger and more complex.

Medical and health services managers also will be employed by health care management companies that provide management services to hospitals and other organizations and to specific departments such as emergency, information management systems, managed care contract negotiations, and physician recruiting.

Job prospects. Job opportunities will be good, especially for applicants with work experience in the health care field and strong business management skills should have the best opportunities. Medical and health services managers with experience in large hospital facilities will enjoy an advantage in the job market, as hospitals become larger and more complex. Competition for jobs at the highest management levels will be keen because of the high pay and prestige.

Earnings

Median annual earnings of wage and salary medical and health services managers were $73,340 in May 2006. The middle 50 percent earned between $57,240 and $94,780. The lowest 10 percent earned less than $45,050, and the highest 10 percent earned more than $127,830. Median annual earnings in the industries employing the largest numbers of medical and health services managers in May 2006 were:

General medical and surgical hospitals	$78,660
Outpatient care centers	67,920
Offices of physicians	67,540
Nursing care facilities	66,730
Home health care services	66,720

Earnings of medical and health services managers vary by type and size of the facility and by level of responsibility. For example, the Medical Group Management Association reported that, in 2006, median salaries for administrators were $72,875 in practices with 6 or fewer physicians, $95,766 in practices with 7 to 25 physicians, and $132,955 in practices with 26 or more physicians.

According to a survey by the Professional Association of Health Care Office Management, 2006 average total compensation for office managers in specialty physicians' practices was $70,474 in gastroenterology, $70,599 in dermatology, $76,392 in cardiology, $67,317 in ophthalmology, $67,222 in obstetrics and gynecology, $77,621 in orthopedics, $62,125 in pediatrics, $66,853 in internal medicine, and $60,040 in family practice.

Related Occupations

Medical and health services managers have training or experience in both health and management. Other occupations requiring knowledge of both fields are insurance underwriters and social and community service managers.

Sources of Additional Information

Information about undergraduate and graduate academic programs in this field is available from:

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➤ Association of University Programs in Health Administration, 2000 North 14th St., Suite 780, Arlington, VA 22201.
Internet: **http://www.aupha.org**

For a list of accredited graduate programs in medical and health services administration, contact:

➤ Commission on Accreditation of Healthcare Management Education, 2000 North 14th St., Suite 780, Arlington, VA 2220.
Internet: **http://www.cahme.org**

For information about career opportunities in health care management, contact:

➤ American College of Healthcare Executives, One N. Franklin St., Suite 1700, Chicago, IL 60606.
Internet: **http://www.healthmanagementcareers.org**

For information about career opportunities in long-term care administration, contact:

➤ American College of Health Care Administrators, 300 N. Lee St., Suite 301, Alexandria, VA 22314.
Internet: **http://www.achca.org**

For information about career opportunities in medical group practices and ambulatory care management, contact:

➤ Medical Group Management Association, 104 Inverness Terrace East, Englewood, CO 80112.
Internet: **http://www.mgma.org**

For information about medical and health care office managers, contact:

➤ Professional Association of Health Care Office Management, 461 East Ten Mile Rd., Pensacola, FL 32534.

For information about career opportunities in health information management, contact:

➤ American Health Information Management Association, 233 N. Michigan Ave., Suite 2150, Chicago, IL 60601.
Internet: **http://www.ahima.org**

Property, Real Estate, and Community Association Managers

(O*NET 11–9141.00)

Significant Points

- Opportunities should be best for those with college degrees in business administration, real estate, or related fields, and with professional designations.
- Particularly good opportunities are expected for those with experience managing housing for older people or with experience running a health unit.
- More than half of property, real estate, and community association managers are self-employed.

Nature of the Work

To businesses and investors, properly managed real estate is a source of income and profits; to homeowners, well-managed property is a way to preserve and enhance resale values and increase comfort. Property, real estate, and community association managers maintain and increase the value of real estate investments by handling the logistics of running a property. *Property and real estate managers* oversee the performance of income-producing commercial or residential properties and ensure that real estate investments achieve their expected revenues. *Community association managers* manage the common property and services of condominiums, cooperatives, and planned communities through their homeowner or community associations.

When owners of apartments, office buildings, or retail or industrial properties lack the time or expertise needed for the day-to-day management of their real estate investments or homeowner associations, they often hire a property or real estate manager or a community association manager. The manager is employed either directly by the owner or indirectly through a contract with a property management firm.

Generally, property and real estate managers handle the financial operations of the property, ensuring that rent is collected and that mortgages, taxes, insurance premiums, payroll, and maintenance bills are paid on time. In community associations, homeowners pay no rent and pay their own real estate taxes and mortgages, but community association managers collect association dues. Some property managers, usually senior-level property managers, supervise the preparation of financial statements and periodically report to the owners on the status of the property, occupancy rates, expiration dates of leases, and other matters.

Often, property managers negotiate contracts for janitorial, security, groundskeeping, trash removal, and other services. When contracts are awarded competitively, managers solicit bids from several contractors and advise the owners on which bid to accept. They monitor the performance of contractors, and investigate and resolve complaints from residents and tenants when services are not properly provided. Managers also purchase supplies and equipment for the property, and make arrangements with specialists for repairs that cannot be handled by regular property maintenance staff.

In addition to fulfilling these duties, property managers must understand and comply with relevant legislation, such as the Americans with Disabilities Act, the Federal Fair Housing Amendment Act, and local fair housing laws. They must ensure that their renting and advertising practices are not discriminatory, and that the property itself complies with all of the local, State, and Federal regulations and building codes.

Onsite property managers are responsible for the day-to-day operations of a single property, such as an office building, a shopping center, a community association, or an apartment complex. To ensure that the property is safe and properly maintained, onsite managers routinely inspect the grounds, facilities, and equipment to determine whether repairs or maintenance are needed. In handling requests for repairs or trying to resolve complaints, they meet not only with current residents, but also with prospective residents or tenants to show vacant apartments or office space. Onsite managers also are responsible for enforcing the terms of rental or lease agreements, such as rent collection, parking and pet restrictions, and termination-of-lease procedures. Other important duties of onsite managers include keeping accurate, up-to-date records of income and expenditures from property operations and submitting regular expense reports to the senior-level property manager or owners.

Property managers who do not work onsite act as a liaison between the onsite manager and the owner. They also market

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vacant space to prospective tenants by hiring a leasing agent, advertising, or other means, and they establish rental rates in accordance with prevailing local economic conditions.

Some property and real estate managers, often called *real estate asset managers*, act as the property owners' agent and adviser for the property. They plan and direct the purchase, development, and disposition of real estate on behalf of the business and investors. These managers focus on long-term strategic financial planning, rather than on day-to-day operations of the property.

In deciding to acquire property, real estate asset managers consider several factors, such as property values, taxes, zoning, population growth, transportation, and traffic volume and patterns. Once a site is selected, they negotiate contracts for the purchase or lease of the property, securing the most beneficial terms. Real estate asset managers review their company's real estate holdings periodically and identify properties that are no longer financially profitable. They then negotiate the sale of, or terminate the lease on, such properties.

Community association managers, on the other hand, do work that more closely parallels that of onsite property managers. They collect monthly assessments, prepare financial statements and budgets, negotiate with contractors, and help to resolve complaints. In other respects, however, the work of association managers differs from that of other residential property and real estate managers because they interact with homeowners and other residents on a daily basis. Usually hired by a volunteer board of directors of the association, they administer the daily affairs, and oversee the maintenance, of property and facilities that the homeowners own and use jointly through the association. They also assist the board and owners in complying with association and government rules and regulations.

Some associations encompass thousands of homes and employ their own onsite staff and managers. In addition to administering the associations' financial records and budget, managers may be responsible for the operation of community pools, golf courses, and community centers, and for the maintenance of landscaping and parking areas. Community association managers also may meet with the elected boards of directors to discuss and resolve legal issues or disputes that may affect the owners, as well as to review any proposed changes or improvements by homeowners to their properties, to make sure that they comply with community guidelines.



Property, real estate, and community association managers handle the logistics of running a property.

Work environment. The offices of most property, real estate, and community association managers are clean, modern, and well lighted. However, many managers spend a major portion of their time away from their desks. Onsite managers, in particular, may spend a large portion of their workday away from their offices, visiting the building engineer, showing apartments, checking on the janitorial and maintenance staff, or investigating problems reported by tenants. Property and real estate managers frequently visit the properties they oversee, sometimes daily when contractors are doing major repair or renovation work. Real estate asset managers may spend time away from home while traveling to company real estate holdings or searching for properties to acquire.

Property, real estate, and community association managers often must attend evening meetings with residents, property owners, community association boards of directors, or civic groups. Not surprisingly, many managers put in long workweeks, especially before financial and tax reports are due and before board and annual meetings. Some apartment managers are required to live in the apartment complexes where they work, so that they are available to handle emergencies, even when they are off duty. They usually receive compensatory time off for working nights or weekends. Many apartment managers receive time off during the week so that they are available on weekends to show apartments to prospective residents.

Training, Other Qualifications, and Advancement

Employers increasingly are hiring college graduates with a bachelor's or master's degree in business administration, accounting, finance, or real estate, even if they don't have much practical experience.

Education and training. Most employers prefer to hire college graduates for property management positions. In fact, employers increasingly are hiring inexperienced college graduates with a bachelor's or master's degree in business administration, accounting, finance, real estate, or public administration for these positions. Those with degrees in the liberal arts also may qualify, especially if they have relevant coursework. Many people entering jobs such as assistant property manager have onsite management experience.

Licensure. Managers of public housing subsidized by the Federal Government are required to be certified, but many property, real estate, and community association managers who work with all types of property choose to earn a professional designation voluntarily, because it represents formal recognition of their achievements and affords status in the occupation. Real estate managers who buy or sell property are required to be licensed by the State in which they practice. In a few States, property association managers must be licensed.

Other qualifications. Previous employment as a real estate sales agent may be an asset to onsite managers, because it provides experience that is useful in showing apartments or office space. In the past, those with backgrounds in building maintenance have advanced to onsite manager positions on the strength of their knowledge of building mechanical systems, but this path is becoming less common as employers place greater emphasis

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on administrative, financial, and communication abilities for managerial jobs.

People most commonly enter real estate asset manager jobs by transferring from positions as property managers or real estate brokers. Real estate asset managers must be good negotiators, adept at persuading and working with people, and good at analyzing data in order to assess the fair-market value of property or its development potential. Resourcefulness and creativity in arranging financing are essential for managers who specialize in land development.

Good speaking, writing, computer, and financial skills, as well as an ability to deal tactfully with people, are essential in all areas of property management.

Certification and advancement. Many people begin property management careers as assistants. Assistants work closely with a property manager and learn how to prepare budgets, analyze insurance coverage and risk options, market property to prospective tenants, and collect overdue rent payments. In time, many assistants advance to property manager positions.

Some people start as onsite managers of apartment buildings, office complexes, or community associations. As they acquire experience, often working under the direction of a more experienced property manager, they may advance to positions of greater responsibility. Those who excel as onsite managers often transfer to assistant offsite property manager positions, in which they can acquire experience handling a broad range of property management responsibilities.

The responsibilities and compensation of property, real estate, and community association managers increase as these workers manage more and larger properties. Most property managers, often called portfolio managers, are responsible for several properties at a time. As their careers advance, they gradually are entrusted with larger properties that are more complex to manage. Many specialize in the management of one type of property, such as apartments, office buildings, condominiums, cooperatives, homeowners' associations, or retail properties. Managers who excel at marketing properties to tenants might specialize in managing new properties, while those who are particularly knowledgeable about buildings and their mechanical systems might specialize in the management of older properties requiring renovation or more frequent repairs. Some experienced managers open their own property management firms.

Many employers encourage attendance at short-term formal training programs conducted by various professional and trade associations that are active in the real estate field. Employers send managers to these programs to improve their management skills and expand their knowledge of specialized subjects, such as the operation and maintenance of building mechanical systems, the enhancement of property values, insurance and risk management, personnel management, business and real estate law, community association risks and liabilities, tenant relations, communications, accounting and financial concepts, and reserve funding. Managers also participate in these programs to prepare themselves for positions of greater responsibility in property management. The completion of these programs, plus related job experience and a satisfactory score on a written examination can lead to certification, or the formal award of a professional designation, by the sponsoring association. (Some organizations offering certifications are listed as sources of additional information at the end of this statement.) Some associations also require their members to adhere to a specific code of ethics.

Employment

Property, real estate, and community association managers held about 329,000 jobs in 2006. About 36 percent worked for real estate agents and brokers, lessors of real estate, or activities related to real estate. Others worked for real estate development companies, government agencies that manage public buildings, and corporations with extensive holdings of commercial properties. More than half of property, real estate, and community association managers are self-employed.

Job Outlook

Faster than average employment growth is expected. Opportunities should be best for jobseekers with a college degree in business administration, real estate, or a related field, and for those who attain a professional designation. Particularly good opportunities are expected for those with experience managing housing for older people or with experience running a health unit.

Employment change. Employment of property, real estate, and community association managers is projected to increase by 15 percent during the 2006–16 decade, faster than the average for all occupations. Job growth among onsite property managers in commercial real estate is expected to accompany the projected expansion of the real estate and rental and leasing industry. An increase in the Nation's stock of apartments, houses, and offices also should require more property managers. Developments of new homes are increasingly being organized with community or homeowner associations that provide community services and oversee jointly owned common areas requiring professional management. To help properties become more profitable or to enhance the resale values of homes, more commercial and residential property owners are expected to place their investments in the hands of professional managers. Moreover, the number of older people will grow during the 2006–16 projection period, increasing the need for specialized housing, such as assisted-living facilities and retirement communities that require management.

Job prospects. In addition to openings from job growth, a number of openings are expected as managers transfer to other occupations or leave the labor force. Opportunities should be best for jobseekers with a college degree in business administration, real estate, or a related field, and for those who attain a professional

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Property, real estate, and community association managers	11-9141	329,000	379,000	50,000	15

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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designation. Because of the expected increase in assisted-living and retirement communities, particularly good opportunities are expected for those with experience managing housing for older people or with experience running a health unit.

Earnings

Median annual earnings of salaried property, real estate, and community association managers were $43,070 in May 2006. The middle 50 percent earned between $28,700 and $64,200 a year. The lowest 10 percent earned less than $20,140, and the highest 10 percent earned more than $95,170 a year. Median annual earnings of salaried property, real estate, and community association managers in the largest industries that employed them in May 2006 were:

Land subdivision	$78,040
Local government	55,210
Activities related to real estate	40,590
Offices of real estate agents and brokers	40,500
Lessors of real estate	37,480

Many resident apartment managers and onsite association managers receive the use of an apartment as part of their compensation package. Managers often are reimbursed for the use of their personal vehicles, and managers employed in land development often receive a small percentage of ownership in the projects that they develop.

Related Occupations

Property, real estate, and community association managers plan, organize, staff, and manage the real estate operations of businesses. Workers who perform similar functions in other fields include administrative services managers, education administrators, food service managers, lodging managers, medical and health services managers, real estate brokers and sales agents, and urban and regional planners.

Sources of Additional Information

For information about education and careers in property management, as well as information about professional designation and certification programs in both residential and commercial property management, contact:

➤ Institute of Real Estate Management, 430 N. Michigan Ave., Chicago, IL 60611. Internet: **http://www.irem.org**

For information on careers and certification programs in commercial property management, contact:

➤ Building Owners and Managers Institute, 1521 Ritchie Hwy., Arnold, MD 21012. Internet: **http://www.bomi.org**

For information on careers and professional designation and certification programs in residential property management and community association management, contact:

➤ Community Associations Institute, 225 Reinekers Ln., Suite 300, Alexandria, VA 22314.
Internet: **http://www.caionline.org**

➤ National Board of Certification for Community Association Managers, 225 Reinekers Ln., Suite 310, Alexandria, VA 22314.
Internet: **http://www.nbccam.org**

Purchasing Managers, Buyers, and Purchasing Agents

(O*NET 11-3061.00, 13-1021.00, 13-1022.00, 13-1023.00)

Significant Points

- About 43 percent are employed in wholesale trade or manufacturing establishments.
- Some firms prefer to promote existing employees to these positions, while others recruit and train college graduates.
- Employment is projected to have little or no job growth.
- Opportunities should be best for those with a college degree.

Nature of the Work

Purchasing managers, buyers, and purchasing agents shop for a living. They buy the goods and services the company or institution needs to either resell to customers or for the establishment's own use. *Wholesale and retail buyers* purchase goods, such as clothing or electronics, for resale. *Purchasing agents* buy goods and services for use by their own company or organization; they might buy raw materials for manufacturing or office supplies, for example. *Purchasing agents and buyers of farm products* purchase goods such as grain, Christmas trees, and tobacco for further processing or resale.

Purchasing professionals consider price, quality, availability, reliability, and technical support when choosing suppliers and merchandise. They try to get the best deal for their company, meaning the highest quality goods and services at the lowest possible cost to their companies. In order to accomplish this successfully, purchasing managers, buyers, and purchasing agents study sales records and inventory levels of current stock, identify foreign and domestic suppliers, and keep abreast of changes affecting both the supply of, and demand for, needed products and materials. To be effective, purchasing specialists must have a working technical knowledge of the goods or services to be purchased.

In large industrial organizations, a distinction often is drawn between the work of a buyer or purchasing agent and that of a *purchasing manager*. Purchasing agents commonly focus on routine purchasing tasks, often specializing in a commodity or group of related commodities, such as steel, lumber, cotton, grains, fabricated metal products, or petroleum products. Purchasing agents usually track market conditions, price trends, and futures markets. Purchasing managers usually handle the more complex or critical purchases and may supervise a group of purchasing agents handling other goods and services. Whether a person is titled purchasing manager, buyer, or purchasing agent depends somewhat on specific industry and employer practices. But purchasing managers often have a much larger range of duties than purchasing agents. They may actively seek new technologies and suppliers. They may create and oversee systems

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that allow individuals within their organizations to buy their own supplies, lowering the cost of each transaction.

Purchasing specialists employed by government agencies or manufacturing firms usually are called purchasing directors, managers, or agents; or contract specialists. These workers acquire materials, parts, machines, supplies, services, and other inputs to the production of a final product. Purchasing agents and managers obtain items ranging from raw materials, fabricated parts, machinery, and office supplies to construction services and airline tickets. Some purchasing managers specialize in negotiating and supervising supply contracts and are called contract or supply managers.

Often, purchasing specialists in government place solicitations for services and accept bids and offers through the Internet. Government purchasing agents and managers must follow strict laws and regulations in their work, in order to avoid any appearance of impropriety.

Purchasing specialists who buy finished goods for resale are employed by wholesale and retail establishments, where they commonly are known as buyers or merchandise managers. Wholesale and retail buyers are an integral part of a complex system of distribution and merchandising that caters to the vast array of consumer needs and desires. Wholesale buyers purchase goods directly from manufacturers or from other wholesale firms for resale to retail firms, commercial establishments, institutions, and other organizations. In retail firms, buyers purchase goods from wholesale firms or directly from manufacturers for resale to the public.

Buyers largely determine which products their establishment will sell. Therefore, it is essential that they have the ability to predict what will appeal to consumers. They must constantly stay informed of the latest trends, because failure to do so could jeopardize profits and the reputation of their company. They keep track of inventories and sales levels through computer software that is linked to the store's cash registers. Buyers also follow ads in newspapers and other media to check competitors' sales activities, and they watch general economic conditions to anticipate consumer buying patterns. Buyers working for large and medium-sized firms usually specialize in acquiring one or two lines of merchandise, whereas buyers working for small stores may purchase the establishment's complete inventory.

The use of private-label merchandise and the consolidation of buying departments have increased the responsibilities of retail buyers. Private-label merchandise, produced for a particular retailer, requires buyers to work closely with vendors to develop and obtain the desired product. The downsizing and consolidation of buying departments increases the demands placed on buyers because, although the amount of work remains unchanged, there are fewer people to accomplish it. The result is an increase in the workloads and levels of responsibility for all.

Many merchandise managers assist in the planning and implementation of sales promotion programs. Working with merchandise executives, they determine the nature of the sale and purchase items accordingly. Merchandise managers may work with advertising personnel to create an ad campaign. For example, they may determine in which media the advertisement will be placed—newspapers, direct mail, television, or some combination of all three. In addition, merchandise managers often visit the selling floor to ensure that goods are properly displayed. Buyers stay in constant contact with store and department managers to find out what products are selling well and which items the customers are demanding to be added to the product line. Often, assistant buyers are responsible for placing orders and checking shipments.

Evaluating suppliers is one of the most critical functions of a purchasing manager, buyer, or purchasing agent. Many firms now run on a lean manufacturing schedule and use just-in-time inventories so any delays in the supply chain can shut down production and cost the firm its customers and reputation. Purchasing professionals use many resources to find out all they can about potential suppliers. The Internet has become an effective tool in searching catalogs, trade journals, and industry and company publications, and directories. Purchasing professionals will attend meetings, trade shows, and conferences to learn of new industry trends and make contacts with suppliers. Purchasing managers, agents, and buyers will usually interview prospective suppliers and visit their plants and distribution centers to asses their capabilities. It is important to make certain that the supplier is capable of delivering the desired goods or services on time, in the correct quantities without sacrificing quality. Once all of the necessary information on suppliers is gathered, orders are placed and contracts are awarded to those suppliers who meet the purchaser's needs. Most of the transaction process is now automated using electronic purchasing systems that link the supplier and firms together through the Internet.

Purchasing professionals can gain instant access to specifications for thousands of commodities, inventory records, and their customers' purchase records to avoid overpaying for goods and to avoid shortages of popular goods or surpluses of goods that do not sell as well. These systems permit faster selection, customization, and ordering of products, and they allow buyers to concentrate on the qualitative and analytical aspects of the job. Long-term contracts are an important strategy of purchasing professionals because it allows purchasers to consolidate their supply bases around fewer suppliers. In today's global economy, purchasing managers, buyers, and purchasing agents should expect to deal with foreign suppliers which may require travel to other countries and to be familiar with other cultures and languages.

Changing business practices have altered the traditional roles of purchasing or supply management specialists in many industries. For example, manufacturing companies increasingly involve workers in this occupation at most stages of product development because of their ability to forecast a part's or material's cost, availability, and suitability for its intended purpose. Furthermore, potential problems with the supply of materials may be avoided by consulting the purchasing department in the early stages of product design.

Purchasing specialists often work closely with other employees in their own organization when deciding on purchases, an arrangement sometimes called "team buying." For example, before submitting an order, they may discuss the design of custom-made products with company design engineers, talk about problems involving the quality of purchased goods with quality assurance engineers and production supervisors, or mention shipment problems to managers in the receiving department.

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Purchasing managers, buyers, and purchasing agents work to get the best merchandise at the lowest cost.

Work environment. Most purchasing managers, buyers, and purchasing agents work in comfortable offices. They frequently work more than the standard 40-hour week, because of special sales, conferences, or production deadlines. Evening and weekend work also is common before holiday and back-to-school seasons for those working in retail trade. Consequently, many retail firms discourage the use of vacation time during peak periods.

Buyers and merchandise managers often work under great pressure. Because wholesale and retail stores are so competitive, buyers need physical stamina to keep up with the fast-paced nature of their work.

Many purchasing managers, buyers, and purchasing agents travel at least several days a month. Purchasers for worldwide manufacturing companies and large retailers, as well as buyers of high fashion, may travel outside the United States.

Training, Other Qualifications, and Advancement

Qualified people may begin as trainees, purchasing clerks, expediters, junior buyers, or assistant buyers. They often need continuing education, certification, or a bachelor's degree to advance. Retail and wholesale firms prefer to hire applicants who have a college degree and who are familiar with the merchandise they sell and with wholesaling and retailing practices. Some retail firms promote qualified employees to assistant buyer positions; others recruit and train college graduates as assistant buyers. Most employers use a combination of methods.

Education and training. Educational requirements tend to vary with the size of the organization. Large stores and distributors prefer applicants who have completed a bachelor's degree program with a business emphasis. Many manufacturing firms put an even greater emphasis on formal training, preferring applicants with a bachelor's or master's degree in engineering, business, economics, or one of the applied sciences. A master's degree is essential for advancement to many top-level purchasing manager jobs.

Regardless of academic preparation, new employees must learn the specifics of their employer's business. Training periods vary in length, with most lasting 1 to 5 years. In wholesale and retail establishments, most trainees begin by selling merchandise, supervising sales workers, checking invoices on material received, and keeping track of stock. As they progress, trainees are given increased buying-related responsibilities.

In manufacturing, new purchasing employees often are enrolled in company training programs and spend a considerable amount of time learning about their firm's operations and purchasing practices. They work with experienced purchasers to learn about commodities, prices, suppliers, and markets. In addition, they may be assigned to the production planning department to learn about the material requirements system and the inventory system the company uses to keep production and replenishment functions working smoothly.

Other qualifications. Purchasing managers, buyers, and purchasing agents must know how to use word processing and spreadsheet software and the Internet. Other important qualities include the ability to analyze technical data in suppliers' proposals; good communication, negotiation, and mathematical skills; knowledge of supply-chain management; and the ability to perform financial analyses.

People who wish to become wholesale or retail buyers should be good at planning and decisionmaking and have an interest in merchandising. Anticipating consumer preferences and ensuring that goods are in stock when they are needed requires resourcefulness, good judgment, and self-confidence. Buyers must be able to make decisions quickly and to take risks. Marketing skills and the ability to identify products that will sell also are very important. Employers often look for leadership ability, too, because buyers spend a large portion of their time supervising assistant buyers and dealing with manufacturers' representatives and store executives.

Experienced buyers may advance by moving to a department that manages a larger volume or by becoming a merchandise manager. Others may go to work in sales for a manufacturer or wholesaler.

Certification and advancement. An experienced purchasing agent or buyer may become an assistant purchasing manager in charge of a group of purchasing professionals before advancing to purchasing manager, supply manager, or director of materials management. At the top levels, duties may overlap with other management functions, such as production, planning, logistics, and marketing.

Regardless of industry, continuing education is essential for advancement. Many purchasing managers, buyers, and purchasing agents participate in seminars offered by professional societies and take college courses in supply management. Professional certification is becoming increasingly important, especially for those just entering the occupation.

There are several recognized credentials for purchasing agents and purchasing managers. The Certified Purchasing Manager (C.P.M.) designation is conferred by the Institute for Supply Management. In 2008, this certification will be replaced by the Certified Professional in Supply Management (CPSM) credential, covering the wider scope of duties now performed by purchasing professionals. The Certified Purchasing Professional (CPP) and Certified Professional Purchasing Manager (CPPM) designations are conferred by the American Purchasing Society. The Certified Supply Chain Professional credential is conferred by APICS, the Association for Operations Management. For workers in Federal, State, and local government, the National Institute

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of Governmental Purchasing offers the designations of Certified Professional Public Buyer (CPPB) and Certified Public Purchasing Officer (CPPO). Most of these certifications are awarded only after work-related experience and education requirements are met and written or oral exams are successfully completed.

Employment

Purchasing managers, buyers, and purchasing agents held about 529,000 jobs in 2006. About 43 percent worked in the wholesale trade and manufacturing industries and another 11 percent worked in retail trade. The remainder worked mostly in service establishments, such as management of companies and enterprises, or different levels of government. A small number were self-employed.

The following tabulation shows the distribution of employment by occupational specialty:

Purchasing agents, except wholesale, retail, and farm products	287,000
Wholesale and retail buyers, except farm products	157,000
Purchasing managers	70,000
Purchasing agents and buyers, farm products	16,000

Job Outlook

Employment of purchasing managers, buyers, and purchasing agents is expected to have little or no job growth through the year 2016. Generally, opportunities will be best for individuals with a bachelor's degree. In government and in large companies, opportunities will be best for those with a master's degree.

Employment change. No change in overall employment of purchasing managers, buyers, and purchasing agents is expected during the 2006-16 decade.

Demand for purchasing workers will be limited by improving software, which has eliminated much of the paperwork involved in ordering and procuring supplies, and also by the growing number of purchases being made electronically through the Internet and electronic data interchange (EDI). Demand will also be limited by offshoring of routine purchasing actions to other countries and by consolidation of purchasing departments, which makes purchasing agents more efficient.

Demand for purchasing workers in the manufacturing sector will be less than demand in the services sector, as the overall service sector grows more rapidly than the manufacturing sector. Also, many purchasing agents are now charged with procuring services that traditionally had been done in-house, such as computer and IT (information technology) support in addition to traditionally contracted services such as advertising.

Employment of purchasing managers is expected to grow more slowly than average. The use of the Internet to conduct electronic commerce has made information easier to obtain, thus increasing the productivity of purchasing managers. The Internet also allows both large and small companies to bid on contracts. Exclusive supply contracts and long-term contracting have allowed companies to negotiate with fewer suppliers less frequently.

Employment of wholesale and retail buyers, except farm products, is expected to have little or no change in employment. In the retail industry, mergers and acquisitions have caused buying departments to consolidate. In addition, larger retail stores are eliminating local buying departments and centralizing them at their headquarters.

Employment of purchasing agents, except wholesale, retail, and farm products, is expected to have little or no change in employment, primarily because of the increased globalization of the U.S. economy. As more materials and supplies come from abroad, firms have begun to outsource more of their purchasing duties to foreign purchasing agents who are located closer to the foreign suppliers of goods and materials they will need. This trend is expected to continue, but it will likely be limited to routine transactions with complex and critical purchases still being handled in-house.

Finally, employment of purchasing agents and buyers, farm products, is projected to decline 9 percent, as overall growth in agricultural industries and retailers in the grocery-related industries consolidate.

Job prospects. Persons who have a bachelor's degree in business should have the best chance of obtaining a buyer position in wholesale or retail trade or within government. A bachelor's degree, combined with industry experience and knowledge of a technical field, will be an advantage for those interested in working for a manufacturing or industrial company. Government agencies and larger companies usually require a master's degree in business or public administration for top-level purchasing positions.

Earnings

Median annual earnings of purchasing managers were $81,570 in May 2006. The middle 50 percent earned between $60,890 and $105,780 a year. The lowest 10 percent earned less than $46,540, and the highest 10 percent earned more than $132,040 a year.

Median annual earnings for purchasing agents and buyers of farm products were $46,770 in May 2006. The middle 50 percent earned between $34,770 and $64,100 a year. The lowest

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16 Number	Change, 2006-16 Percent
Purchasing managers, buyers, and purchasing agents	—	529,000	531,000	1,200	0
Purchasing managers	11-3061	70,000	72,000	2,400	3
Purchasing agents and buyers, farm products	13-1021	16,000	15,000	-1,400	-9
Wholesale and retail buyers, except farm products	13-1022	157,000	156,000	-200	0
Purchasing agents, except wholesale, retail, and farm products	13-1023	287,000	288,000	400	0

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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10 percent earned less than $26,520, and the highest 10 percent earned more than $88,650 a year.

Median annual earnings for wholesale and retail buyers, except farm products, were $44,640 in May 2006. The middle 50 percent earned between $33,640 and $60,590 a year. The lowest 10 percent earned less than $26,270, and the highest 10 percent earned more than $83,080 a year. Median annual earnings in the industries employing the largest numbers of wholesale and retail buyers, except farm products, were:

Management of companies and enterprises	$54,390
Grocery and related product wholesalers	46,080
Wholesale electronic markets and agents and brokers	45,020
Building material and supplies dealers	40,380
Grocery stores	34,210

Median annual earnings for purchasing agents, except wholesale, retail, and farm products, were $50,730 in May 2006. The middle 50 percent earned between $39,000 and $66,730 a year. The lowest 10 percent earned less than $31,350, and the highest 10 percent earned more than $83,900 a year. Median annual earnings in the industries employing the largest numbers of purchasing agents, except wholesale, retail, and farm products, were:

Federal executive branch	$68,500
Aerospace product and parts manufacturing	59,390
Navigational, measuring, electromedical, and control instruments manufacturing	55,620
Management of companies and enterprises	54,820
Local government	48,170

Purchasing managers, buyers, and purchasing agents receive the same benefits package as other workers, including vacations, sick leave, life and health insurance, and pension plans. In addition to receiving standard benefits, retail buyers often earn cash bonuses based on their performance and may receive discounts on merchandise bought from their employer.

Related Occupations

Like purchasing managers, buyers, and purchasing agents, procurement clerks work to obtain materials and goods for businesses. Workers in other occupations who need a knowledge of marketing and the ability to assess consumer demand include those in advertising, marketing, promotions, public relations, and sales managers; food service managers: insurance sales agents; lodging managers; sales engineers; and sales representatives, wholesale and manufacturing.

Sources of Additional Information

Further information about education, training, employment, and certification for purchasing careers is available from:

➤ American Purchasing Society, North Island Center, Suite 203, 8 East Galena Blvd., Aurora, IL 60506.

➤ Association for Operations Management, APICS, 5301 Shawnee Rd., Alexandria, VA 22312-2317.
Internet: **http://www.apics.org**

➤ Institute for Supply Management, P.O. Box 22160, Tempe, AZ 85285-2160. Internet: **http://www.ism.ws**

➤ National Institute of Governmental Purchasing, Inc., 151 Spring St., Suite 300, Herndon, VA 20170-5223.
Internet: **http://www.nigp.org**

Top Executives

(O*NET 11-1011.00, 11-1021.00)

Significant Points

- Keen competition is expected because the prestige and high pay of these jobs attract a large number of applicants.
- Top executives are among the highest paid workers; however, long hours, considerable travel, and intense pressure to succeed are common.
- The formal education and experience of top executives vary as widely as the nature of their responsibilities.

Nature of the Work

All organizations have specific goals and objectives that they strive to meet. Top executives devise strategies and formulate policies to ensure that these objectives are met. Although they have a wide range of titles—such as chief executive officer, chief operating officer, board chair, president, vice president, school superintendent, county administrator, or tax commissioner—all formulate policies and direct the operations of businesses and corporations, public sector organizations, nonprofit institutions, and other organizations.

A corporation's goals and policies are established by the *chief executive officer* in collaboration with other top executives, who are overseen by a board of directors. In a large corporation, the chief executive officer meets frequently with subordinate executives to ensure that operations are conducted in accordance with these policies. The chief executive officer of a corporation retains overall accountability; however, a *chief operating officer* may be delegated several responsibilities, including the authority to oversee executives who direct the activities of various departments and implement the organization's policies on a day-to-day basis. In publicly held and nonprofit corporations, the board of directors ultimately is accountable for the success or failure of the enterprise, and the chief executive officer reports to the board.

In addition to being responsible for the operational success of a company, top executives also are increasingly being held accountable for the accuracy of their financial reporting, particularly among publicly traded companies. For example, recently enacted legislation contains provisions for corporate governance, internal control, and financial reporting.

The nature of the responsibilities of other high-level executives depends on the size of the organization. In small organizations, such as independent retail stores or small manufacturers, a partner, owner, or general manager often is responsible for purchasing, hiring, training, quality control, and day-to-day supervisory duties. In large organizations, the duties of executives

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While top executives are among the highest paid workers, long hours and intense pressure to succeed are common.

are highly specialized. Some managers, for instance, are responsible for the overall performance of one aspect of the organization, such as manufacturing, marketing, sales, purchasing, finance, personnel, training, administrative services, computer and information systems, property management, transportation, or legal services. (Some of these and other management occupations are discussed elsewhere in this section of the *Handbook*.)

Chief financial officers direct the organization's financial goals, objectives, and budgets. They oversee the investment of funds and manage associated risks, supervise cash management activities, execute capital-raising strategies to support a firm's expansion, and deal with mergers and acquisitions.

Chief information officers are responsible for the overall technological direction of their organizations. They are increasingly involved in the strategic business plan of a firm as part of the executive team. To perform effectively, they also need knowledge of administrative procedures, such as budgeting, hiring, and supervision. These managers propose budgets for projects and programs and make decisions on staff training and equipment purchases. They hire and assign computer specialists, information technology workers, and support personnel to carry out specific parts of the projects. They supervise the work of these employees, review their output, and establish administrative procedures and policies. Chief information officers also provide organizations with the vision to master information technology as a competitive tool.

Chief executives have overall responsibility for the operation of their organizations. Working with executive staff, they set goals and arrange programs to attain these goals. Executives also appoint department heads, who manage the employees who carry out programs. Chief executives also oversee budgets and ensure that resources are used properly and that programs are carried out as planned.

Chief executive officers carry out a number of other important functions, such as meeting with staff and board members to determine the level of support for proposed programs. Chief executive officers in government often nominate citizens to boards and commissions, encourage business investment, and promote economic development in their communities. To do all of these varied tasks effectively, chief executives rely on a staff of highly skilled personnel. Executives who control small companies, however, often do this work by themselves.

General and operations managers plan, direct, or coordinate the operations of companies or public and private sector organizations. Their duties include formulating policies, managing daily operations, and planning the use of materials and human resources, but are too diverse and general in nature to be classified in any one area of management or administration, such as personnel, purchasing, or administrative services. In some organizations, the duties of general and operations managers may overlap the duties of chief executive officers.

Work environment. Top executives typically have spacious offices and numerous support staff. General managers in large firms or nonprofit organizations usually have comfortable offices close to those of the top executives to whom they report. Long hours, including evenings and weekends, are standard for most top executives and general managers, although their schedules may be flexible.

Substantial travel between international, national, regional, and local offices to monitor operations and meet with customers, staff, and other executives often is required of managers and executives. Many managers and executives also attend meetings and conferences sponsored by various associations. The conferences provide an opportunity to meet with prospective donors, customers, contractors, or government officials and allow managers and executives to keep abreast of technological and managerial innovations.

In large organizations, job transfers between local offices or subsidiaries are common for persons on the executive career track. Top executives are under intense pressure to succeed; depending on the organization, this may mean earning higher profits, providing better service, or attaining fundraising and charitable goals. Executives in charge of poorly performing organizations or departments usually find their jobs in jeopardy.

Training, Other Qualifications, and Advancement

The formal education and experience required by top executives vary as widely as their responsibilities do, but many of these workers have at least a bachelor's degree and considerable experience.

Education and training. Many top executives have a bachelor's or graduate degree in business administration, liberal arts, or a more specialized discipline. The specific degree required often depends on the type of organization for which they work. College presidents, for example, typically have a doctorate in the field in which they originally taught, and school superintendents often have a master's degree in education administration. (For information on lower-level managers in educational services, see the *Handbook* statement on education administrators.) A brokerage office manager needs a strong background in securities and finance, and department store executives generally have extensive experience in retail trade.

Some top executives in the public sector have a background in public administration or liberal arts. Others might have a more specific background related to their jobs. For example, a health commissioner might have a graduate degree in health services administration or business administration. (For information

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on lower-level managers in health services, see the *Handbook* statement on medical and health services managers.)

Many top executive positions are filled from within the organization by promoting experienced, lower-level managers when an opening occurs. In industries such as retail trade or transportation, for instance, it is possible for individuals without a college degree to work their way up within the company and become managers. However, many companies prefer that their top executives have extensive managerial experience and, therefore, hire individuals who have been managers in other organizations.

Other qualifications. Top executives must have highly developed personal skills. An analytical mind able to quickly assess large amounts of information and data is very important, as is the ability to consider and evaluate the relationships between numerous factors. Top executives also must be able to communicate clearly and persuasively. For managers to succeed they need other important qualities as well, including leadership, self-confidence, motivation, decisiveness, flexibility, sound business judgment, and determination.

Certification and advancement. Advancement may be accelerated by participation in company training programs that impart a broader knowledge of company policy and operations. Managers also can help their careers by becoming familiar with the latest developments in management techniques at national or local training programs sponsored by various industry and trade associations. To facilitate their promotion to an even higher level, managers who have experience in a particular field, such as accounting or engineering, may attend executive development programs geared towards their background.

Participation in conferences and seminars can expand knowledge of national and international issues influencing the organization and can help the participants develop a network of useful contacts. For example, the Institute of Certified Professional Managers offers the Certified Manager (CM) credential, which is earned by completing training and passing an exam. The certification is held by individuals at all experience levels, from those seeking to enter management to those who are already senior executives. Certification is not necessary for advancement but may be helpful in developing and demonstrating valuable management skills.

General managers may advance to a top executive position, such as executive vice president, in their own firm or they may take a corresponding position in another firm. They may even advance to peak corporate positions such as chief operating officer or chief executive officer. Chief executive officers often become members of the board of directors of one or more firms, typically as a director of their own firm and often as chair of its board of directors. Some top executives establish their own firms or become independent consultants.

Employment

Top executives held about 2.2 million jobs in 2006. Employment by detailed occupation was distributed as follows:

General and operations managers	1,720,000
Chief executives	402,000

Top executives are found in every industry, but service-providing industries, including government, employed over 3 out of 4 top executives.

Job Outlook

Employment of top executives is projected to have little or no change. Keen competition for jobs is expected because of the prestige and high pay of these positions.

Employment change. Employment of top executives—including chief executives, general and operations managers, and legislators—is expected to grow 2 percent from 2006 to 2016. Because top managers are essential to the success of any organization, their jobs are unlikely to be automated or offshored to other countries. Some top executive jobs may be eliminated through industry consolidation, as upper management is streamlined after mergers and acquisitions. Employment of top executives is not as sensitive to growth in business as employment in many other occupations. As a business grows, the number of top executives changes little relative to the total number of employees. Therefore, top executives are not expected to experience as much employment growth as workers in the occupations they oversee.

Projected employment growth of top executives varies by industry. For example, employment growth is expected to grow faster than average in professional, scientific, and technical services and about as fast as the average in administrative and support services. However, employment is projected to decline in some manufacturing industries.

Job prospects. Keen competition is expected for top executive positions because the prestige and high pay attract a large number of qualified applicants. Because this is a large occupation, numerous openings will occur each year as executives transfer to other positions, start their own businesses, or retire. However, many executives who leave their jobs transfer to other executive positions, a pattern that tends to limit the number of job openings for new entrants to the occupation.

Experienced managers whose accomplishments reflect strong leadership qualities and the ability to improve the efficiency or competitive position of an organization will have the best opportunities. In an increasingly global economy, experience in international economics, marketing, information systems, and knowledge of several languages also may be beneficial.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Top executives	—	2,123,000	2,157,000	34,000	2
Chief executives	11-1011	402,000	410,000	8,200	2
General and operations managers	11-1021	1,720,000	1,746,000	26,000	2

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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Earnings

Top executives are among the highest paid workers in the U.S. economy. However, salary levels vary substantially depending on the level of managerial responsibility; length of service; and type, size, and location of the firm. For example, a top manager in a very large corporation can earn significantly more than a counterpart in a small firm.

Median annual earnings of wage and salary general and operations managers in May 2006 were $85,230. The middle 50 percent earned between $58,230 and $128,580. Because the specific responsibilities of general and operations managers vary significantly within industries, earnings also tend to vary considerably. Median annual earnings in the industries employing the largest numbers of general and operations managers were:

Architectural, engineering, and related services	$113,280
Management of companies and enterprises	105,130
Building equipment contractors	85,270
Depository credit intermediation	85,050
Local government	74,950

Median annual earnings of wage and salary chief executives in May 2006 were greater than $145,600; some chief executives of large companies earn hundreds of thousands to over a million dollars annually, although salaries vary substantially by type and level of responsibilities and by industry.

In addition to salaries, total compensation often includes stock options and other performance bonuses. The use of executive dining rooms and company aircraft and cars, expense allowances, and company-paid insurance premiums and physical examinations also are among benefits commonly enjoyed by top executives in private industry. A number of chief executive officers also are provided with company-paid club memberships and other amenities.

Related Occupations

Top executives plan, organize, direct, control, and coordinate the operations of an organization and its major departments or programs. The members of the board of directors and lower-level managers also are involved in these activities. Many other management occupations have similar responsibilities; however, they are concentrated in specific industries or are responsible for a specific department within an organization. A few examples are administrative services managers; education administrators; financial managers; food service managers; and advertising, marketing, promotions, public relations, and sales managers. Legislators oversee their staffs and help set public policies in Federal, State, and local governments.

Sources of Additional Information

For more information on top executives, including educational programs and job listings, contact:

➤ American Management Association, 1601 Broadway, 6th Floor, New York, NY 10019.
Internet: **http://www.amanet.org**

➤ National Management Association, 2210 Arbor Blvd., Dayton, OH 45439. Internet: **http://www.nma1.org**

For more information on executive financial management careers, contact:

➤ Financial Executives International, 200 Campus Dr., P.O. Box 674, Florham Park, NJ 07932.
Internet: **http://www.financialexecutives.org**

➤ Financial Management Association International, College of Business Administration, University of South Florida, 4202 East Fowler Ave., BSN 3331, Tampa, FL 33620.
Internet: **http://www.fma.org**

For information about management skills development, including the Certified Manager (CM) credential, contact:

➤ Institute for Certified Professional Managers, 1598 S. Main St., Harrisonburg, VA 22801. Internet: **http://www.icpm.biz**

Business and Financial Operations Occupations

Accountants and Auditors

(O*NET 13-2011.00, 13-2011.01, 13-2011.02)

Significant Points

- Most jobs require at least a bachelor's degree in accounting or a related field.
- Opportunities will be best for jobseekers who have a master's degree, obtain certification or licensure or who are proficient in the use of accounting and auditing computer software.
- Faster-than-average growth of accountant and auditor jobs will result from an increase in the number of businesses, changing financial laws and regulations, and greater scrutiny of company finances.

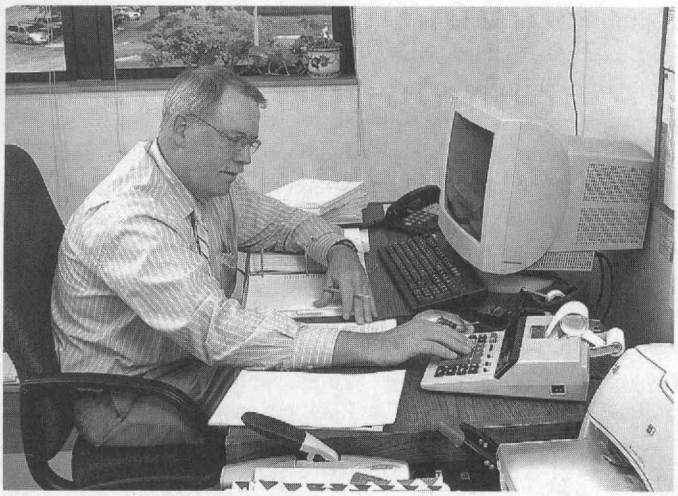
Nature of the Work

Accountants and auditors help to ensure that the Nation's firms are run efficiently, its public records kept accurately, and its taxes paid properly and on time. They analyze and communicate financial information for various entities such as companies, individual clients, and government. Beyond carrying out the fundamental tasks of the occupation—preparing, analyzing, and verifying financial documents in order to provide information to clients—many accountants also offer budget analysis, financial and investment planning, information technology consulting, and limited legal services.

Specific job duties vary widely among the four major fields of accounting and auditing: *public, management, government accounting*, and *internal auditing*.

Public accountants perform a broad range of accounting, auditing, tax, and consulting activities for their clients, which may be corporations, governments, nonprofit organizations, or individuals. For example, some public accountants concentrate

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Many accountants produce extensive financial reports for a company's recordkeeping.

on tax matters, such as advising companies about the tax advantages and disadvantages of certain business decisions and preparing individual income tax returns. Others offer advice in areas such as compensation or employee health care benefits, the design of accounting and data-processing systems, and the selection of controls to safeguard assets. Still others audit clients' financial statements and inform investors and authorities that the statements have been correctly prepared and reported. These accountants are also referred to as *external auditors*. Public accountants, many of whom are Certified Public Accountants (CPAs), generally have their own businesses or work for public accounting firms.

Some public accountants specialize in forensic accounting—investigating and interpreting white-collar crimes such as securities fraud and embezzlement, bankruptcies and contract disputes, and other complex and possibly criminal financial transactions, including money laundering by organized criminals. Forensic accountants combine their knowledge of accounting and finance with law and investigative techniques to determine whether an activity is illegal. Many forensic accountants work closely with law enforcement personnel and lawyers during investigations and often appear as expert witnesses during trials.

In response to recent accounting scandals, new Federal legislation restricts the nonauditing services that public accountants can provide to clients. If an accounting firm audits a client's financial statements, that same firm cannot provide advice on human resources, technology, investment banking, or legal matters, although accountants may still advise on tax issues. Accountants may also advise other clients in these areas and may provide advice within their own firm.

Management accountants—also called cost, managerial, industrial, corporate, or private accountants—record and analyze the financial information of the companies for which they work. Among their other responsibilities are budgeting, performance evaluation, cost management, and asset management. Usually, management accountants are part of executive teams involved in strategic planning or the development of new products. They analyze and interpret the financial information that corporate executives need in order to make sound business decisions. They also prepare financial reports for other groups, including stockholders, creditors, regulatory agencies, and tax authorities. Within accounting departments, management accountants may work in various areas, including financial analysis, planning and budgeting, and cost accounting.

Government accountants and auditors work in the public sector, maintaining and examining the records of government agencies and auditing private businesses and individuals whose activities are subject to government regulations or taxation. Accountants employed by Federal, State, and local governments ensure that revenues are received and expenditures are made in accordance with laws and regulations. Those employed by the Federal Government may work as Internal Revenue Service agents or in financial management, financial institution examination, or budget analysis and administration.

Internal auditors verify the effectiveness of their organization's internal controls and check for mismanagement, waste, or fraud. They examine and evaluate their firms' financial and information systems, management procedures, and internal controls to ensure that records are accurate and controls are adequate. They also review company operations, evaluating their efficiency, effectiveness, and compliance with corporate policies and government regulations. Because computer systems commonly automate transactions and make information readily available, internal auditors may also help management evaluate the effectiveness of their controls based on real-time data, rather than personal observation. They may recommend and review controls for their organization's computer systems, to ensure their reliability and integrity of the data.

Internal auditors may also have specialty titles, such as information technology auditors, environmental auditors, and compliance auditors.

Technology is rapidly changing the nature of the work of most accountants and auditors. With the aid of special software packages, accountants summarize transactions in the standard formats of financial records and organize data in special formats employed in financial analysis. These accounting packages greatly reduce the tedious work associated with data management and recordkeeping. Computers enable accountants and auditors to be more mobile and to use their clients' computer systems to extract information from databases and the Internet. As a result, a growing number of accountants and auditors with extensive computer skills specialize in correcting problems with software or in developing software to meet unique data management and analytical needs. Accountants also are beginning to perform more technical duties, such as implementing, controlling, and auditing computer systems and networks and developing a business's technology plans.

Accountants also act as personal advisors. They not only provide clients with accounting and tax help, but also help them develop personal budgets, manage assets and investments, plan for retirement, and recognize and reduce their exposure to risks. This role is in response to clients' demands for a single trustworthy individual or firm to meet all of their financial needs. However, accountants are restricted from providing these services to clients whose financial statements they also prepare. (See financial analysts and personal financial advisors elsewhere in the *Handbook*.)

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Work environment. Most accountants and auditors work in a typical office setting. Some may be able to do part of their work at home. Accountants and auditors employed by public accounting firms, government agencies, and organizations with multiple locations may travel frequently to perform audits at branches, clients' places of business, or government facilities.

Most accountants and auditors usually work a standard 40-hour week, but many work longer hours, particularly if they are self-employed and have numerous clients. Tax specialists often work long hours during the tax season.

Training, Other Qualifications, and Advancement

Most accountants and auditors need at least a bachelor's degree in business, accounting, or a related field. Many accountants and auditors choose to obtain certification to help advance their careers, such as becoming a Certified Public Accountant (CPA).

Education and training. Most accountant and auditor positions require at least a bachelor's degree in accounting or a related field. Beginning accounting and auditing positions in the Federal Government, for example, usually require 4 years of college (including 24 semester hours in accounting or auditing) or an equivalent combination of education and experience. Some employers prefer applicants with a master's degree in accounting, or with a master's degree in business administration with a concentration in accounting. Some universities and colleges are now offering programs to prepare students to work in growing specialty professions such as internal auditing,. Many professional associations offer continuing professional education courses, conferences, and seminars.

Some graduates of junior colleges or business or correspondence schools, as well as bookkeepers and accounting clerks who meet the education and experience requirements set by their employers, can obtain junior accounting positions and advance to accountant positions by demonstrating their accounting skills on the job.

Most beginning accountants and auditors may work under supervision or closely with an experienced accountant or auditor before gaining more independence and responsibility.

Licensure and certification. Any accountant filing a report with the Securities and Exchange Commission (SEC) is required by law to be a Certified Public Accountant (CPA). This may include senior level accountants working for or on behalf of public companies that are registered with the SEC. CPAs are licensed by their State Board of Accountancy. Any accountant who passes a national exam and meets the other requirements of the State where they practice can become a CPA. The vast majority of States require CPA candidates to be college graduates, but a few States will substitute a number of years of public accounting experience for a college degree.

As of 2007, 42 States and the District of Columbia required CPA candidates to complete 150 semester hours of college coursework—an additional 30 hours beyond the usual 4-year bachelor's degree. Several other States have adopted similar legislation that will become effective before 2009. Colorado, Delaware, New Hampshire, and Vermont are the only States that do not have any immediate plans to require the 150 semester hours. In response to this trend, many schools have altered their curricula accordingly, with most programs offering master's degrees as part of the 150 hours. Prospective accounting majors should carefully research accounting curricula and the requirements of any States in which they hope to become licensed.

All States use the four-part Uniform CPA Examination prepared by the American Institute of Certified Public Accountants (AICPA). The CPA examination is rigorous, and less than one-half of those who take it each year pass every part they attempt on the first try. Candidates are not required to pass all four parts at once, but most States require candidates to pass all four sections within 18 months of passing their first section. The CPA exam is now computerized and is offered 2 months out of every quarter at various testing centers throughout the United States. Most States also require applicants for a CPA certificate to have some accounting experience; however requirements vary by State or jurisdiction.

Nearly all States require CPAs and other public accountants to complete a certain number of hours of continuing professional education before their licenses can be renewed. The professional associations representing accountants sponsor numerous courses, seminars, group study programs, and other forms of continuing education.

Other qualifications. Previous experience in accounting or auditing can help an applicant get a job. Many colleges offer students the opportunity to gain experience through summer or part-time internship programs conducted by public accounting or business firms. In addition, as many business processes are now automated, practical knowledge of computers and their applications is a great asset for jobseekers in the accounting and auditing fields.

People planning a career in accounting and auditing should have an aptitude for mathematics and be able to analyze, compare, and interpret facts and figures quickly. They must be able to clearly communicate the results of their work to clients and managers both verbally and in writing. Accountants and auditors must be good at working with people, business systems, and computers. At a minimum, accountants and auditors should be familiar with basic accounting and computer software packages. Because financial decisions are made on the basis of their statements and services, accountants and auditors should have high standards of integrity.

Certification and advancement. Professional recognition through certification, or a designation other than the CPA, provides a distinct advantage in the job market. Certification can attest to professional competence in a specialized field of accounting and auditing. Accountants and auditors can seek credentials from a wide variety of professional societies.

The Institute of Management Accountants confers the Certified Management Accountant (CMA) designation upon applicants who complete a bachelor's degree or who attain a minimum score or higher on specified graduate school entrance exams. Applicants must have worked at least 2 years in management accounting, pass a four-part examination, agree to meet continuing education requirements, and comply with standards of professional conduct. The exam covers areas such as financial statement analysis, working-capital policy, capital structure, valuation issues, and risk management.

The Institute of Internal Auditors offers the Certified Internal Auditor (CIA) designation to graduates from accredited colleges

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and universities who have worked for 2 years as internal auditors and have passed a four-part examination. The IIA also offers the designations of Certified in Control Self-Assessment (CCSA), Certified Government Auditing Professional (CGAP), and Certified Financial Services Auditor (CFSA) to those who pass the exams and meet educational and experience requirements.

The ISACA, formerly known as the Information Systems Audit and Control Association, confers the Certified Information Systems Auditor (CISA) designation upon candidates who pass an examination and have 5 years of experience auditing information systems. Information systems experience, financial or operational auditing experience, or related college credit hours can be substituted for up to 2 years information systems auditing, control or security experience.

The Accreditation Council for Accountancy and Taxation, a satellite organization of the National Society of Accountants, confers four designations: Accredited Business Accountant (ABA), Accredited Tax Advisor (ATA), Accredited Tax Preparer (ATP), and Elder Care Specialist (ECS)—on accountants specializing in tax preparation for small and medium-sized businesses. Candidates for the ABA must pass an exam; candidates for the other designations must complete the required coursework and in some cases pass an exam.

The Association of Certified Fraud Examiners offers the Certified Fraud Examiner (CFE) designation for forensic or public accountants involved in fraud prevention, detection, deterrence, and investigation. To obtain the designation, individuals must have a bachelor's degree, 2 years of relevant experience, pass a four-part examination, and abide by a code of professional ethics. Related work experience may be substituted for the educational requirement.

The Association of Government Accountants grants the Certified Government Financial Manager (CGFM) designation for accountants, auditors, and other government financial workers at the Federal, State, and local levels. Candidates must have a minimum of a bachelor's degree, 24 hours of study in financial management, 2 years of experience in government, and passing scores on a series of three exams. The exams cover topics in governmental environment; governmental accounting, financial reporting, and budgeting; and financial management and control.

For those accountants with their CPA, the AICPA offers the option to receive any or all of the Accredited in Business Valuation (ABV), Certified Information Technology Professional (CITP), or Personal Financial Specialist (PFS) designations. CPA's with these designations demonstrate a level of expertise in these areas in which accountants practice ever more frequently. The business valuation designation requires a written exam and the completion of a minimum of 10 business valuation projects that demonstrate a candidate's experience and competence. The technology designation requires the achievement of a set number of points awarded for business technology experience and education. Candidates for the personal financial specialist designation also must achieve a certain level of points based on experience and education, pass a written exam, and submit references.

Many senior corporation executives have a background in accounting, internal auditing, or finance. Beginning public accountants often advance to positions with more responsibility in 1 or 2 years and to senior positions within another few years. Those who excel may become supervisors, managers, or partners; open their own public accounting firm; or transfer to executive positions in management accounting or internal auditing in private firms.

Management accountants often start as cost accountants, junior internal auditors, or trainees for other accounting positions. As they rise through the organization, they may advance to accounting manager, chief cost accountant, budget director, or manager of internal auditing. Some become controllers, treasurers, financial vice presidents, chief financial officers, or corporation presidents.

Public accountants, management accountants, and internal auditors usually have much occupational mobility. Practitioners often shift into management accounting or internal auditing from public accounting, or between internal auditing and management accounting. It is less common for accountants and auditors to move from either management accounting or internal auditing into public accounting. Additionally, because they learn about and review the internal controls of various business units within a company, internal auditors often gain the experience needed to become upper-level managers.

Employment

Accountants and auditors held about 1.3 million jobs in 2006. They worked throughout private industry and government, but 21 percent of wage and salary accountants worked for accounting, tax preparation, bookkeeping, and payroll services firms. Approximately 10 percent of accountants or auditors was self-employed.

Many management accountants, internal auditors, or government accountants and auditors are not CPAs; however, a large number are licensed CPAs. Most accountants and auditors work in urban areas, where public accounting firms and central or regional offices of businesses are concentrated.

Some individuals with backgrounds in accounting and auditing are full-time college and university faculty; others teach part time while working as self-employed accountants or as accountants for private industry or government. (See teachers—postsecondary elsewhere in the *Handbook*.)

Job Outlook

Strong growth of accountants and auditor jobs over the 2006-16 decade is expected to result from stricter accounting and auditing regulations, along with an expanding economy. The best job

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Accountants and auditors	13-2011	1,274,000	1,500,000	226,000	18

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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prospects will be for accountants and auditors who have a college degree or any certification, but especially a CPA.

Employment change. Employment of accountants and auditors is expected to grow by 18 percent between 2006 and 2016, which is faster than the average for all occupations. This occupation will have a very large number of new jobs arise, almost 226,000 over the projections decade. An increase in the number of businesses, changing financial laws, and corporate governance regulations, and increased accountability for protecting an organization's stakeholders will drive growth.

As the economy grows, the number of business establishments will increase, requiring more accountants and auditors to set up books, prepare taxes, and provide management advice. As these businesses grow, the volume and complexity of information reviewed by accountants and auditors regarding costs, expenditures, taxes, and internal controls will expand as well. The globalization of business also has led to more demand for accounting expertise and services related to international trade and accounting rules and international mergers and acquisitions.

An increased need for accountants and auditors also will arise from changes in legislation related to taxes, financial reporting standards, business investments, mergers, and other financial events. As a result of accounting scandals at several large corporations, Congress passed the Sarbanes-Oxley Act of 2002 in an effort to curb corporate accounting fraud. This legislation requires public companies to maintain well-functioning internal controls to ensure the accuracy and reliability of their financial reporting. It also holds the company's chief executive personally responsible for falsely reporting financial information.

These changes are expected to lead to increased scrutiny of company finances and accounting procedures and should create opportunities for accountants and auditors, particularly CPAs, to audit financial records more thoroughly. Management accountants and internal auditors increasingly will also be needed to discover and eliminate fraud before audits, and ensure that important processes and procedures are documented accurately and thoroughly. Also, efforts to make government agencies more efficient and accountable will increase demand for government accountants.

Increased focus on and numbers of financial crimes such as embezzlement, bribery, and securities fraud will increase the demand for forensic accountants to detect illegal financial activity by individuals, companies, and organized crime rings. Computer technology has made these crimes easier to commit, and they are on the rise. At the same time, the development of new computer software and electronic surveillance technology has made tracking down financial criminals easier, thus increasing the ease, and likelihood of, discovery. As success rates of investigations grow, demand for forensic accountants will increase.

The changing role of accountants and auditors also will spur job growth, although this will be slower than in the past because of changes in the law. Federal legislation now prohibits accountants from providing many types of management and consulting services to clients whose books they audit. However, accountants will still be able to advise clients that are not publicly traded companies and those they do not audit.

Also, the increasing popularity of tax preparation firms and computer software will shift accountants away from tax preparation. As computer programs continue to simplify some accounting-related tasks, clerical staff will increasingly handle many routine calculations.

Job prospects. Overall, job opportunities for accountants and auditors should be favorable. Those who earn a CPA should have excellent job prospects. After most States instituted the 150-hour rule for CPAs, enrollment in accounting programs declined. However, enrollment is again growing as more students have become attracted to the profession by the attention from the accounting scandals.

In the aftermath of the accounting scandals, professional certification is even more important to ensure that accountants' credentials and knowledge of ethics are sound. Regardless of specialty, accountants and auditors who have earned professional recognition through certification or licensure should have the best job prospects. Applicants with a master's degree in accounting or a master's degree in business administration with a concentration in accounting also will have an advantage.

Individuals who are proficient in accounting and auditing computer software or have expertise in specialized areas—such as international business, specific industries, or current legislation—may have an advantage in getting some accounting and auditing jobs. In addition, employers increasingly seek applicants with strong interpersonal and communication skills. Many accountants work on teams with others who have different backgrounds, so they must be able to communicate accounting and financial information clearly and concisely. Regardless of qualifications, however, competition will remain keen for the most prestigious jobs in major accounting and business firms.

In addition to openings from job growth, the need to replace accountants and auditors who retire or transfer to other occupations will produce numerous job openings in this large occupation.

Earnings

Median annual earnings of wage and salary accountants and auditors were $54,630 in May 2006. The middle half of the occupation earned between $42,520 and $71,960. The top 10 percent earned more than $94,050, and the bottom 10 percent earned less than $34,470. Median annual earnings in the industries employing the largest numbers of accountants and auditors were as follows:

Accounting, tax preparation, bookkeeping, and payroll services	$57,020
Management of companies and enterprises	55,560
Local government	50,120
Depository credit intermediation	49,380
State government	47,200

According to a salary survey conducted by the National Association of Colleges and Employers, bachelor's degree candidates in accounting received starting offers averaging $46,718 a year in 2006; master's degree candidates in accounting were offered $49,277 initially.

According to a 2007 salary survey conducted by Robert Half International, a staffing services firm specializing in accounting and finance, general accountants and internal auditors with up to 1 year of experience earned between $31,500 and $48,250 a year. Those with 1 to 3 years of experience earned between

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$36,000 and $60,000. Senior accountants and auditors earned between $43,250 and $79,250, managers between $51,250 and $101,500, and directors of accounting and internal auditing between $68,000 and $208,000. The variation in salaries reflects differences in size of firm, location, level of education, and professional credentials.

In the Federal Government, the starting annual salary for junior accountants and auditors was $28,862 in 2007. Candidates who had a superior academic record might start at $35,752, while applicants with a master's degree or 2 years of professional experience usually began at $43,731. Beginning salaries were slightly higher in selected geographic areas where the prevailing local pay level was higher. Accountants employed by the Federal Government in nonsupervisory, supervisory, and managerial positions averaged $78,665 a year in 2007; auditors averaged $83,322.

Wage and salary accountants and auditors usually receive standard benefits, including health and medical insurance, life insurance, a 401(k) plan, and paid annual leave. High-level senior accountants may receive additional benefits, such as the use of a company car and an expense account.

Related Occupations

Accountants and auditors design internal control systems and analyze financial data. Others for whom training in accounting is valuable include budget analysts; cost estimators; loan officers; financial analysts and personal financial advisors; tax examiners, collectors, and revenue agents; bill and account collectors; and bookkeeping, accounting, and auditing clerks. Recently, some accountants have assumed the role of management analysts and are involved in the design, implementation, and maintenance of accounting software systems. Others who perform similar work include computer programmers, computer software engineers, and computer support specialists and systems administrators.

Sources of Additional Information

Information on accredited accounting programs can be obtained from:

➤ AACSB International—Association to Advance Collegiate Schools of Business, 777 South Harbour Island Blvd., Suite 750, Tampa FL 33602-5730.
Internet:
http://www.aacsb.edu/accreditation/AccreditedMembers.asp

Information about careers in certified public accounting and CPA standards and examinations may be obtained from:

➤ American Institute of Certified Public Accountants, 1211 Avenue of the Americas, New York, NY 10036.
Internet: **http://www.aicpa.org**

➤ The Uniform CPA Examination, 1211 Avenue of the Americas, New York, NY 10036. Internet: **http://www.cpa-exam.org**

Information on CPA licensure requirements by State may be obtained from:

➤ National Association of State Boards of Accountancy, 150 Fourth Ave. North, Suite 700, Nashville, TN 37219-2417.
Internet: **http://www.nasba.org**

Information on careers in management accounting and the CMA designation may be obtained from:

➤ Institute of Management Accountants, 10 Paragon Dr., Montvale, NJ 07645-1718. Internet: **http://www.imanet.org**

Information on the Accredited in Accountancy, Accredited Business Accountant, Accredited Tax Advisor, or Accredited Tax Preparer designation may be obtained from:

➤ Accreditation Council for Accountancy and Taxation, 1010 North Fairfax St., Alexandria, VA 22314.-1574.
Internet: **http://www.acatcredentials.org**

Information on the Certified Fraud Examiner designation may be obtained from:

➤ Association of Certified Fraud Examiners, 716 West Ave, Austin, TX 78701-2727.

Information on careers in internal auditing and the CIA designation may be obtained from:

➤ The Institute of Internal Auditors, 247 Maitland Ave., Altamonte Springs, FL 32701-4201.
Internet: **http://www.theiia.org**

Information on careers in information systems auditing and the CISA designation may be obtained from:

➤ ISACA, 3701 Algonquin Rd., Suite 1010, Rolling Meadows, IL 60008. Internet: **http://www.isaca.org**

Information on careers in government accounting and the CGFM designation may be obtained from:

➤ Association of Government Accountants, 2208 Mount Vernon Ave., Alexandria, VA 22301.
Internet: **http://www.agacgfm.org**

Information on obtaining positions as an accountant or auditor with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result. For advice on how to find and apply for Federal jobs, see the *Occupational Outlook Quarterly* article "How to get a job in the Federal Government," online at:
http://www.bls.gov/opub/ooq/2004/summer/art01.pdf

Appraisers and Assessors of Real Estate

(O*NET 13-2021.00, 13-2021.01, 13-2021.02)

Significant Points

- Appraisers and assessors must meet licensing and/or certification requirements which vary by State, but generally include specific training requirements, a period of work as a trainee, and passing one or more examinations.
- More than 3 out of 10 were self-employed; salaried assessors worked primarily in local government, while salaried appraisers worked mainly for real estate firms.
- Employment is expected to grow faster than average.

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Nature of the Work

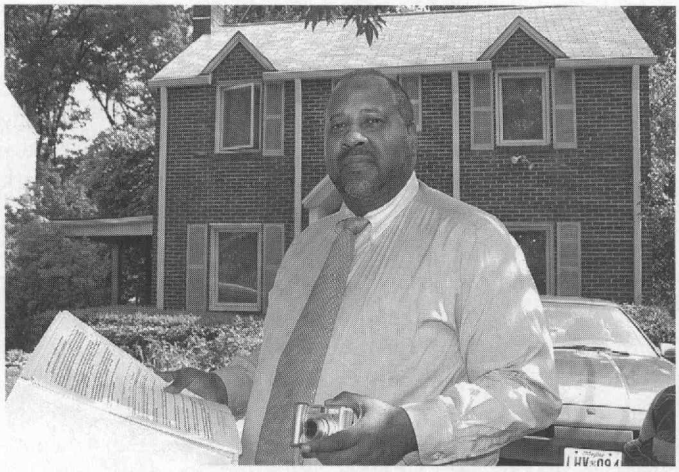
Appraisers and assessors of real estate estimate the value of property for a variety of purposes, such as to assess property tax, to confirm adequate collateral for mortgages, to confirm or help set a good sales price, to settle an estate, or to aid in a divorce settlement. They often specialize in appraising or assessing a certain type of real estate such as residential buildings or commercial properties. However, they may be called on to estimate the value of any type of real estate, ranging from farmland to a major shopping center. Assessors estimate the value of all properties in a locality for property tax purposes whereas appraisers appraise properties one at a time.

Valuations of all types of real property are conducted using similar methods, regardless of the type of property or who employs the appraiser or assessor. Appraisers and assessors work in localities they are familiar with so they have knowledge of any environmental or other concerns that may affect the value of a property. They note any unique characteristics of the property and of the surrounding area, such as a specific architectural style of a building or a major highway located next to the parcel. They also take into account additional aspects of a property like the condition of the foundation and roof of a building or any renovations that may have been done. Additionally, they may take pictures to document a certain room or feature, in addition to taking pictures of the exterior of the building. After visiting the property, the appraiser or assessor will estimate the fair value of the property by taking into consideration such things as comparable home sales, lease records, location, view, previous appraisals, and income potential.

Appraisers and assessors write detailed reports on their research and observations, stating the value of the parcel as well as the precise reasoning and methodology of how they arrived at the estimate. Writing reports has become faster and easier through the use of laptop computers, allowing them to access data and write at least some of the report on-site. Another computer technology that has affected this occupation is the electronic map of a given jurisdiction and its respective property distribution. Appraisers and assessors use these maps to obtain an accurate perspective on the property and buildings surrounding a property. Digital photos also are commonly used to document the physical appearance of a building or land at the time of appraisal.

Appraisers have independent clients and focus solely on valuing one property at a time. They primarily work on a client-to-client basis, and make appraisals for a variety of reasons. Real property appraisers often specialize by the type of real estate they appraise, such as residential properties, golf courses, or strip malls. In general, commercial appraisers have the ability to appraise any real property but may specialize only in property used for commercial purposes, such as stores or hotels. Residential appraisers focus on appraising homes or other residences and only value those that house 1 to 4 families. Other appraisers have a general practice and value any type of real property.

Assessors predominately work for local governments and are responsible for valuing properties for property tax assessment purposes. Most senior assessors are appointed or elected to their position. Unlike appraisers, assessors often value entire



Appraisers and assessors of real estate may use photographs to help analyze a property.

neighborhoods using mass appraisal techniques to value all the homes in a local neighborhood at one time. Although they do not usually focus on a single property they may assess a single property if the property owner challenges the assessment. They may use a computer-programmed automated valuation model specifically developed for their assigned jurisdictions. In most jurisdictions the entire community must be revalued annually or every few years. Depending on the size of the jurisdiction and the number of staff in an assessor's office, an appraisal firm, often called a revaluation firm, may do much of the work of valuing the properties in the jurisdiction. These results are then officially certified by the assessor.

When properties are reassessed, assessors issue notices of assessments and taxes that each property owner must pay. Assessors must be current on tax assessment procedures and must be able to defend the accuracy of their property assessments, either to the owner directly or at a public hearing, since assessors also are responsible for dealing with tax payers who want to contest their assigned property taxes. Assessors also keep a database of every parcel in their jurisdiction labeling the property owner, issued tax assessment, and size of the property, as well as property maps of the jurisdiction that detail the property distribution of the jurisdiction.

Work environment. Appraisers and assessors spend much of their time researching and writing reports. However, with the advancement of computers and other technologies, such as wireless Internet, time spent in the office has decreased as research can now be done in less time or on-site or at home. Records that once required a visit to a courthouse or city hall often can be found online. This has especially affected self-employed appraisers, often called independent fee appraisers, who make their own office hours, allowing them to spend much more time on-site doing research and less time in their office. Time spent on-site versus in the office also depends on the specialty. For example, residential appraisers tend to spend less time on office work than commercial appraisers, who could spend up to several weeks at one site analyzing documents and writing reports. Appraisers who work for private institutions generally spend most of their time inside the office, making on-site visits when necessary. Appraisers and assessors usually conduct on-site appraisal work alone.

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Independent fee appraisers tend to work more than a standard 40 hour work week, in addition to working evenings and weekends writing reports. On-site visits usually occur during daylight hours, and according to the client's schedule. Assessors and privately employed appraisers, on the other hand, usually work a standard 40-hour work week. Occasionally they work an evening or Saturday, to speak with a concerned tax payer, for example. More than 10 percent of appraisers and assessors worked part time in 2006.

Most independent fee appraisers' offices are relatively small, consisting of either just themselves or a small staff. However, private institutions such as banks and mortgage broker offices may employ several appraisers in one office. The size of the office employing assessors depends on the size of the local government; in some States assessments are by counties whereas in other States assessments are made by municipalities or other local governments. Therefore a county assessor's office probably would employ more assessors than a small town, which may only employ a single assessor.

Training, Other Qualifications, and Advancement

The requirements to become a fully qualified appraiser or assessor are complex and vary by State and, sometimes, by the value or type of property. In general, both appraisers and assessors must be licensed or certified requirements. Prospective appraisers and assessors should check with their State to determine the specific requirements.

Education and training. Currently, no formal degree requirements exist to become an appraiser or assessor. However, starting in 2008 all appraisers and assessors who need a license will be required to have a bachelor's degree or the equivalent in credit hours. Most practicing appraisers and assessors have at least a bachelor's degree, sometimes in a related field such as economics, finance, or real estate. The specific training courses necessary, however, are not commonly available as part of most bachelor's programs and must be taken separately, usually at community colleges or through appraisal- or assessor-related organizations.

Obtaining on-the-job training is also an essential part of becoming a fully qualified assessor or appraiser and is required for obtaining a license or certification. In the past, many appraisers obtained experience working in financial institutions or real estate offices. However, the current trend is for candidates to get their initial experience in the office of an independent fee appraiser.

Assessors tend to start out in an assessor's office that is willing to provide on-the-job training; smaller municipalities are often unable to provide this experience. An alternate source of experience for aspiring assessors is through a revaluation firm.

Licensure. Federal law requires that any appraiser involved in a Federally-related transaction with a loan amount of $250,000 or more must have a State-issued license or certification. Licensing requirements vary by State, but they typically include specific training requirements, a period of work as a trainee, and passing one or more examinations.

All States also are required to conform, at a minimum, to the licensing and certification requirements established by the Appraisal Qualifications Board (AQB) of The Appraisal Foundation, a Congressionally-authorized organization dedicated to this purpose. The AQB requires that appraisers pass a Foundation-approved State examination as well as meet education and experience requirements. The education requirements include a course and examination on the Uniform Standards of Professional Appraisal Practice (USPAP) set forth by the Appraisal Standards Board (ASB) of The Appraisal Foundation.

Although Federal standards do not require an appraisal license for appraisers valuing real property with loan amounts of less than $250,000, many States require any practicing appraiser to obtain a license or certification, regardless of transaction value. In addition, many States have different, more stringent requirements for licensure than those set forth by the AQB.

One State-issued appraiser license is the State Certified General Real Property Appraiser license, which allows an appraiser to value any type of real property regardless of value. Another State-issued license is the State Certified Residential Real Property Appraiser license, which allows an appraiser to value any residential unit of 1 to 4 families regardless of value, and any other type of property with a value of up to $250,000. An additional license, which is recommended or used by many States, is the State Licensed Residential Appraiser license, which permits its holder to appraise commercial property up to $250,000 and 1 to 4 family residential units worth up to $1 million.

Starting in 2008, several new educational requirements enacted by the AQB for State Licensure will take effect. For the State Licensed Residential Appraiser license, which is available or required in a majority of States, the candidate must obtain 150 qualifying education hours, 15 of which must be on the National USPAP Course, and at least 2,000 hours of on-the-job training. For the State Certified Residential Appraiser and the State Certified General Appraiser licenses, the required education hours are much more rigorous, at 200 hours and 300 hours, respectively. In addition, all candidates must pass an examination. Also starting in 2008, individuals wishing to become State certified appraisers will need to either possess a college degree or complete a specified number of hours in certain college-level courses. Requirements vary by State so candidates should contact their appropriate State agency to see what specific criteria are mandated.

In many States, those working on their appraiser requirements for licensure are classified as a "trainee." Some of these States have their own training programs while others use the AQB's recommended program. The program varies by State but usually requires at least 75 hours of specified appraisal education, 15 of which must be on the National USPAP Course, before applying for a trainee position. The number of additional courses a trainee must take depends on the State requirements for the license they wish to obtain.

The qualifications necessary to become an assessor also vary by State, but often are similar to the requirements for becoming an appraiser. In most States, the State assessor board sets education and experience requirements that must be met to obtain a certificate to practice as an assessor. A few States have no State-wide requirements; rather, standards are set by each locality.

States mandating assessor certification have requirements similar to those for appraisers. Some States also have more

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than one level of certification. All candidates must attend State-approved schools and facilities and take basic appraisal courses. Although appraisers value one property at a time while an assessor typically values many, the methods and techniques used are the same. As a result, the main courses assessors take are the same as those for appraisers. In addition, there usually is a set number of on-the-job hours that must be completed and all assessor candidates in these States must pass an examination. In some States, assessors must abide by the USPAP standards and are strongly encouraged to follow these standards in most other States. For those States not requiring certificates, the hiring assessor's office usually will require the candidate to take basic appraisal courses, complete on-the-job training, and accrue a sufficient number of work hours to meet the requirements for appraisal licenses or certificates. Many assessors also possess a State appraisal license.

For both appraisers and assessors, continuing education is necessary to maintain a license or certification. The minimum continuing education requirement for appraisers, as set by the AQB, is 14 hours per year. Appraisers must also complete a 7 hour National USPAP Update Course every 2 years. Some States have further requirements. Continuing education can be obtained in any State-approved school or facility, as well as recognized seminars and conferences held by associations or related organizations. Assessors also must fulfill a continuing education requirement in most States, but the amount varies by State.

Other qualifications. Appraisers and assessors must possess good analytical skills, mathematical skills, and the ability to pay attention to detail. They also must work well with people and alone. Since they will work with the public, politeness is a must, along with the ability to listen and thoroughly answer any questions about their work.

Certification and advancement. Many appraisers and assessors choose to become a designated member of a regional or nationally recognized appraiser or assessor association. Designations are particularly useful in States or types of practices where a license is not mandatory or a certificate has not been established. Designations are another way for appraisers or assessors to establish themselves in the profession, and are recognizable credentials to show employers and potential clients a higher level of education and experience. Obtaining a designation usually requires 5 to 10 years of training and experience, often more than the minimum licensing requirements of the AQB. Many appraisers and assessors start with getting their license or certificate and work their way up to a designation. Many appraisal associations have a membership category specifically for trainees, who then can receive full membership after licensure. Since States differ greatly on the requirements to become an assessor, licensure is not necessarily required for membership or designations; however, the imposed designation qualifications tend to be very stringent.

Advancement within the occupation comes with experience. The higher the level of appraiser licensure, for example, the higher the fees an independent fee appraiser may charge. Staying in one particular region or focusing on one type of appraising specialty also will help to establish one's business, reputation, and expertise. Assessors often have a career progression within their office, starting as a trainee and eventually ending up appointed or elected as a senior appraiser or supervisor.

Employment

In 2006, appraisers and assessors of real estate held about 101,000 jobs. Most appraisers and assessors work full-time. More than 3 out of 10 were self-employed; virtually all were appraisers. Employment was concentrated in areas with high levels of real estate activity, such as major metropolitan areas. Assessors are more uniformly spread throughout the country than appraisers because every locality has at least one assessor.

About 25 percent worked in local government; almost all were assessors. Another 30 percent, mainly appraisers, worked for real estate firms, while a relatively small number worked for financial institutions, such as banks and credit unions.

Job Outlook

Employment of appraisers and assessors of real estate is expected to grow faster than average for all occupations. Job opportunities should be favorable for those who meet licensing qualifications and have several years of experience.

Employment change. Employment of appraisers and assessors of real estate is expected to grow by 17 percent, which is faster than the average for all occupations, over the 2006-16 decade. Employment of appraisers will grow with increases in the level of real estate activity. Additionally, more appraisers will be hired to help with litigation claims, probate cases, foreclosures, business valuations, and divorce settlements. Employment of assessors will grow with the increase in the amount of real property to be assessed. However, employment will be held down to a certain extent by productivity increases brought about by the increased use of computers and other technologies, which make for faster valuations and allow appraisers to take on more customers and each assessor to assess more properties.

Independent fee appraisers will see the strongest growth because banks and other financial institutions increasingly are contracting work out to them to make loan appraisals on a case-by-case basis. The increased use of automated valuation models to conduct appraisals for loan and mortgage purposes also will shift work out of the financial sector. Additionally, more work is being done in service sectors of the economy, such as in the legal and accounting sectors.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Appraisers and assessors of real estate	13-2021	101,000	118,000	17,000	17

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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Job prospects. Employment opportunities should be best in areas with active real estate markets, such as the East and West coasts and major cities and suburbs. Although opportunities for established appraisers and assessors are expected to be good in these areas, those wishing to enter the occupation may have difficulty locating a trainee position because traditional sources of training positions increasingly are prefer not to take on new trainees.

The cyclical nature of the real estate market also will have a direct effect on the job prospects of appraisers, especially those who appraise residential properties. In times of recession, fewer people buy or sell real estate, causing a decrease in the demand for appraisers. As a result, opportunities will be best for appraisers who are able to switch specialties and appraise different types of properties.

Because assessors are needed in every local or State jurisdiction to make assessments for property tax purposes regardless of the state of the local economy, assessors are less affected by economic and real estate market fluctuations than are appraisers. In addition to growth openings, there should be numerous openings because of the need to replace the many appraisers and assessors who are expected to retire or decrease their working hours over the projection period.

Earnings

Median annual earnings of wage and salary appraisers and assessors of real estate were $44,460 in May 2006. The middle 50 percent earned between $32,080 and $64,460. The lowest 10 percent earned less than $24,000 and the highest 10 percent earned more than $86,140. Median annual earnings of those working for local governments were $40,650. Median annual earnings of those working for real estate firms were $44,120. Generally, those working in urban and coastal regions earned more than those working in rural locations.

Related Occupations

Other occupations that involve the inspection of real estate include construction and building inspectors, real estate brokers and sales agents, and urban and regional planners. Appraisers and assessors must also place a monetary value on properties. Occupations also involved in valuing items include claims adjusters, appraisers, examiners and investigators, as well as cost estimators.

Sources of Additional Information

For more information on licensure requirements, contact:

➤ The Appraisal Foundation, 1155 15th Street NW., Suite 1111, Washington, DC 20005.
Internet: **http://www.appraisalfoundation.org**

For more information on individual State licensure requirements, contact:

➤ Appraisal Subcommittee (ASC), 2000 K Street, NW., Suite 310; Washington, D.C. 20006. Internet: **http://www.asc.gov**

For more information on appraisers of real estate, contact:

➤ American Society of Appraisers, 555 Herndon Pkwy., Suite 125, Herndon, VA 20170. Internet: **http://www.appraisers.org**

➤ Appraisal Institute, 550 W. Van Buren St., Suite 1000, Chicago, IL 60607. Internet: **http://www.appraisalinstitute.org**

➤ National Association of Independent Fee Appraisers, 401 N. Michigan Ave. Suite 2200, Chicago, IL 60611.

➤ National Association of Real Estate Appraisers, 1224 North Nokomis NE., Alexandria, MN 56308.

For more information on assessors of real estate, contact:

➤ International Association of Assessing Officers, 314 W 10th St., Kansas City, MO 64105. Internet: **http://www.iaao.org**

Budget Analysts

(O*NET 13-2031.00)

Significant Points

- Good job opportunities are expected.
- A bachelor's degree generally is the minimum educational requirement, but many employers prefer or require a master's degree.
- About 44 percent of all budget analysts work in Federal, State, and local governments.

Nature of the Work

Efficiently distributing limited financial resources is an important challenge in all organizations. In most large and complex organizations, this task would be nearly impossible without budget analysts. These workers develop, analyze, and execute budgets, which are used to allocate current resources and estimate future financial needs.

Budget analysts work in private industry, nonprofit organizations, and the public sector. In private sector firms, a budget analyst's main responsibility is to examine the budget and seek new ways to improve efficiency and increase profits. In nonprofit and governmental organizations, which usually are not concerned with profits, analysts try to find the most efficient way to distribute funds and other resources among various departments and programs.

In recent years, as limited funding has led to downsizing and restructuring throughout private industry and government, budget analysts have seen their role broadened. In addition to managing an organization's budget, they are often involved in program performance evaluation, policy analysis, and the drafting of budget-related legislation. At times, they also conduct training sessions for company or government agency personnel regarding new budget procedures.

At the beginning of each budget cycle, managers and department heads submit proposed operational and financial plans to budget analysts for review. These plans outline the organization's programs, estimate the financial needs of these programs, and propose funding initiatives to meet those needs.

Analysts examine budget estimates and proposals for completeness; accuracy; and conformance with established procedures, regulations, and organizational objectives. Sometimes they employ cost-benefit analyses to review financial requests, assess program tradeoffs, and explore alternative funding methods. They also examine past budgets and research economic and financial developments that affect the organization's spending.

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This process enables analysts to evaluate proposals in terms of the organization's priorities and financial resources.

After the initial review process, budget analysts consolidate individual departmental budgets into operating and capital budget summaries. These summaries contain statements that argue for or against funding requests. Budget summaries are then submitted to senior management, or, as is often the case in State and local governments, to appointed or elected officials. Budget analysts then help the chief operating officer, agency head, or other top managers analyze the proposed plan and devise possible alternatives if the projected results are unsatisfactory. The final decision to approve the budget usually is made by the organization head in a private firm, or, in government, by elected officials such as State legislators.

Throughout the year, analysts periodically monitor the budget by reviewing reports and accounting records to determine if allocated funds have been spent as specified. If deviations appear between the approved budget and actual performance, budget analysts may write a report explaining the variations and recommending revised procedures. To avoid or alleviate deficits, budget analysts may recommend program cuts or a reallocation of excess funds. They also inform program managers and others within the organization of the status and availability of funds in different accounts. Before new programs begin or existing programs are changed, a budget analyst must assess the program's efficiency and effectiveness. Analysts also may be involved in long-range financial planning.

Financial software has greatly increased the amount of data and information that budget analysts can consider. The analysts also make extensive use of spreadsheet, database, and word-processing software.

Work environment. Budget analysts usually work in a comfortable office setting. They spend the majority of their time working independently, compiling and analyzing data and preparing budget proposals. Some budget analysts travel to obtain budget details first-hand or to personally verify funding allocation.

The schedules of budget analysts vary throughout the budget cycle, and many are required to work additional hours during the initial development, midyear reviews, and final reviews of budgets. In 2006, about 65 percent of budget analysts worked between 35 and 44 hours per week, while about 17 percent worked more than 44 hours per week, and about 10 percent worked fewer than 35 hours per week. The pressures of deadlines and tight work schedules can be stressful.

Training, Other Qualifications, and Advancement

A bachelor's degree usually is the minimum educational requirement for budget analyst jobs, but some organizations prefer or require a master's degree. Entry-level budget analysts usually begin with limited responsibilities but can be promoted to intermediate-level positions within 1 to 2 years, and to senior positions with additional experience.

Education and training. Private firms and government agencies generally require budget analysts to have at least a bachelor's degree, but many prefer or require a master's degree. Within the Federal Government, a bachelor's degree in any field is sufficient for an entry-level budget analyst position, but master's degrees are preferred. State and local governments have varying requirements, but a bachelor's degree in one of many areas, including accounting, finance, business, public administration, economics, statistics, political science, or sociology, is a common requirement. Many States, especially larger, more urban States, require a master's degree. Many government employers prefer candidates with strong analytic and policy analysis backgrounds that may be obtained through such majors as political science, economics, public administration, or public finance.

Some firms prefer candidates with a degree in business because business courses emphasize both quantitative and analytical skills, which are equally important in budget analysis. Sometimes a degree in a field closely related to that of the employing industry or organization, such as engineering, may be preferred. Because developing a budget requires strong numerical and analytical skills, courses in statistics or accounting are helpful, regardless of the prospective budget analyst's major field of study. Occasionally, budget-related or finance-related work experience can be substituted for formal education.

Entry-level budget analysts in the Federal Government receive extensive on-the-job and classroom training. In most other organizations, however, budget analysts usually learn the job by working through one complete budget cycle. During the cycle, which typically lasts 1 year, analysts become familiar with the various steps involved in the budgeting process. Many budget analysts also take professional development classes throughout their careers.

Other qualifications. Budget analysts must abide by strict ethical standards. Integrity, objectivity, and confidentiality are all essential when dealing with financial information, and budget analysts must avoid any personal conflicts of interest. Most budget analysts also need mathematical skills and should be able to use software packages, including spreadsheet, database,



Almost half of all budget analysts work in Federal, State, and local governments.

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Budget analysts	13-2031	62,000	66,000	4,400	7

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

data-mining, financial analysis, and graphics programs. Strong oral and written communication skills also are essential, because budget analysts must prepare, present, and defend budget proposals to decision makers. In addition, budget analysts must be able to work under strict time constraints.

Certification and advancement. Entry-level budget analysts usually begin with limited responsibilities, working under close supervision. Capable entry-level analysts can be promoted to intermediate-level positions within 1 to 2 years, and to senior positions with additional experience. Because of the importance and high visibility of their jobs, senior budget analysts are prime candidates for promotion to management positions in various parts of their organizations, or with other organizations with which they have worked.

Some government budget analysts employed at the Federal, State, or local level may earn the Certified Government Financial Manager designation granted by the Association of Government Accountants. Other government financial officers also may earn this designation. To do so, candidates must have a minimum of a bachelor's degree, 24 credit hours of study in financial management, and 2 years of government work experience in financial management. They also must pass a series of three exams that cover topics on the government; governmental accounting, financial reporting, and budgeting; and financial management and control. To maintain the designation, individuals must complete 80 hours of continuing professional education every 2 years.

Employment

Budget analysts held 62,000 jobs throughout private industry and government in 2006. Federal, State, and local governments are major employers, accounting for 44 percent of budget analyst jobs. Many other budget analysts worked in manufacturing; financial services; management services; professional, scientific, and technical services; and schools.

Job Outlook

Budget analyst jobs are expected to increase about as fast as the average, and job prospects should generally be good, especially for applicants with a master's degree.

Employment change. Employment of budget analysts is expected to increase by 7 percent between 2006 and 2016, which is about as fast as the average for all occupations. Employment growth will be driven by the continuing demand for sound financial analysis in both the public and the private sectors.

As businesses and other organizations become more complex and specialized, budget planning and financial control will demand greater attention. In recent years, computer applications used in budget analysis have become increasingly sophisticated, allowing more data to be processed in a shorter time. As a result, budget analysts have seen their workload broadened, and they are expected to produce more than they have in the past.

Budget analysts will also continue to acquire new responsibilities in other areas, such as policy analysis and performance evaluation, which make them more important to their organizations.

Job prospects. Good job prospects are expected for budget analysts over the 2006-16 decade. Job openings should result from employment growth and from the need to replace workers who retire or leave the occupation for other reasons. Candidates with a master's degree are expected to have the best opportunities. Familiarity with spreadsheet, database, data-mining, financial-analysis, and graphics software packages also should enhance a jobseeker's prospects.

Because of the importance of financial analysis, and because financial and budget reports must be completed during all phases of the business cycle, budget analysts usually are less vulnerable to layoffs than many other types of workers.

Earnings

Salaries of budget analysts vary widely by experience, education, and employer. Median annual earnings of wage-and-salary budget analysts in May 2006 were $61,430. The middle 50 percent earned between $49,070 and $77,000. The lowest 10 percent earned less than $40,070, and the highest 10 percent earned more than $93,080. Median annual earnings in the industries employing the largest numbers of budget analysts were:

Management of companies and enterprises	$65,280
Federal Government	65,240
State government	55,990
Local government	55,120
Colleges, universities, and professional schools	51,270

In the Federal Government, budget analysts usually start as trainees, earning $28,862 or $35,752 per year in 2007. Candidates with a master's degree began at $43,731. Beginning salaries were slightly higher in areas where the prevailing local pay level was higher. The average annual salary in 2007 for budget analysts employed by the Federal Government was $71,267.

According to a 2007 survey conducted by Robert Half International—a staffing services firm specializing in accounting and finance—starting salaries of financial, budget, treasury, and cost analysts in small companies ranged from $32,750 to $39,250. In large companies, starting salaries ranged from $36,500 to $43,750.

Related Occupations

Budget analysts analyze and interpret financial data, make recommendations for the future, and assist in the implementation

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of new ideas and financial strategies. Other workers who have similar duties include accountants and auditors, cost estimators, economists, financial analysts and personal financial advisors, financial managers, loan officers, and management analysts.

Sources of Additional Information

Information about career opportunities as a budget analyst may be available from your State or local employment service.

Information on careers and certification in government financial management may be obtained from:

➤ Association of Government Accountants, 2208 Mount Vernon Ave., Alexandria, VA 22301.
Internet: **http://www.agacgfm.org**

Information on careers in budget analysis at the State government level may be obtained from:

➤ National Association of State Budget Officers, Hall of the States Building, Suite 642, 444 North Capitol St.NW., Washington, DC 20001. Internet: **http://www.nasbo.org**

Information on obtaining budget analyst positions with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850. This number is not toll free, and charges may result. For advice on how to find and apply for Federal jobs, see the *Occupational Outlook Quarterly* article "How to get a job in the Federal Government," online at:
http://www.bls.gov/opub/ooq/2004/summer/art01.pdf

Claims Adjusters, Appraisers, Examiners, and Investigators

(O*NET 13-1031.00, 13-1031.01, 13-1031.02, 13-1032.00)

Significant Points

- Employment is expected to increase moderately, but many job openings will arise from the need to replace workers who retire or leave for other reasons.
- Licensing and continuing education requirements vary by State.
- College graduates have the best opportunities; competition will be keen for jobs as investigators because this occupation attracts many qualified people.

Nature of the Work

Individuals and businesses purchase insurance policies to protect against monetary losses. In the event of a loss, policyholders submit claims, or requests for payment, seeking compensation for their loss. Adjusters, appraisers, examiners, and investigators deal with those claims. They work primarily for property and casualty insurance companies, for whom they handle a wide variety of claims alleging property damage, liability, or bodily injury. Their main role is to investigate the claims, negotiate settlements, and authorize payments to claimants, all the while mindful not to violate the claimant's rights under Federal and State privacy laws. They must determine whether the customer's insurance policy covers the loss and how much of the loss should be paid to the claimant. Although many adjusters, appraisers, examiners, and investigators have overlapping functions and may even perform the same tasks, the insurance industry generally assigns specific roles to each of these claims workers.

Adjusters plan and schedule the work required to process a claim. They might, for example, handle the claim filed after an automobile accident or after a storm damages a customer's home. Adjusters investigate claims by interviewing the claimant and witnesses, consulting police and hospital records, and inspecting property damage to determine the extent of the company's liability. Adjusters may consult with other professionals, such as accountants, architects, construction workers, engineers, lawyers, and physicians, who can offer a more expert evaluation of a claim. The information gathered—including photographs and statements, either written, audio, or on video tape—is set down in a report that is then used to evaluate the associated claim. When the policyholder's claim is legitimate, the claims adjuster negotiates with the claimant and settles the claim. When claims are contested, adjusters will work with attorneys and expert witnesses to defend the insurer's position.

Many companies centralize claims adjustment in a claims center, where the cost of repair is estimated and a check is issued immediately. More complex cases, usually involving bodily injury, are referred to senior adjusters. Some adjusters work with multiple types of insurance, but most specialize in homeowner claims, business losses, automotive damage, or workers' compensation.

Claimants can opt not to rely on the services of their insurance company's adjuster and may instead choose to hire a public adjuster. These workers assist clients in preparing and presenting claims to insurance companies and in trying to negotiate a fair settlement. They perform the same services as adjusters who work directly for companies, but they work in the best interests of the client, rather than the insurance company. Independent adjusters are also self-employed and are typically hired by an insurance carrier on a freelance or contractual basis. Insurance companies may choose to hire independent adjusters in lieu of hiring them as regular employees.

Claims examiners within property and casualty insurance firms may have duties similar to those of an adjuster, but often their primary job is to review the claims submitted in order to ensure that proper guidelines have been followed. They may assist adjusters with complex and complicated claims or when a disaster suddenly greatly increases the volume of claims.

Most claims examiners work for life or health insurance companies. In health insurance companies, examiners review health-related claims to see whether costs are reasonable given the diagnosis. Examiners use guides with information on the average period of disability, the expected treatments, and the average hospital stay for the various ailments. Examiners check claim applications for completeness and accuracy, interview medical specialists, and consult policy files to verify the information reported in a claim. Examiners will then either au-

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thorize the appropriate payment or refer the claim to an investigator for a more thorough review. Claims examiners usually specialize in group or individual insurance plans and in hospital, dental, or prescription drug claims.

In life insurance, claims examiners review the causes of death, particularly in the case of an accident, because most life insurance policies pay additional benefits if a death is accidental. Claims examiners also may review new applications for life insurance to make sure that the applicants have no serious illnesses that would make them a high risk to insure and thus disqualify them from obtaining insurance.

Another occupation that plays an important role in the accurate settlement of claims is that of the *appraiser*, whose role is to estimate the cost or value of an insured item. The majority of appraisers employed by insurance companies and independent adjusting firms are *auto damage appraisers*. These appraisers inspect damaged vehicles after an accident and estimate the cost of repairs. This information is then relayed to the adjuster, who incorporates the appraisal into the settlement. Auto damage appraisers are valued by insurance companies because they can provide an unbiased judgment of repair costs. Otherwise, the companies would have to rely on auto mechanics' estimates, which might be unreasonably high.

Many claims adjusters and auto damage appraisers are equipped with laptop computers from which they can download the necessary forms and files from insurance company databases. They also may use digital cameras, which allow photographs of the damage to be sent to the company via the Internet. Many also input information about the damage directly into their computers, where software programs produce estimates of damage on standard forms. These new technologies allow for faster and more efficient processing of claims.

When adjusters or examiners suspect fraud, they refer the claim to an investigator. *Insurance investigators* in an insurance company's special investigative unit handle claims in which the company suspects fraudulent or criminal activity, such as arson, falsified workers' disability claims, staged accidents, or unnecessary medical treatments. The severity of insurance fraud cases can vary greatly, from claimants simply overstating the damage to a vehicle to complicated fraud rings responsible for many claimants and supported by dishonest doctors, lawyers, and even insurance personnel.

Investigators usually start with a database search to obtain background information on claimants and witnesses. Investigators can access certain personal information and identify Social Security numbers, aliases, driver's license numbers, addresses, phone numbers, criminal records, and past claims histories to establish whether a claimant has ever attempted insurance fraud. Then, investigators may visit claimants and witnesses to obtain a recorded statement, take photographs, and inspect facilities, such as doctors' offices, to determine whether the doctors have a proper license. Investigators often consult with legal counsel and can be expert witnesses in court cases.

Often, investigators also perform surveillance work. For example, in a case involving fraudulent workers' compensation claims, an investigator may covertly observe the claimant for several days or even weeks. If the investigator observes the subject performing an activity that is ruled out by injuries stated in a workers' compensation claim, the investigator will take video or still photographs to document the activity and report it to the insurance company.

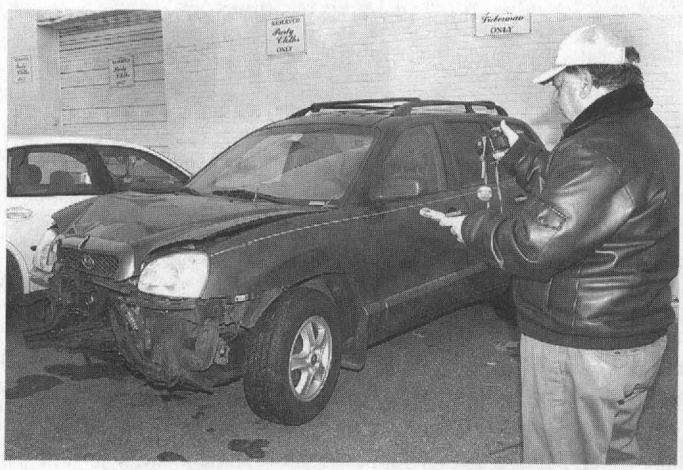
Work environment. Working environments of claims adjusters, appraisers, examiners, and investigators vary greatly. Many claims adjusters and auto damage appraisers, often work outside the office, inspecting damaged buildings and automobiles. Adjusters who inspect damaged buildings must be wary of potential hazards such as collapsed roofs and floors, as well as weakened structures.

Adjusters report to the office every morning to get their assignments, while others simply call in from home and spend their days traveling to claim sites. New technology, such as laptop computers and cellular telephones, is making telecommuting easier for claims adjusters and auto damage appraisers. Many adjusters work inside their office only a few hours a week, while others conduct their business entirely out of their home and automobile. Occasionally, experienced adjusters must be away from home for days—for example, when they travel to the scene of a disaster such as a tornado, hurricane, or flood—to work with local adjusters and government officials.

Most claims examiners employed by life and health insurance companies work a standard 5-day, 40-hour week in a typical office environment. In contrast, adjusters often must arrange their work schedules to accommodate evening and weekend appointments with clients. This sometimes results in adjusters working irregular schedules or more than 40 hours a week, especially when they have a lot of claims to investigate. Adjusters often are called to work in the event of emergencies and may have to work 50 or 60 hours a week until all claims are resolved.

Appraisers spend much of their time offsite at automotive body shops estimating vehicle damage costs. The remaining time may be spent working in the office. Many independent appraisers work from home, which has been made easier through new computer software valuation programs. Auto damage appraisers typically work regular hours, and rarely work on the weekends. Self employed appraisers also have the flexibility to make their own hours, as many appraisals are done by appointment.

Some days, investigators will spend all day in the office, searching databases, making telephone calls, and writing re-



Auto damage appraisers may document the state of the automobile in their loss estimation reports.

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ports. Other times, they may be away, performing surveillance activities or interviewing witnesses. Some of the work can involve confrontation with claimants and others involved in a case, so the job can be stressful and dangerous. Insurance investigators often work irregular hours because of the need to conduct surveillance and contact people who are not available during normal working hours. Early morning, evening, and weekend work is common.

Training, Other Qualifications, and Advancement

Training and entry requirements vary widely for claims adjusters, appraisers, examiners, and investigators. Although many in these occupations do not have a college degree, most companies prefer to hire college graduates.

Education and training. There are no formal education requirements for any of these occupations, and a high school degree is typically the minimal requirement needed to obtain employment. However, most employers prefer to hire college graduates or people who have some postsecondary training.

No specific college major is recommended, but a variety of degrees can be an asset. For example, a claims adjuster who has a business or an accounting background might be suited to specialize in claims of financial loss due to strikes, breakdowns of equipment, or damage to merchandise. College training in architecture or engineering is helpful in adjusting industrial claims, such as those involving damage from fires or other accidents. A legal background can be beneficial to someone handling workers' compensation and product liability cases. A medical background is useful for those examiners working on medical and life insurance claims.

The following tabulation presents the 2006 percent distribution of all claims adjusters, appraisers, examiners, and investigators by their highest level of educational attainment:

	Percent
High school graduate or less	22
Some college, no degree	17
Associate's degree	12
Bachelor's degree	45
Graduate degree	5

For auto damage appraiser jobs, firms typically prefer to hire people who also have experience as an estimator or as a manager of an auto body repair shop. Also, an appraiser must know how to repair vehicles in order to identify and estimate damage. Technical skills are essential. While auto damage appraisers do not require a college education, most companies prefer to hire persons with formal training. Many vocational colleges offer 2-year programs in auto body repair and teach students how to estimate the costs to repair damaged vehicles.

For investigator jobs, most insurance companies prefer to hire people trained as law enforcement officers, private investigators, claims adjusters, or examiners because these workers have good interviewing and interrogation skills.

Beginning claims adjusters, appraisers, examiners, and investigators work on small claims under the supervision of an experienced workers. As they learn more about claims investigation and settlement, they are assigned larger, more complex claims. Trainees take on more responsibility as they demonstrate competence in handling assignments and progress in their coursework. Auto damage appraisers may also receive some on-the-job training, which may last several months. They may work under close supervision while estimating damage costs until their employer decides they are ready to perform estimates on their own.

Continuing education is very important for claims adjusters, appraisers, examiners, and investigators because Federal and State laws and court decisions affect how claims are handled or who is covered by insurance policies. Also, examiners working on life and health claims must be familiar with new medical procedures and prescription drugs. Examiners working on auto claims must be familiar with new car models and repair techniques.

Many companies offer training sessions to inform their employees of industry changes, and a number of schools and associations give courses and seminars on various topics having to with claims. Correspondence courses via the Internet are also making long-distance learning possible.

Licensure. Licensing requirements for claims adjusters, appraisers, examiners, and investigators vary by State. Some States have few requirements, while others require either the completion of prelicensing education, a satisfactory score on a licensing exam, or both. Earning a voluntary professional designation can sometimes substitute for completing an exam. In some States, claims adjusters employed by insurance companies can work under the company license and need not become licensed themselves. Public adjusters may need to meet separate or additional requirements. For example, some States require public adjusters to file a surety bond.

Some States that require licensing also require a certain number of continuing education credits per year in order to renew the license. Workers can fulfill their continuing education requirements by attending classes or workshops, by writing articles for claims publications, or by giving lectures and presentations.

Other qualifications. Claims adjusters, appraisers, and examiners often work closely with claimants, witnesses, and other insurance professionals, so they must be able to communicate effectively with others. Knowledge of computer applications also is very helpful. In addition, a valid driver's license and a good driving record are required for workers who must travel on the job. Some companies require applicants to pass a series of written aptitude tests designed to measure their communication, analytical, and general mathematical skills.

When hiring investigators, employers look for individuals who have ingenuity and who are persistent and assertive. Investigators should not be afraid of confrontation, should communicate well, and should be able to think on their feet. Good interviewing and interrogation skills also are important and usually are acquired in earlier careers in law enforcement.

Certification and advancement. Employees who demonstrate competence in claims work or administrative skills may be promoted to more responsible managerial or administrative jobs. Similarly, claims investigators may rise to become supervisor or manager of the investigations department. Once they achieve expertise, many choose to start their own independent adjusting or auto damage appraising firms.

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Claims adjusters, appraisers, examiners, and investigators	13-1030	319,000	347,000	29,000	9
Claims adjusters, examiners, and investigators	13-1031	305,000	332,000	27,000	9
Insurance appraisers, auto damage	13-1032	13,000	15,000	1,700	13

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

Numerous examiners and adjusters also earn professional certifications and designations to demonstrate their professional expertise. Although requirements for these designations vary, many entail at least 5 to 10 years of experience in the claims field and the successful completion of an examination; in addition, a certain number of continuing education credits must be earned each year to retain the designation.

Employment

Adjusters, appraisers, examiners, and investigators held about 319,000 jobs in 2006. Insurance carriers, agencies, brokerages, and related industries, such as private claims adjusting companies, employed more than 7 out of 10 claims adjusters, appraisers, examiners, and investigators. Less than 5 percent of these jobs were held by auto damage insurance appraisers. Relatively few adjusters, appraisers, examiners, and investigators were self-employed.

Job Outlook

Despite average job growth, keen competition for claims adjuster, appraiser, examiner, and investigator jobs is expected, especially in smaller, privately owned companies. For claims adjusters, opportunities will be best for those who have a license and related experience. For appraiser jobs, opportunities will be best for those who have some vocational training and previous auto body repair experience.

Employment change. Employment of claims adjusters, appraisers, examiners, and investigators is expected to grow by 9 percent over the 2006-16 decade, which is about as fast as the average for all occupations. Many insurance carriers are downsizing their claims staff in an effort to contain costs. Larger companies are relying more on customer service representatives in call centers, for example, to handle the recording of the necessary details of the claim, allowing adjusters to spend more of their time investigating claims. New technology is reducing the amount of time it takes for an adjuster to complete a claim, thereby increasing the number of claims that one adjuster can handle. The demand for these jobs will increase regardless of new technology, however, because they cannot be easily automated. Additionally, a growing need for adjusters, appraisers, examiners, and investigators will stem from more insurance policies being sold to accommodate a growing population. Further, as the elderly population increases, there will be a greater need for health care, resulting in more health insurance claims.

Employment of insurance investigators is not expected to grow significantly, despite the expected increase in the number of claims in litigation and the number and complexity of insurance fraud cases. Technology, such as the Internet, reduces the amount of time it takes investigators to perform background checks, allowing them to handle more cases. However, adjusters are still needed to contact policyholders, inspect damaged property, and consult with experts.

As with claims adjusters, examiners, and investigators, employment of auto damage appraisers should grow by 13 percent, which is also about as fast as the average for all occupations. Insurance companies and agents continue to sell growing numbers of auto insurance policies, leading to more claims being filed that require the attention of an auto damage appraiser. The work of auto damage appraisers is also not easily automated because most appraisals require an onsite inspection, but new technology is making them somewhat more efficient. In addition, some insurance companies are opening their own repair facilities, which may reduce the need for auto damage appraisers.

Job prospects. Numerous job openings also will result from job growth and the need to replace workers who transfer to other occupations or leave the labor force. Overall, college graduates and those with previous related experience will have the best opportunities for jobs as claims adjusters, examiners, and investigators. Auto damage appraisers with related vocational training and auto body shop experience will also have good prospects. People entering these occupations with no previous experience or formal training may find more opportunities working directly for an insurance carrier.

Competition for investigator jobs will remain keen because the occupation attracts many qualified people, including retirees from law enforcement, the military, and experienced claims adjusters and examiners who choose to get an investigator license. Heightened media and public awareness of insurance fraud also may attract qualified candidates to this occupation.

Earnings

Earnings of claims adjusters, appraisers, examiners, and investigators vary significantly. Median annual earnings were $50,660 in May 2006 for wage and salary workers. The middle 50 percent earned between $38,520 and $65,210. The lowest 10 percent earned less than $30,890, and the highest 10 percent earned more than $79,170.

Median annual earnings of wage and salary auto damage insurance appraisers were $49,180 in May 2006. The middle 50 percent earned between $40,870 and $57,830. The lowest 10 percent earned less than $34,220, and the highest 10 percent earned more than $68,420.

Many claims adjusters, especially those who work for insurance companies, receive additional bonuses or benefits as part of their job. Adjusters often are furnished a laptop computer, a cellular telephone, and a company car, or are reimbursed for the use of their own vehicle for business purposes.

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Related Occupations

Property-casualty insurance adjusters and life and health insurance examiners must determine the validity of a claim and negotiate a settlement. They also are responsible for determining how much to reimburse the client. Occupations similar to those of claims adjusters, appraisers, examiners, and investigators include cost estimators; bill and account collectors; medical records and health information technicians; billing and posting clerks; credit authorizers, checkers, and clerks; and bookkeeping, accounting, and auditing clerks.

In determining the validity of a claim, insurance adjusters must inspect the damage in order to assess the magnitude of the loss. Workers who perform similar duties include fire inspectors and investigators and construction and building inspectors.

To ensure that company practices and procedures are followed, property and casualty examiners review insurance claims to which a claims adjuster has already proposed a settlement. Others in occupations that review documents for accuracy and compliance with a given set of rules and regulations are tax examiners, collectors, and revenue agents, as well as accountants and auditors.

Like automotive body and related repairers and automotive service technicians and mechanics, auto damage appraisers must be familiar with the structure and functions of various automobiles and their parts. They must also be familiar with techniques to estimate value, which is a requirement similar to appraisers and assessors of real estate.

Insurance investigators detect and investigate fraudulent claims and criminal activity. Their work is similar to that of private detectives and investigators.

Sources of Additional Information

General information about a career as a claims adjuster, appraiser, examiner, or investigator is available from the home offices of many insurance companies.

Information about licensing requirements for claims adjusters may be obtained from the department of insurance in each State.

Information about the property-casualty insurance field can be obtained by contacting:

➤ Insurance Information Institute, 110 William St., New York, NY 10038. Internet: **http://www.iii.org**

Information about the health insurance field can be obtained by contacting:

➤ National Association of Health Underwriters, 2000 North 14th Street, Suite 450, Arlington, VA 22201.
Internet: **http://www.nahu.org**

For information about professional designation and training programs, contact any of the following organizations:

➤ American College, 270 South Bryn Mawr Ave., Bryn Mawr, PA 19010–2196.
Internet: **http://www.theamericancollege.edu**

➤ American Institute for Chartered Property Casualty Underwriters and the Insurance Institute of America, 720 Providence Rd., P.O. Box 3016, Malvern, PA 19355–0716.
Internet: **http://www.aicpcu.org**

➤ International Claim Association, 1255 23rd St. NW., Washington, DC 20037. Internet: **http://www.claim.org**

➤ LOMA, 2300 Windy Ridge Parkway, Suite 600, Atlanta, GA 30339-8443. Internet: **http://www.loma.org**

Information on careers in auto damage appraising can be obtained from:

➤ Independent Automotive Damage Appraisers Association, P.O. Box 12291 Columbus, GA 31917–2291.
Internet: **http://www.iada.org**

Cost Estimators

(O*NET 13-1051.00)

Significant Points

- About 62 percent of cost estimators work in the construction industry, and another 15 percent are employed in manufacturing industries.
- Voluntary certification can be valuable to cost estimators; some individual employers may require professional certification for employment.
- Very good employment opportunities are expected.
- In construction and manufacturing, job prospects should be best for those with industry work experience and a bachelor's degree in a related field.

Nature of the Work

Accurately forecasting the scope, cost, and duration of future projects is vital to the survival of any business. Cost estimators develop the cost information that business owners or managers need to make a bid for a contract or to decide on the profitability of a proposed new product or project. They also determine which endeavors are making a profit.

Regardless of the industry in which they work, estimators compile and analyze data on all of the factors that can influence costs, such as materials, labor, location, duration of the project, and special machinery requirements, including computer hardware and software. Job duties vary widely depending on the type and size of the project.

The methods for estimating costs can differ greatly by industry. On a construction project, for example, the estimating process begins with the decision to submit a bid. After reviewing various preliminary drawings and specifications, the estimator visits the site of the proposed project. The estimator needs to gather information on access to the site; the availability of electricity, water, and other services; and surface topography and drainage. The estimator usually records this information in a signed report that is included in the final project estimate.

After the site visit, the estimator determines the quantity of materials and labor the firm will need to furnish. This process, called the quantity survey or "takeoff," involves completing standard estimating forms, filling in dimensions, numbers of units, and other information. A cost estimator working for a general contractor, for example, estimates the costs of all of the items that the contractor must provide. Although subcontractors estimate their costs as part of their own bidding process, the general contractor's cost estimator often analyzes bids made by

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subcontractors. Also during the takeoff process, the estimator must make decisions concerning equipment needs, the sequence of operations, the size of the crew required, and physical constraints at the site. Allowances for wasted materials, inclement weather, shipping delays, and other factors that may increase costs also must be incorporated in the estimate.

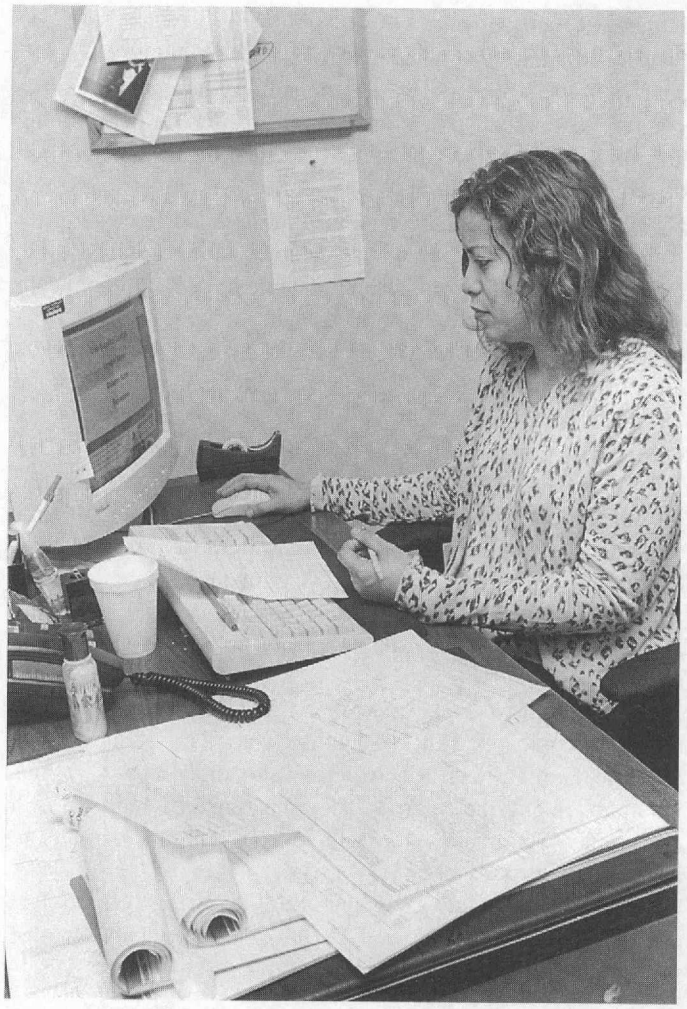
After completing the quantity surveys, the estimator prepares a cost summary for the entire project, including the costs of labor, equipment, materials, subcontracts, overhead, taxes, insurance, markup, and any other costs that may affect the project. The chief estimator then prepares the bid proposal for submission to the owner.

Construction cost estimators also may be employed by the project's architect or owner to estimate costs or to track actual costs relative to bid specifications as the project develops. Estimators often specialize in large construction companies employing more than one estimator. For example, one may estimate only electrical work and another may concentrate on excavation, concrete, and forms.

In manufacturing and other firms, cost estimators usually are assigned to the engineering, cost, or pricing department. The estimator's goal is to accurately estimate the costs associated with making products. The job may begin when management requests an estimate of the costs associated with a major redesign of an existing product or the development of a new product or production process. When estimating the cost of developing a new product, for example, the estimator works with engineers, first reviewing blueprints or conceptual drawings to determine the machining operations, tools, gauges, and materials that would be required. The estimator then prepares a parts list and determines whether it is more efficient to produce or to purchase the parts. To do this, the estimator asks for price information from potential suppliers. The next step is to determine the cost of manufacturing each component of the product. Some high-technology products require a considerable amount of computer programming during the design phase. The cost of software development is one of the fastest growing and most difficult activities to estimate. As a result, some cost estimators now specialize in estimating only computer software development and related costs.

The cost estimator then prepares time-phase charts and learning curves. Time-phase charts indicate the time required for tool design and fabrication, tool "debugging"—finding and correcting all problems—manufacturing of parts, assembly, and testing. Learning curves graphically represent the rate at which the performance of workers producing parts for the new product improves with practice. These curves are commonly called "cost reduction" curves, because many problems—such as engineering changes, rework, shortages of parts, and lack of operator skills—diminish as the number of units produced increases, resulting in lower unit costs.

Using all of this information, the estimator then calculates the standard labor hours necessary to produce a specified number of units. Standard labor hours are then converted to dollar values, to which are added factors for waste, overhead, and profit to yield the unit cost in dollars. The estimator then compares the cost of purchasing parts with the firm's estimated cost of manufacturing them to determine which is cheaper.



Cost estimators analyze data on factors that influence costs to determine whether a contract is viable.

Computers play an integral role in cost estimation because estimating often involves complex mathematical calculations and requires advanced mathematical techniques. For example, to undertake a parametric analysis (a process used to estimate costs per unit based on square footage or other specific requirements of a project), cost estimators use a computer database containing information on the costs and conditions of many other similar projects. Although computers cannot be used for the entire estimating process, they can relieve estimators of much of the drudgery associated with routine, repetitive, and time-consuming calculations. New and improved cost estimating software has lead to more efficient computations, leaving estimators greater time to visit and analyze projects.

Operations research, production control, cost, and price analysts who work for government agencies may do significant amounts of cost estimating in the course of their regular duties. In addition, the duties of construction managers may include estimating costs. (For more information, see the statements on operations research analysts and construction managers elsewhere in the *Handbook*.)

Work environment. Although estimators spend most of their time in a comfortable office, construction estimators also visit worksites that can be dusty, dirty, and occasionally hazardous. Likewise, estimators in manufacturing spend time on the fac-

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tory floor, where it also can be noisy and dirty. In some industries, frequent travel between a firm's headquarters and its subsidiaries or subcontractors may be required.

Estimators normally work a 40-hour week, but overtime is common. Cost estimators often work under pressure and stress, especially when facing bid deadlines. Inaccurate estimating can cause a firm to lose a bid or to lose money on a job that was not accurately estimated.

Training, Other Qualifications, and Advancement

Job entry requirements for cost estimators vary by industry. In the construction industry, employers increasingly prefer to hire cost estimators with a bachelor's degree in construction science, construction management, or building science, although it is also possible for experienced construction workers to become cost estimators. Employers in manufacturing usually prefer someone with a bachelor's degree in mathematics, statistics, or engineering.

Education and training. In the construction industry, employers increasingly prefer individuals with a degree in building science, construction management, or construction science, all of which usually include several courses in cost estimating. Most construction estimators also have considerable construction experience, gained through work in the industry, internships, or cooperative education programs. Applicants with a thorough knowledge of construction materials, costs, and procedures in areas ranging from heavy construction to electrical work, plumbing systems, or masonry work have a competitive edge.

In manufacturing industries, employers prefer to hire individuals with a degree in engineering, physical science, operations research, mathematics, or statistics or in accounting, finance, business, economics, or a related subject. In most industries, experience in quantitative techniques is important.

Many colleges and universities include cost estimating as part of bachelor's and associate degree curriculums in civil engineering, industrial engineering, and construction management or construction engineering technology. In addition, cost estimating is often part of master's degree programs in construction science or construction management. Organizations representing cost estimators, such as the Association for the Advancement of Cost Engineering (AACE International) and the Society of Cost Estimating and Analysis (SCEA), also sponsor educational and professional development programs. These programs help students, estimators-in-training, and experienced estimators learn about changes affecting the profession. Specialized courses and programs in cost-estimating techniques and procedures also are offered by many technical schools, community colleges, and universities.

Estimators also receive much training on the job because every company has its own way of handling estimates. Working with an experienced estimator, newcomers become familiar with each step in the process. Those with no experience reading construction specifications or blueprints first learn that aspect of the work. Then they may accompany an experienced estimator to the construction site or shop floor, where they observe the work being done, take measurements, or perform other routine tasks. As they become more knowledgeable, estimators learn how to tabulate quantities and dimensions from drawings and how to select the appropriate prices for materials.

Other qualifications. Cost estimators should have an aptitude for mathematics; be able to quickly analyze, compare, and interpret detailed but sometimes poorly defined information; and be able to make sound and accurate judgments based on this information. The ability to focus on details, while analyzing and overcoming larger obstacles, is essential. Assertiveness and self-confidence in presenting and supporting conclusions are also important, as are strong communications and interpersonal skills, because estimators may work as part of a team alongside managers, owners, engineers, and design professionals. Cost estimators also need knowledge of computers, including word-processing and spreadsheet packages. In some instances, familiarity with special estimation software or programming skills also may be required.

Certification and advancement. Voluntary certification can be valuable to cost estimators because it provides professional recognition of the estimator's competence and experience. In some instances, individual employers may even require professional certification for employment. Both AACE International and SCEA administer certification programs. To become certified, estimators usually must have between 2 and 8 years of estimating experience and must pass an examination. In addition, certification requirements may include the publication of at least one article or paper in the field.

For most estimators, advancement takes the form of higher pay and prestige. Some move into management positions, such as project manager for a construction firm or manager of the industrial engineering department for a manufacturer. Others may go into business for themselves as consultants, providing estimating services for a fee to government or to construction or manufacturing firms.

Employment

Cost estimators held about 221,000 jobs in 2006. About 62 percent of estimators were in the construction industry, and another 15 percent were employed in manufacturing. The remainder worked in a wide range of other industries.

Cost estimators work throughout the country, usually in or near major industrial, commercial, and government centers and in cities and suburban areas undergoing rapid change or development.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Cost estimators	13-1051	221,000	262,000	41,000	19

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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Job Outlook

Employment of cost estimators is expected to grow faster than average. Very good employment opportunities are expected.

Employment change. Employment is expected to grow by 19 percent between 2006 and 2016, which is faster than the average for all occupations. Employment growth in the construction industry, in which most cost estimators are employed, will account for the majority of new jobs in this occupation. Construction and repair of highways, streets, bridges, subway systems, airports, water and sewage systems, and electric power plants and transmission lines will stimulate demand for many more cost estimators. Similarly, increasing population and business growth will result in more construction of residential homes, office buildings, shopping malls, hospitals, schools, restaurants, and other structures that require cost estimators. As the population ages, the demand for nursing and extended-care facilities will also increase. The growing complexity of construction projects will also boost demand for cost estimators as a larger number of workers specialize in a particular area of construction.

Job prospects. Because there are no formal bachelor's degree programs in cost estimating, some employers have difficulty recruiting qualified cost estimators, resulting in very good employment opportunities. Job prospects in construction should be best for those who have a degree in construction science, construction management, or building science plus practical experience in the various phases of construction or in a specialty craft area. For cost estimating jobs in manufacturing, those with degrees in mathematics, statistics, engineering, accounting, business administration, or economics should have the best job prospects.

In addition to job openings arising from employment growth, many additional openings should result annually from the need to replace workers who transfer to other occupations due to the sometimes stressful nature of the work, or who retire or leave the occupation for other reasons.

Employment of cost estimators, like that of many other construction workers, is sensitive to the fluctuations of the economy. Workers in these trades may experience periods of unemployment when the overall level of construction falls. On the other hand, shortages of these workers may occur in some areas during peak periods of building activity.

Earnings

Salaries of cost estimators vary widely by experience, education, size of firm, and industry. Median annual earnings of wage and salary cost estimators in May 2006 were $52,940. The middle 50 percent earned between $40,320 and $69,460. The lowest 10 percent earned less than $31,600, and the highest 10 percent earned more than $88,310. Median annual earnings in the industries employing the largest numbers of cost estimators were:

Nonresidential building construction	$60,870
Building equipment contractors	56,170
Foundation, structure, and building exterior contractors	52,520
Residential building construction	52,460
Building finishing contractors	51,610

According to a July 2007 salary survey by the National Association of Colleges and Employers, those with bachelor's degrees in construction science/management received job offers averaging $46,930 a year.

Related Occupations

Other workers who quantitatively analyze information include accountants and auditors; budget analysts; claims adjusters, appraisers, examiners, and investigators; economists; financial analysts and personal financial advisors; insurance underwriters; loan officers; market and survey researchers; and operations research analysts. In addition, the duties of industrial production managers and construction managers also may involve analyzing costs.

Sources of Additional Information

Information about career opportunities, certification, educational programs, and cost-estimating techniques may be obtained from the following organizations:

➤ Association for the Advancement of Cost Engineering (AACE International), 209 Prairie Ave., Suite 100, Morgantown, WV 26501. Internet: **http://www.aacei.org**

➤ Society of Cost Estimating and Analysis, 527 Maple Ave. East, Suite 301, Vienna, VA 22180.
Internet: **http://www.sceaonline.net**

Financial Analysts and Personal Financial Advisors

(O*NET 13-2051.00, 13-2052.00)

Significant Points

- Good interpersonal skills and an aptitude for working with numbers are among the most important qualifications for financial analysts and personal financial advisors.
- Keen competition is anticipated for these highly paid positions, despite rapid job growth; those who have earned a professional designation or an MBA are expected to have the best opportunities.
- Almost one third of personal financial advisors are self-employed.

Nature of the Work

Financial analysts and personal financial advisors provide analysis and guidance to businesses and individuals in making investment decisions. Both types of specialists gather financial information, analyze it, and make recommendations. However, their job duties differ because of the type of investment information they provide and their relationships with investors.

Financial analysts assess the economic performance of companies and industries for firms and institutions with money to invest. Also called *securities analysts* and *investment analysts*, they work for investment banks, insurance companies, mutual and pension funds, securities firms, the business media, and

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other businesses, helping them make investment decisions or recommendations. Financial analysts read company financial statements and analyze commodity prices, sales, costs, expenses, and tax rates in order to determine a company's value and to project its future earnings. They often meet with company officials to gain a better insight into the firm's prospects and to determine its managerial effectiveness.

Financial analysts can usually be divided into two basic types: those who work on the *buy side* and those who work on the *sell side*. Analysts on the buy side work for companies that have a great deal of money to invest. These companies, called institutional investors, include mutual funds, hedge funds, insurance companies , independent money managers, and charitable organizations, such as universities and hospitals, with large endowments. Buy side financial analysts work to devise investment strategies for a company's portfolio. Conversely, analysts on the sell side help securities dealers to sell their products. These companies include investment banks and securities firms. The business media also hire financial advisors that are supposed to be impartial, and as such occupy a role somewhere in the middle.

Financial analysts generally focus on a specific industry, region, or type of product. For example, an analyst may focus on the utilities industry, Latin America, or the options market. Firms with larger research departments may divide the work even further so their analysts can maintain sharp focus. Within their areas of specialty, analysts assess current trends in business practices, products, and competition. They must keep abreast of new regulations or policies that may affect the investments they are watching and monitor the economy to determine its effect on earnings. Some experienced analysts called *portfolio managers* supervise a team of analysts and help guide a company in selecting the right mix of products, industries, and regions for their investment portfolio. Others who manage mutual funds or hedge funds perform a similar role and are generally called *fund managers*. Other analysts, called *risk managers*, analyze portfolio decisions and determine how to maximize profits through diversification and hedging.

Some financial analysts, called *ratings analysts*, evaluate the ability of companies or governments that issue bonds to repay their debts. On the basis of their evaluation, a management team assigns a rating to a company's or government's bonds, which helps them to decide whether to include them in a portfolio. Other financial analysts perform budget, cost, and credit analysis as part of their responsibilities.

Financial analysts use spreadsheet and statistical software packages to analyze financial data, spot trends, and develop forecasts. Analysts also use the data they find to measure the financial risks associated with making a particular investment decision. On the basis of their results, they write reports and make presentations, usually with recommendations to buy or sell particular investments.

Personal financial advisors assess the financial needs of individuals. Advisors use their knowledge of investments, tax laws, and insurance to recommend financial options to individuals. They help them to identify and plan to meet short- and long-term goals. Planners help clients with retirement and estate planning, funding the college education of children, and general investment choices. Many also provide tax advice or sell life insurance. Although most planners offer advice on a wide range of topics, some specialize in areas such as retirement and estate planning or risk management.



Personal financial advisors often meet with their clients to help them make investment decisions.

Personal financial advisors usually work with many clients, and they often must find their own customers. Many personal financial advisors spend a great deal of their time making sales calls and marketing their services. Many advisors also meet potential clients by giving seminars or lectures or through business and social contacts. Finding clients and building a customer base is one of the most important aspects of becoming successful as a financial advisor.

Financial advisors begin work with a client by setting up a consultation. This is usually an in-person meeting where the advisor obtains as much information as possible about the client's finances and goals. The advisor then develops a comprehensive financial plan that identifies problem areas, makes recommendations for improvement, and selects appropriate investments compatible with the client's goals, attitude toward risk, and expectation or need for a return on the investment. Sometimes this plan is written, but more often it is in the form of verbal advice. Advisors sometimes meet with accountants or legal professionals for help.

Financial advisors usually meet with established clients at least once a year to update them on potential investments and adjust their financial plan to any life changes—such as marriage, disability, or retirement. Financial advisors also answer clients' questions regarding changes in benefit plans or the consequences of a change in their jobs or careers. Financial planners must educate their clients about risks and various possible scenarios so that the clients don't harbor unrealistic expectations.

Most personal financial advisors buy and sell financial products, such as securities and life insurance. Fees and commissions from the purchase and sale of securities and life insurance

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plans are one of the major sources of income for most personal financial advisors.

Private bankers or *wealth managers* are personal financial advisors who work for people who have a lot of money to invest. While most investors are simply saving for retirement or their children's college education, these individuals have large amounts of capital and often use the returns on their investments as a major source of income. Because they have so much capital, these clients resemble institutional investors and approach investing differently from the general public. Private bankers manage portfolios for these individuals using the resources of the bank, including teams of financial analysts, accountants, lawyers, and other professionals. Private bankers sell these services to wealthy individuals, generally spending most of their time working with a small number of clients. Unlike most personal financial advisors, private bankers meet with their clients regularly to keep them abreast of financial matters; they often have the responsibility of directly managing customers' finances.

Work environment. Financial analysts and personal financial advisors usually work in offices or their own homes. Financial analysts may work long hours, travel frequently to visit companies or potential investors, and face the pressure of deadlines. Much of their research must be done after office hours because their days are filled with telephone calls and meetings.

Personal financial advisors usually work standard business hours, but they also schedule meetings with clients in the evenings or on weekends. Many also teach evening classes or hold seminars in order to bring in more clients. Some personal financial advisors spend a fair amount of their time traveling, usually to attend conferences and training sessions, but also occasionally to visit clients.

Private bankers also generally work during standard business hours, but because they work so closely with their clients, they may have to be available outside normal hours upon request.

Training, Other Qualifications, and Advancement

Financial analysts and most personal financial advisors must have a bachelor's degree. Many also earn a master's degree in finance or business administration or get professional designations. Because the field is so specialized, workers frequently attend training and seminars to learn the latest developments.

Education and training. A bachelor's or graduate degree is required for financial analysts and is strongly preferred for personal financial advisors. Most companies require financial analysts to have at least a bachelor's degree in finance, business administration, accounting, statistics, or economics. Coursework in statistics, economics, and business is required, and knowledge of accounting policies and procedures, corporate budgeting, and financial analysis methods is recommended. A master's degree in finance or business administration also is desirable. Also useful are advanced courses in options pricing or bond valuation and knowledge of risk management.

Employers usually do not require a specific field of study for personal financial advisors, but a bachelor's degree in accounting, finance, economics, business, mathematics, or law provides good preparation for the occupation. Courses in investments, taxes, estate planning, and risk management are also helpful. Programs in financial planning are becoming more widely available in colleges and universities.

Licensure. The Financial Industry Regulatory Authority (FINRA) is the main licensing organization for the securities industry. Depending on an individual's work, many different licenses may be required, although buy side analysts are less likely to need licenses. The majority of these licenses require sponsorship by an employer, so companies do not expect individuals to have these licenses before starting a job. Experienced workers who change jobs will need to have their licenses renewed with the new company.

Almost all personal financial advisors need the Series 7 and Series 63 or 66 licenses. These licenses give their holders the right to act as a registered representative of a securities firm and to give financial advice. Because the Series 7 license requires sponsorship, self-employed personal financial advisors must maintain a relationship with a large securities firm. This relationship allows them to act as representatives of that firm in the buying and selling of securities.

If personal financial advisors choose to sell insurance, they need additional licenses issued by State licensing boards.

Other qualifications. Strong math, analytical, and problem-solving skills are essential qualifications for financial analysts. Good communication skills also are necessary, because these workers must present complex financial concepts and strategies. Self-confidence, maturity, and the ability to work independently are important as well. Financial analysts must be detail-oriented, motivated to seek out obscure information, and familiar with the workings of the economy, tax laws, and money markets. Financial analysts should also be very comfortable with computers, as they are frequently used in doing work. Although much of the software they use is proprietary, they must be comfortable working with spreadsheets and statistical packages.

Personal financial advisors need many of the same skills, but they must emphasize customer service. They need strong sales ability, including the ability to make customers feel comfortable. It is important for them to be able to present financial concepts to clients in easy-to-understand language. Personal financial advisors must also be able to interact casually with people from many different backgrounds. Some advisors have experience in a related occupation, such as accountant, auditor, insurance sales agent, or broker.

Private bankers work directly with wealthy individuals, so they must be polished and refined. They should be able to interact comfortably with people who may be well-known in the community.

Certification and advancement. Although not required, certifications can enhance professional standing and is recommended by many employers.

Financial analysts can earn the Chartered Financial Analyst (CFA) designation, sponsored by the CFA Institute. To qualify for this designation, applicants need a bachelor's degree and four years of work experience in a related field and must pass three examinations. The first exam is administered twice per year, while the second and third are administered annually. These exams cover subjects such as accounting, economics, securities analysis, financial markets and instruments, corporate finance,

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asset valuation, and portfolio management. Increasingly, personal financial advisors, sometimes called wealth managers, working with wealthy individuals have the CFA designation.

Personal financial advisors may obtain the Certified Financial Planner credential, often referred to as CFP. This certification, issued by the Certified Financial Planner Board of Standards, requires 3 years of relevant experience; the completion of education requirements, including a bachelor's degree; passing a comprehensive examination, and adherence to a code of ethics. The exams test the candidate's knowledge of the financial planning process, insurance and risk management, employee benefits planning, taxes and retirement planning, and investment and estate planning. Candidates are also required to have a working knowledge of debt management, planning liability, emergency fund reserves, and statistical modeling.

Financial analysts advance by moving into positions where they are responsible for larger or more important products. They may also supervise teams of financial analysts. Eventually, they may become portfolio managers or fund managers, directing the investment portfolios of their companies or funds.

Personal financial advisors have several different paths to advancement. Many accumulate clients and manage more assets. Those who work in firms may move into managerial positions. Others may choose to open their own branch offices for large securities firms and serve as independent registered representatives for those firms. In most cases, employees of established firms are barred from keeping their clients after they leave a firm, so an advisor who leaves a firm to establish a new business must find new customers. Many newly independent personal financial advisors sell their services to family and friends, hoping to win business through referrals.

Employment

Financial analysts and personal financial advisors held 397,000 jobs in 2006, of which financial analysts held 221,000. Many financial analysts work at the headquarters of large financial institutions, most of which are based in New York City or other major financial centers. More than 2 out of 5 financial analysts worked in the finance and insurance industries, including securities and commodity brokers, banks and credit institutions, and insurance carriers. Others worked throughout private industry and government.

Personal financial advisors held 176,000 jobs in 2006. Jobs were spread throughout the country. Much like financial analysts, more than half worked in finance and insurance industries, including securities and commodity brokers, banks, insurance carriers, and financial investment firms. However, about 30 percent of personal financial advisors were self-employed, operating small investment advisory firms, usually in urban areas.

Job Outlook

Employment of financial analysts and personal financial advisors is expected to grow much faster than the average for all occupations. Growth will be especially strong for personal financial advisors, which are projected to be among the 10 fastest growing occupations. Despite strong job growth, keen competition will continue for these well paid jobs, especially for new entrants.

Employment change. As the level of investment increases, overall employment of financial analysts and personal financial advisors is expected to increase by 37 percent during the 2006-16 decade, which is much faster than the average for all occupations.

Personal financial advisors are projected to grow by 41 percent, which is much faster than the average for all occupations, over the projections decade. Growing numbers of advisors will be needed to assist the millions of workers expected to retire in the next 10 years. As more members of the large baby boom generation reach their peak years of retirement savings, personal investments are expected to increase and more people will seek the help of experts. Many companies also have replaced traditional pension plans with retirement savings programs, so more individuals are managing their own retirements than in the past, creating jobs for advisors. In addition, people are living longer and must plan to finance longer retirements.

Deregulation of the financial services industry also is expected to continue to spur demand for personal financial advisors in the banking industry. In recent years, banks and insurance companies have been allowed to expand into the securities industry. Many firms are adding investment advice to their services and are expected to increase their hiring of personal financial advisors.

Employment of financial analysts is expected to grow by 34 percent between 2006 and 2016, which is also much faster than the average for all occupations. Primary factors for this growth are increasing complexity of investments and growth in the industry. As the number and type of mutual funds and the amount of assets invested in these funds increase, mutual fund companies will need more financial analysts to research and recommend investments.

Job prospects. Despite overall employment growth, competition for jobs is expected to be keen in these high-paying occupations. Growth in the industry will create many new positions, but there are still far more people who would like to enter the occupation. For those aspiring to financial analyst jobs, a strong academic background is absolutely essential. Good grades in

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Financial analysts and personal financial advisors	—	397,000	544,000	147,000	37
Financial analysts	13-2051	221,000	295,000	75,000	34
Personal financial advisors	13-2052	176,000	248,000	72,000	41

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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courses such as finance, accounting, and economics are very important to employers. An MBA or certification is helpful in maintaining employment.

Personal financial advisors will also face competition, as many other services compete for customers. Many individuals enter the field by working for a bank or full-service brokerage. Most independent advisories fail within the first year of business, making self-employment challenging. Because the occupation requires sales, people who have strong selling skills will ultimately be most successful. A college degree and certification can lend credibility.

Earnings. Median annual earnings, including bonuses, of wage and salary financial analysts were $66,590 in May 2006. The middle 50 percent earned between $50,700 and $90,690. The lowest 10 percent earned less than $40,340, and the highest 10 percent earned more than $130,130. The bonuses that many financial analysts receive in addition to their salary can be a significant part of their total earnings. Usually, the bonus is based on how well their predictions compare to the actual performance of a benchmark investment.

Median annual earnings of wage and salary personal financial advisors were $66,120 in May 2006. The middle 50 percent earned between $44,130 and $114,260. The lowest 10 percent earned less than $32,340 and the highest 10 percent earned more than $145,600. Personal financial advisors who work for financial services firms are generally paid a salary plus bonus. Advisors who work for financial investment or planning firms or who are self-employed either charge hourly fees for their services or opt to earn their money through fees on stock and insurance purchases. Advisors generally receive commissions for financial products they sell, in addition to charging a fee. Those who manage a client's assets may charge a percentage of those assets. Earnings of self-employed workers are not included in the medians given here.

Related Occupations

Other jobs requiring expertise in finance and investment or in the sale of financial products include accountants and auditors, financial managers, insurance sales agents real estate brokers and sales agents, budget analysts, insurance underwriters, actuaries, and securities, commodities, and financial services sales agents.

Sources of Additional Information

For general information on securities industry employment, contact:

➤ Financial Industry Regulatory Authority (FINRA), 1735 K St.NW., Washington, DC 20006.
Internet: **http://www.finra.org**

➤ Securities Industry and Financial Markets Association, 120 Broadway, 35th Floor, New York, NY 10271.
Internet: **http://www.sifma.org**

For information on financial analyst careers, contact:

➤ American Academy of Financial Management, 2 Canal St., Suite 2317, New Orleans, LA 70130.
Internet: **http://www.aafm.org**

➤ CFA Institute, P.O. Box 3668, 560 Ray C. Hunt Dr., Charlottesville, VA 22903.
Internet: **http://www.cfainstitute.org**

For information on personal financial advisor careers, contact:

➤ Certified Financial Planner Board of Standards, Inc., 1670 Broadway, Suite 600, Denver, CO 80202.
Internet: **http://www.cfp.net**

➤ Financial Planning Association, 4100 E. Mississippi Ave., Suite 400, Denver, CO 80246-3053.
Internet: **http://www.fpanet.org**

➤ Investment Management Consultants Association, 5619 DTC Parkway, Suite 500, Greenwood Village, CO 80111.
Internet: **http://www.imca.org**

For additional career information, see the *Occupational Outlook Quarterly* article "Financial analysts and personal financial advisors" in print at many libraries and career centers. and online:
http://www.bls.gov/opub/ooq/2000/summer/art03.pdf

Insurance Underwriters

(O*NET 13-2053.00)

Significant Points

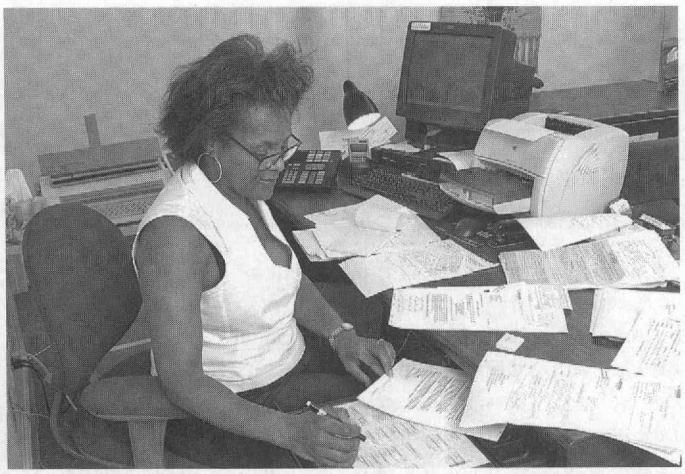
- Most large insurance companies prefer to hire people who have a college degree in business administration or finance with courses in accounting.
- Continuing education is necessary for advancement.
- Employment is expected to grow more slowly than average as the spread of underwriting software increases worker productivity.
- Job opportunities should be best for those with a background in finance and strong computer and communication skills.

Nature of the Work

Insurance companies protect individuals and organizations from financial loss by assuming billions of dollars in risk each year—risks of car accident, property damage, illness, and other occurrences. Underwriters decide if insurance is provided and under what terms. They are needed to identify and calculate the risk of loss from policyholders, establish who receives a policy, determine the appropriate premium, and write policies that cover this risk. An insurance company may lose business to competitors if the underwriter appraises risks too conservatively, or it may have to pay excessive claims if the underwriting actions are too liberal.

With the aid of computers, underwriters analyze information in insurance applications to determine whether a risk is acceptable and will not result in a loss. Insurance applications often are supplemented with reports from loss-control representatives, medical reports, reports from data vendors, and actuarial studies. Underwriters then must decide whether to issue the policy and, if so, determine the appropriate premium to charge. In making this determination, underwriters consider a wide variety of factors about the applicant. For example, an underwriter working in health insurance may consider age, family history,

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Underwriters consider many factors when determining eligibility for an insurance policy.

and current health whereas an underwriter working for a property-casualty insurance company is concerned with the causes of loss to which property is exposed and the safeguards taken by the applicant. Therefore, underwriters serve as the main link between the insurance carrier and the insurance agent. On occasion, they accompany sales agents to make presentations to prospective clients.

Technology plays an important role in an underwriter's job. Underwriters use computer applications called "smart systems" to manage risks more efficiently and accurately. These systems analyze and rate insurance applications, recommend acceptance or denial of the risk, and adjust the premium rate in accordance with the risk. With these systems, underwriters are better equipped to make sound decisions and avoid excessive losses.

The Internet also has affected the work of underwriters. Many insurance carriers' computer systems are now linked to various databases on the Internet that allow immediate access to information—such as driving records—necessary in determining a potential client's risk. This kind of access reduces the amount of time and paperwork necessary for an underwriter to complete a risk assessment.

Although there are many possible lines of insurance to work in, most underwriters specialize in one of four broad categories: life, health, mortgage, and property and casualty. Life and health insurance underwriters may further specialize in group or individual policies.

An increasing proportion of insurance sales, particularly in life and health insurance, are being made through group contracts. A standard group policy insures everyone in a specified group through a single contract at a standard premium rate. The group underwriter analyzes the overall composition of the group to ensure that the total risk is not excessive. Another type of group policy provides members of a group—senior citizens, for example—with individual policies reflecting their needs. These usually are casualty policies, such as those covering automobiles. The casualty underwriter analyzes the application of each group member and makes individual appraisals. Some group underwriters meet with union or employer representatives to discuss the types of policies available to their group.

Property and casualty underwriters usually specialize in either commercial or personal insurance and then by type of risk insured, as in fire, homeowners', automobile, marine, or liability insurance, as well as workers' compensation. In cases where property-casualty companies provide insurance through a single "package" policy covering various types of risks, the underwriter must be familiar with different lines of insurance. For business insurance, the underwriter often must be able to evaluate the firm's entire operation in appraising its application for insurance.

Work environment. Underwriters have desk jobs that require no unusual physical activity. Their offices usually are comfortable and pleasant. Most underwriters are based in a company headquarters or regional branch office, but they occasionally attend meetings away from home for several days. Construction and marine underwriters frequently travel to inspect worksites and assess risks.

Although underwriters typically work a standard 40-hour week, more are working longer hours due to the downsizing of many insurance companies. For some underwriters, evening and weekend hours are not uncommon.

Training, Other Qualifications, and Advancement

Although there are no formal education requirements for becoming an underwriter, many employers prefer candidates with a bachelor's degree or professional designation, some insurance-related experience, and strong computer skills. Much of what an underwriter does may be learned through on-the-job training, so the majority of underwriters start their careers as trainees.

Education and training. For entry-level underwriting jobs, most large insurance companies prefer college graduates who have a degree in business administration or finance with courses or experience in accounting. However, a bachelor's degree in almost any field—plus courses in business law and accounting—provides a good general background and may be sufficient to qualify an individual. Because computers are an integral part of most underwriters' jobs, some coursework with computers is also beneficial. Many employers prefer to hire candidates with several years of related experience in underwriting or insurance.

New employees usually start as underwriter trainees or assistant underwriters. They may help collect information on applicants and evaluate routine applications under the supervision of an experienced risk analyst. Property and casualty trainees study claims files to become familiar with factors associated with certain types of losses. Many larger insurers offer work-study training programs, lasting from a few months to a year. As trainees gain experience, they are assigned policy applications that are more complex and cover greater risks.

The computer programs many underwriters use to assess risk are always being improved upon and updated, so on-the-job computer training may continue throughout an underwriter's career.

Other qualifications. Underwriting can be a satisfying career for people who enjoy analyzing information and paying attention to detail. In addition, underwriters must possess good judgment in order to make sound decisions. Excellent communication and interpersonal skills also are essential, as much of

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16 Number	Change, 2006-16 Percent
Insurance underwriters	13-2053	104,000	111,000	6,600	6

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

the underwriter's work involves dealing with agents and other insurance professionals.

Certification and advancement. Continuing education is necessary for advancement. Independent-study programs for experienced underwriters are available. The Insurance Institute of America offers a training program for beginning underwriters. It also offers the designation of Associate in Commercial Underwriting (ACU) for those starting a career in underwriting business insurance policies. People interested in underwriting personal insurance policies may earn the Associate in Personal Insurance (API) designation. To earn either the ACU or API designation, underwriters complete a series of courses and examinations that generally lasts 1 to 2 years.

The American Institute for Chartered Property Casualty Underwriters awards the Chartered Property and Casualty Underwriter (CPCU) designation to experienced underwriters. Earning the CPCU designation requires passing 8 exams, having at least 3 years of insurance experience, and abiding by the Institute's and CPCU Society's code of professional ethics.

The American College offers the equivalent Chartered Life Underwriter (CLU) designation and the Registered Health Underwriter (RHU) designation for life and health insurance professionals.

Experienced underwriters who complete courses of study may advance to senior underwriter or underwriting manager positions. Some underwriting managers are promoted to senior managerial jobs. Some employers require a master's degree to achieve this level. Other underwriters are attracted to the earnings potential of sales and, therefore, obtain State licenses to sell insurance and related financial products as agents or brokers.

Employment

Insurance underwriters held about 104,000 jobs in 2006. Insurance carriers employed 65 percent of all underwriters. Most of the remaining underwriters work in insurance agencies or for organizations that offer insurance services to insurance companies and policyholders. A small number of underwriters work in agencies owned and operated by banks, mortgage companies, and real estate firms.

Most underwriters are based in the insurance company's home office, but some, mainly in the property and casualty area, work out of regional branch offices of the insurance company. These underwriters usually have the authority to underwrite most risks and determine an appropriate rating without consulting the home office.

Job Outlook

Although growth is expected to be more slowly than the average for all occupations, job prospects will remain good because of the continuous turnover experienced in this occupation.

Employment change. Employment of underwriters is expected to grow by 6 percent during the 2006-16 decade, which is slower than the average for all occupations. Underwriting software will continue to make workers more productive, but it does not do away with the need for human skills. As a result, employment of underwriters will increase as a growing economy and population expands the insurance needs of businesses and individuals.

Demand for underwriters also is expected to improve as insurance carriers try to restore profitability to make up for an unusually large number of underwriting losses in recent years. As the carriers' returns on their investments have declined, insurers are placing more emphasis on underwriting to generate revenues. This renewed interest in underwriting should result in some long-term growth for underwriters.

Job prospects. Job opportunities should be best for those with experience in related insurance jobs, a background in finance, and strong computer and communication skills. In addition to openings arising from job growth, openings also will be created by the need to replace underwriters who retire or transfer to another occupation.

New and emerging fields of insurance will be the source of the most job opportunities for underwriters. Insurance carriers are always assessing new risks and offering new types of policies to meet changing circumstances. Underwriters are needed particularly in the area of product development, where they assess risks and set the premiums for new lines of insurance. One new line of insurance being offered by life insurance carriers is long-term care insurance and it may provide job opportunities for underwriters.

Earnings

Median annual earnings of wage and salary insurance underwriters were $52,350 in May 2006. The middle 50 percent earned between $40,000 and $71,070 a year. The lowest 10 percent earned less than $32,270, while the highest 10 percent earned more than $92,240. Median annual earnings of underwriters working with insurance carriers were $52,900, while underwriters' median annual earnings in agencies, brokerages, and other insurance related activities were $51,820.

Insurance companies usually provide better-than-average benefits, including retirement plans and employer-financed group life and health insurance. Insurance companies usually pay tuition for underwriting courses that their trainees complete, and some also offer salary incentives.

Related Occupations

Underwriters make decisions on the basis of financial and statistical data. Other workers with the same type of responsibility include accountants and auditors, actuaries, budget analysts, cost estimators, financial managers, loan officers, and credit

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analysts. Other related jobs in the insurance industry include insurance sales agents and claims adjusters, appraisers, examiners, and investigators.

Sources of Additional Information

Information about a career as an insurance underwriter is available from the home offices of many insurance companies.

Information about the property-casualty insurance field can be obtained by contacting:

➤ Insurance Information Institute, 110 William St., New York, NY 10038. Internet: **http://www.iii.org**

Information about the health insurance field can be obtained by contacting:

➤ National Association of Health Underwriters, 2000 North 14th Street, Suite 450, Arlington, VA 22201.
Internet: **http://www.nahu.org**

Information on the underwriting function and the CPCU and AU designations can be obtained from:

➤ American Institute for Chartered Property and Casualty Underwriters and Insurance Institute of America, 720 Providence Rd., P.O. Box 3016, Malvern, PA 19355.
Internet: **http://www.aicpcu.org**

➤ CPCU Society, 720 Providence Road, Malvern, PA 19355.
Internet: **http://www.cpcusociety.org**

Information on the CLU and RHU designations can be obtained from:

➤ American College, 270 South Bryn Mawr Ave., Bryn Mawr, PA 19010. Internet: **http://www.theamericancollege.edu**

Loan Officers

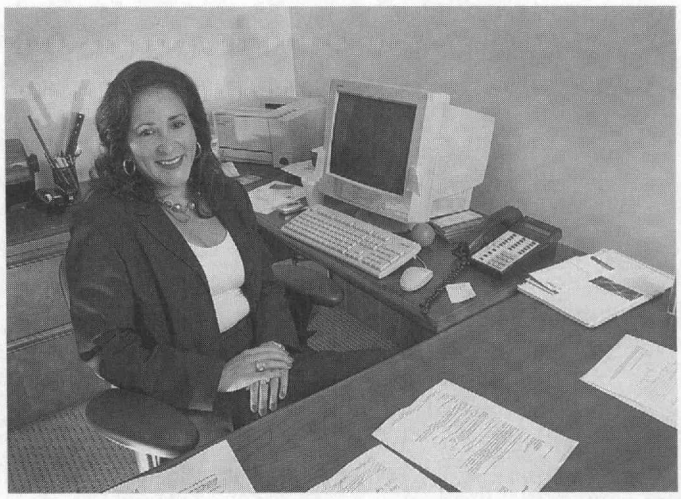
(O*NET 13-2072.00)

Significant Points

- About 9 out of 10 loan officers work for commercial banks, savings institutions, credit unions, and related financial institutions.
- Loan officers usually need a bachelor's degree in finance, economics, or a related field; training or experience in banking, lending, or sales is advantageous.
- Earnings often fluctuate with the number of loans generated, rising substantially when the economy is good and interest rates are low.

Nature of the Work

For many individuals, taking out a loan is the only way to buy a house, car, or college education. For businesses, loans likewise are essential to start many companies, purchase inventory, or invest in capital equipment. *Loan officers* facilitate this lending by finding potential clients and helping them to apply for loans. Loan officers also gather personal information about clients and businesses to ensure an informed decision regarding their creditworthiness and the probability of repayment. Loan officers may also provide guidance to prospective borrowers who have problems qualifying for traditional loans. For example, loan officers might determine the most appropriate type of loan for a particular customer and explain specific requirements and restrictions associated with the loan.



Loan officers determine the creditworthiness of prospective clients.

Loan officers guide clients through the process of applying for a loan. The process begins with a meeting or telephone call with a prospective client, during which the loan officer obtains basic information about the purpose of the loan and explains the different types of loans and credit terms available to the applicant. Loan officers answer questions about the process and sometimes assist clients in filling out the application.

After a client completes the application, the loan officer begins the process of analyzing and verifying the information on the application to determine the client's creditworthiness. Often, loan officers can quickly access the client's credit history by computer and obtain a credit "score," representing a software program's assessment of the client's creditworthiness. When a credit history is not available or when unusual financial circumstances are present, the loan officer may request additional financial information from the client or, in the case of commercial loans, copies of the company's financial statements. Loan officers include such information and their written comments in a loan file, which is used to analyze whether the prospective loan meets the lending institution's requirements. Loan officers then decide, in consultation with their managers, whether to grant the loan. If the loan is approved, a repayment schedule is arranged with the client.

Loan officers usually specialize in commercial, consumer, or mortgage loans. Commercial or business loans help companies pay for new equipment or expand operations; consumer loans include home equity, automobile, and personal loans; mortgage loans are made to purchase real estate or to refinance an existing mortgage. As banks and other financial institutions begin to offer new types of loans and a growing variety of financial services, loan officers will have to learn about these new product lines.

In many instances, loan officers act as salespeople. Commercial loan officers, for example, contact firms to determine their needs for loans. If a firm is seeking new funds, the loan officer will try to persuade the company to obtain the loan from his or her institution. Similarly, mortgage loan officers develop

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relationships with commercial and residential real estate agencies so that, when an individual or firm buys a property, the real estate agent might recommend contacting a specific loan officer for financing.

Some loan officers, called loan underwriters, specialize in evaluating a client's creditworthiness and may conduct a financial analysis or other risk assessment.

Other loan officers, referred to as *loan collection officers*, contact borrowers with delinquent loan accounts to help them find a method of repayment to avoid their defaulting on the loan. If a repayment plan cannot be developed, the loan collection officer initiates collateral liquidation, in which the lender seizes the collateral used to secure the loan—a home or car, for example—and sells it to repay the loan.

Work environment. Working as a loan officer usually involves considerable travel. For example, commercial and mortgage loan officers frequently work away from their offices and rely on laptop computers, cellular telephones, and pagers to keep in contact with their employers and clients. Mortgage loan officers often work out of their home or car, visiting offices or homes of clients to complete loan applications. Commercial loan officers sometimes travel to other cities to prepare complex loan agreements. Consumer loan officers, however, are likely to spend most of their time in an office.

Most loan officers work a standard 40-hour week, but many work longer, depending on the number of clients and the demand for loans. Mortgage loan officers can work especially long hours because they are free to take on as many customers as they choose. Loan officers are especially busy when interest rates are low, causing a surge in loan applications.

Training, Other Qualifications, and Advancement

Loan officers usually need a bachelor's degree in finance, economics, or a related field. Previous banking, lending, or sales experience is also highly valued by employers.

Education and training. Loan officer positions generally require a bachelor's degree in finance, economics, or a related field. Loan officers without a college degree often advance to their positions after gaining several years of work experience in various other related occupations, such as teller or customer service representative.

Licensure. There are currently no specific licensing requirements for loan officers working in banks or credit unions. Training and licensing requirements for loan officers who work in mortgage banks or brokerages vary by State and may include continuing education requirements. As the types of mortgages offered to prospective homebuyers increases, licensing requirements may become more stringent as regulators and lawmakers become more leery of possible predatory lending.

Other qualifications. People planning a career as a loan officer should be good at working with others, confident in their abilities, and highly motivated. Loan officers must be willing to attend community events as representatives of their employer. Sales ability, good interpersonal and communication skills, and a strong desire to succeed also are important qualities for loan officers. Most employers also prefer applicants who are familiar with computers and their applications in banking.

Certification and advancement. Capable loan officers may advance to larger branches of their firms or to managerial positions. Some loan officers advance to supervise other loan officers and clerical staff.

Various banking associations and private schools offer courses and programs for students interested in lending and for experienced loan officers who want to keep their skills current. For example, the Bank Administration Institute, an affiliate of the American Banker's Association, offers the Loan Review Certificate Program for people who review and approve loans. This program enhances the quality of reviews and improves the early detection of deteriorating loans, thereby contributing to the safety and soundness of the loan portfolio.

The Mortgage Bankers Association offers the Certified Mortgage Banker (CMB) designation to loan officers in real estate finance. The association offers three CMB designations: residential, commerce, and masters to candidates who have 3 years of experience, earn educational credits, and pass an exam. Completion of these courses and programs generally enhances employment and advancement opportunities.

Employment

Loan officers held about 373,000 jobs in 2006. About 9 out of 10 loan officers were employed by commercial banks, savings institutions, credit unions, and related financial institutions. Loan officers are employed throughout the Nation, but most work in urban and suburban areas. At some banks, particularly in rural areas, the branch or assistant manager often handles the loan application process.

Job Outlook

Loan officers can expect average employment growth. Job opportunities will be best for people with a college education and related experience.

Employment change. Employment of loan officers is projected to increase 11 percent between 2006 and 2016, which is about as fast as the the average for all occupations. Employment growth stemming from economic expansion and population increases—factors that generate demand for loans—will be partially offset by increased automation that speeds the lending process and by the growing use of the Internet to apply for and obtain loans.

The use of credit scoring has made the loan evaluation process much simpler than in the past and even unnecessary in some cases. Credit scoring allows loan officers—particularly

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Loan officers	13-2072	373,000	415,000	43,000	11

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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loan underwriters—to evaluate many more loans in less time than previously. In addition, the mortgage application process has become highly automated and standardized, a simplification that has enabled mortgage loan vendors to offer their services over the Internet. Online vendors accept loan applications from customers over the Internet and determine which lenders have the best interest rates for particular loans. With this knowledge, customers can go directly to the lending institution, thereby bypassing mortgage loan brokers. Shopping for loans on the Internet, especially for mortgages, is expected to become more common in the future and to slow job growth for loan officers.

Job prospects. Besides openings arising from growth, additional job openings will result from the need to replace workers who retire or otherwise leave the occupation permanently.

College graduates and those with banking, lending, or sales experience should have the best job prospects.

Job opportunities for loan officers are influenced by the volume of applications, which is determined largely by interest rates and by the overall level of economic activity. Although loans remain a major source of revenue for banks, demand for new loans fluctuates and affects the income and employment opportunities of loan officers. An upswing in the economy or a decline in interest rates often results in a surge in real estate buying and mortgage refinancing, requiring loan officers to work long hours processing applications and inducing lenders to hire additional loan officers. Loan officers often are paid by commission on the value of the loans they place, and when the real estate market slows, they often suffer a decline in earnings and may even be subject to layoffs. The same applies to commercial loan officers, whose workloads increase during good economic times as companies seek to invest more in their businesses. In difficult economic conditions, an increase in the number of delinquent loans results in more demand for loan collection officers.

Earnings

Median annual earnings of wage and salary loan officers were $51,760 in May 2006. The middle 50 percent earned between $37,590 and $73,630. The lowest 10 percent earned less than $29,590 while the top 10 percent earned more than $107,040. Median annual earnings in the industries employing the largest numbers of loan officers were as follows:

The form of compensation for loan officers varies. Most are paid a commission based on the number of loans they originate. Some institutions pay only salaries, while others pay their loan officers a salary plus a commission or bonus based on the number of loans originated. Loan officers who are paid on commission usually earn more than those who earn only a salary, and those who work for smaller banks generally earn less than those employed by larger institutions.

According to a salary survey conducted by Robert Half International, a staffing services firm specializing in accounting and finance, consumer loan officers, referred to as personal bankers, with 1 to 3 years of experience earned between $30,750 and $36,250 in 2007, and commercial loan officers with 1 to 3 years of experience made between $45,750 and $70,250. Commercial loan officers with more than 3 years of experience made between $61,750 and $100,750, and consumer loan officers earned between $36,250 and $51,250. Earnings of loan officers with graduate degrees or professional certifications are higher.

Banks and other lenders sometimes may offer their loan officers free checking privileges and somewhat lower interest rates on personal loans.

Related Occupations

Loan officers help people manage financial assets and secure loans. Occupations that involve similar functions include those of securities, commodities, and financial services sales agents; financial analysts and personal financial advisors; real estate brokers and sales agents; insurance underwriters; insurance sales agents; and loan counselors.

Sources of Additional Information

Information about a career as a mortgage loan officer can be obtained from:

➤ Mortgage Bankers Association, 1919 Pennsylvania Ave. NW., Washington, DC 20006.
Internet: **http://www.mortgagebankers.org**

State bankers' associations can furnish specific information about job opportunities in their State. Also, individual banks can supply information about job openings and the activities, responsibilities, and preferred qualifications of their loan officers.

Management Analysts

(O*NET 13-1111.00)

Significant Points

- Despite much faster than average employment growth, keen competition is expected for jobs; opportunities should be best for those with a graduate degree, specialized expertise, and a talent for salesmanship and public relations.
- About 27 percent, over three times the average for all occupations, are self-employed.
- A bachelor's degree is sufficient for many entry-level government jobs; many positions in private industry require a master's degree, specialized expertise, or both.

Nature of the Work

As business becomes more complex, firms are continually faced with new challenges. They increasingly rely on management analysts to help them remain competitive amidst these changes. Management analysts, often referred to as *management consultants* in private industry, analyze and propose ways to improve an organization's structure, efficiency, or profits.

For example, a small but rapidly growing company might employ a consultant who is an expert in just-in-time inventory management to help improve its inventory-control system. In another case, a large company that has recently acquired a new division may hire management analysts to help reorganize the corporate structure and eliminate duplicate or nonessential jobs. In recent

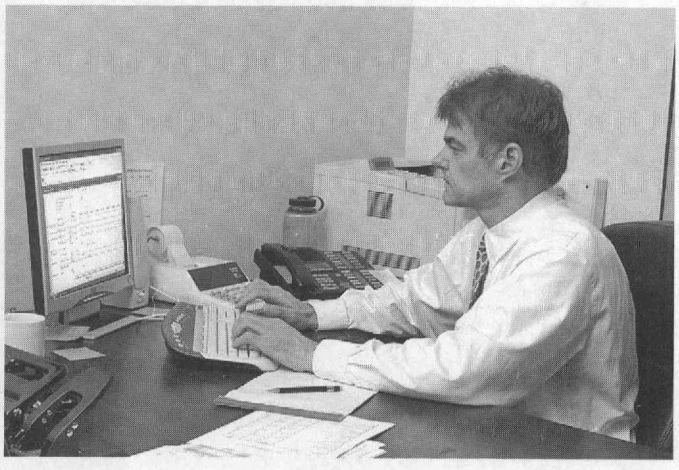
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years, information technology and electronic commerce have provided new opportunities for management analysts. Companies hire consultants to develop strategies for entering and remaining competitive in the new electronic marketplace. (For information on computer specialists working in consulting, see the following statements elsewhere in the *Handbook*: computer software engineers; systems analysts, computer scientists, and database administrators; and computer programmers.)

Management analysts might be single practitioners or part of large international organizations employing thousands of other consultants. Some analysts and consultants specialize in a specific industry, such as health care or telecommunications, while others specialize by type of business function, such as human resources, marketing, logistics, or information systems. In government, management analysts tend to specialize by type of agency. The work of management analysts and consultants varies with each client or employer, and from project to project. Some projects require a team of consultants, each specializing in one area. In other projects, consultants work independently with the organization's managers. In all cases, analysts and consultants collect, review, and analyze information in order to make recommendations to managers.

Both public and private organizations use consultants for a variety of reasons. Some lack the internal resources needed to handle a project, while others need a consultant's expertise to determine what resources will be required and what problems may be encountered if they pursue a particular opportunity. To retain a consultant, a company first solicits proposals from a number of consulting firms specializing in the area in which it needs assistance. These proposals include the estimated cost and scope of the project, staffing requirements, references from a number of previous clients, and a completion deadline. The company then selects the proposal that best suits its needs. Some firms, however, employ internal management consulting groups rather than hiring outside consultants.

After obtaining an assignment or contract, management analysts first define the nature and extent of the problem that they have been asked to solve. During this phase, they analyze relevant data—which may include annual revenues, employment, or expenditures—and interview managers and employees while observing their operations. The analysts or consultants then develop solutions to the problem. While preparing their recommendations, they take into account the nature of the organization, the relationship it has with others in the industry, and its internal organization and culture. Insight into the problem often is gained by building and solving mathematical models, such as one that shows how inventory levels affect costs and product delivery times.



Many management analysts are self-employed.

Once they have decided on a course of action, consultants report their findings and recommendations to the client. Their suggestions usually are submitted in writing, but oral presentations regarding findings also are common. For some projects, management analysts are retained to help implement the suggestions they have made.

Like their private-sector colleagues, management analysts in government agencies try to increase efficiency and worker productivity and to control costs. For example, if an agency is planning to purchase personal computers, it must first determine which type to buy, given its budget and data-processing needs. In this case, management analysts would assess the prices and characteristics of various machines and determine which ones best meet the agency's goals. Analysts may manage contracts for a wide range of goods and services to ensure quality performance and to prevent cost overruns.

Work environment. Management analysts usually divide their time between their offices and the client's site. In either situation, much of an analyst's time is spent indoors in clean, well-lit offices. Because they must spend a significant portion of their time with clients, analysts travel frequently.

Analysts and consultants generally work at least 40 hours a week. Uncompensated overtime is common, especially when project deadlines are approaching. Analysts may experience a great deal of stress when trying to meet a client's demands, often on a tight schedule.

Self-employed consultants can set their workload and hours and work at home. On the other hand, their livelihood depends on their ability to maintain and expand their client base. Salaried consultants also must impress potential clients to get and keep clients for their company.

Training, Other Qualifications, and Advancement

Entry requirements for management analysts vary. For some entry-level positions, a bachelor's degree is sufficient. For others, a master's degree, specialized expertise, or both is required.

Education and training. Educational requirements for entry-level jobs in this field vary between private industry and government. Many employers in private industry generally seek individuals with a master's degree in business administration or a related discipline. Some employers also require additional years of experience in the field or industry in which the worker plans to consult. Other firms hire workers with a bachelor's degree as research analysts or associates and promote them to consultants after several years. Some government agencies require experience, graduate education, or both, but many also hire people with a bachelor's degree and little work experience for entry-level management analyst positions.

Few universities or colleges offer formal programs in management consulting; however, many fields of study provide a suitable educational background for this occupation because of the wide

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range of areas addressed by management analysts. Common fields of study include business, management, accounting, marketing, economics, statistics, computer and information science, or engineering. Most analysts also have years of experience in management, human resources, information technology, or other specialties. Analysts also routinely attend conferences to keep abreast of current developments in their field.

Other qualifications. Management analysts often work with minimal supervision, so they need to be self-motivated and disciplined. Analytical skills, the ability to get along with a wide range of people, strong oral and written communication skills, good judgment, time-management skills, and creativity are other desirable qualities. The ability to work in teams also is an important attribute as consulting teams become more common.

Certification and advancement. As consultants gain experience, they often become solely responsible for specific projects, taking on more responsibility and managing their own hours. At the senior level, consultants may supervise teams working on more complex projects and become more involved in seeking out new business. Those with exceptional skills may eventually become partners in the firm, focusing on attracting new clients and bringing in revenue. Senior consultants who leave their consulting firms often move to senior management positions at non-consulting firms. Others with entrepreneurial ambition may open their own firms.

A high percentage of management consultants are self-employed, partly because business startup and overhead costs are low. Since many small consulting firms fail each year because of lack of managerial expertise and clients, persons interested in opening their own firm must have good organizational and marketing skills. Several years of consulting experience are also helpful.

The Institute of Management Consultants USA, Inc. offers the Certified Management Consultant (CMC) designation to those who meet minimum levels of education and experience, submit client reviews, and pass an interview and exam covering the IMC USA's Code of Ethics. Management consultants with a CMC designation must be recertified every 3 years. Certification is not mandatory for management consultants, but it may give a jobseeker a competitive advantage.

Employment

Management analysts held about 678,000 jobs in 2006. About 27 percent of these workers, over three times the average for all occupations, were self-employed. Management analysts are found throughout the country, but employment is concentrated in large metropolitan areas. Management analysts work in a range of industries, including management, scientific, and technical consulting firms; computer systems design and related services firms; and Federal, State, and local governments.

Job Outlook

Employment of management analysts is expected to grow much faster than average. Despite projected rapid employment growth, keen competition is expected for jobs as management analysts because of the independent and challenging nature of the work and the high earnings potential that make this occupation attractive to many.

Employment change. Employment of management analysts is expected to grow 22 percent over the 2006-16 decade, much faster than the average for all occupations, as industry and government increasingly rely on outside expertise to improve the performance of their organizations. Job growth is projected in very large consulting firms with international expertise and in smaller consulting firms that specialize in specific areas, such as biotechnology, health care, information technology, human resources, engineering, and marketing. Growth in the number of individual practitioners may be hindered by increasing use of consulting teams that are often more versatile.

Job growth for management analysts has been driven by a number of changes in the business environment that have forced firms to take a closer look at their operations. These changes include regulatory changes, developments in information technology, and the growth of electronic commerce. Firms hire consultants to help them adapt to new business regulations, such as the Sarbanes-Oxley Act, which tightened financial reporting rules. Traditional companies hire analysts to help design intranets or company Web sites or to establish online businesses. New Internet startup companies hire analysts not only to design Web sites but also to advise them in traditional business practices, such as pricing strategies, marketing, and inventory and human resource management.

To offer clients better quality and a wider variety of services, consulting firms are partnering with traditional computer software and technology firms. Also, many computer firms are developing consulting practices of their own to take advantage of this expanding market. Although information technology consulting should remain one of the fastest growing consulting areas, employment in the computer services industry can be volatile so the most successful management analysts may also consult in other business areas.

The growth of international business also has contributed to an increase in demand for management analysts. As U.S. firms expand their business abroad, many will hire management analysts to help them form the right strategy for entering the market; to advise them on legal matters pertaining to specific countries; or to help them with organizational, administrative, and other issues, especially if the U.S. company is involved in a partnership or merger with a local firm. These trends provide management analysts with more opportunities to travel or work abroad but also require them to have a more comprehensive knowledge of international business and foreign cultures and

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Management analysts	13-1111	678,000	827,000	149,000	22

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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languages. Just as globalization creates new opportunities for management analysts, it also allows U.S. firms to hire management analysts in other countries; however, because international work is expected to increase the total amount of work, this development is not expected to adversely affect employment in this occupation.

Furthermore, as international and domestic markets have become more competitive, firms have needed to use resources more efficiently. Management analysts increasingly are sought to help reduce costs, streamline operations, and develop marketing strategies. As this process continues and businesses downsize, even more opportunities will be created for analysts to perform duties that previously were handled internally. Finally, more management analysts also will be needed in the public sector, as Federal, State, and local government agencies seek ways to become more efficient.

Job prospects. Despite rapid employment growth, keen competition is expected. The pool of applicants from which employers can draw is quite large since analysts can have very diverse educational backgrounds and work experience. Furthermore, the independent and challenging nature of the work, combined with high earnings potential, makes this occupation attractive to many. Job opportunities are expected to be best for those with a graduate degree, specialized expertise, and a talent for salesmanship and public relations.

Economic downturns also can have adverse effects on employment for some management consultants. In these times, businesses look to cut costs, and consultants may be considered an excess expense. On the other hand, some consultants might experience an increase in work during recessions because they advise businesses on how to cut costs and remain profitable.

Earnings

Salaries for management analysts vary widely by years of experience and education, geographic location, specific expertise, and size of employer. Generally, management analysts employed in large firms or in metropolitan areas have the highest salaries. Median annual earnings of wage and salary management analysts in May 2006 were $68,050. The middle 50 percent earned between $50,860 and $92,390. The lowest 10 percent earned less than $39,840, and the highest 10 percent earned more than $128,330. Median annual earnings in the industries employing the largest numbers of management analysts were:

Management, scientific, and technical consulting services	$76,600
Computer systems design and related services	76,130
Federal executive branch	73,800
Management of companies and enterprises	68,660
State government	50,270

Salaried management analysts usually receive common benefits, such as health and life insurance, a retirement plan, vacation, and sick leave, as well as less common benefits, such as profit sharing and bonuses for outstanding work. In addition, all travel expenses usually are reimbursed by the employer. Self-employed consultants have to maintain their own office and provide their own benefits.

Related Occupations

Management analysts collect, review, and analyze data; make recommendations; and implement their ideas. Occupations with similar duties include accountants and auditors; budget analysts; cost estimators; financial analysts and personal financial advisors; operations research analysts; economists; and market and survey researchers. Some management analysts specialize in information technology and work with computers, as do computer systems analysts and computer scientists and database administrators. Most management analysts also have managerial experience similar to that of administrative services managers; advertising, marketing, promotions, public relations, and sales managers; financial managers; human resources, training, and labor relations managers and specialists; industrial production managers; or top executives.

Sources of Additional Information

Information about career opportunities in management consulting is available from:

➤ Association of Management Consulting Firms, 380 Lexington Ave., Suite 1700, New York, NY 10168.
Internet: **http://www.amcf.org**

Information about the Certified Management Consultant designation can be obtained from:

➤ Institute of Management Consultants USA, Inc., 2025 M St.NW., Suite 800, Washington, DC 20036.
Internet: **http://www.imcusa.org**

Information on obtaining a management analyst position with the Federal Government is available from the Office of Personnel Management (OPM) through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result. For advice on how to find and apply for Federal jobs, see the *Occupational Outlook Quarterly* article "How to get a job in the Federal Government," online at:
http://www.bls.gov/opub/ooq/2004/summer/art01.pdf

Meeting and Convention Planners

(O*NET 13-1121.00)

Significant Points

- Planners often work long hours in the period prior to and during a meeting or convention, and extensive travel may be required.
- Employment is expected to grow faster than average.
- Opportunities will be best for individuals with a bachelor's degree and some experience as a meeting planner.

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Nature of the Work

Meetings and conventions bring people together for a common purpose, and meeting and convention planners work to ensure that this purpose is achieved seamlessly. Meeting planners coordinate every detail of meetings and conventions, from the speakers and meeting location to arranging for printed materials and audio-visual equipment.

The first step in planning a meeting or convention is determining the purpose, message, or impression that the sponsoring organization wants to communicate. Planners increasingly focus on how meetings affect the goals of their organizations; for example, they may survey prospective attendees to find out what motivates them and how they learn best. Planners then choose speakers, entertainment, and content, and arrange the program to present the organization's information in the most effective way.

Meeting and convention planners search for prospective meeting sites, which may be hotels, convention centers, or conference centers. They issue requests for proposals to all the sites in which they are interested. These requests state the meeting dates and outline the planners' needs for the meeting or convention, including meeting and exhibit space, lodging, food and beverages, telecommunications, audio-visual requirements, transportation, and any other necessities. The establishments respond with proposals describing what space and services they can supply, and at what prices. Meeting and convention planners review these proposals and either make recommendations to top management or choose the site themselves.

Once the location is selected, meeting and convention planners arrange support services, coordinate with the facility, prepare the site staff for the meeting, and set up all forms of electronic communication needed for the meeting or convention, such as e-mail, voice mail, video, and online communication.

Meeting logistics, the management of the details of meetings and conventions, such as labor and materials, is another major component of the job. Planners register attendees and issue name badges, coordinate lodging reservations, and arrange transportation. They make sure that all necessary supplies are ordered and transported to the meeting site on time, that meeting rooms are equipped with sufficient seating and audio-visual equipment, that all exhibits and booths are set up properly, and that all materials are printed. They also make sure that the meeting adheres to fire and labor regulations and oversee food and beverage distribution.

There also is a financial management component of the work. Planners negotiate contracts with facilities and suppliers. These contracts, which have become increasingly complex, are often drawn up more than a year in advance of the meeting or convention. Contracts may include clauses requiring the planner to book a certain number of rooms for meeting attendees and imposing penalties if the rooms are not filled. Therefore, it is important that the planner closely estimate how many people will attend the meeting based on previous meeting attendance and current circumstances. Planners must also oversee the finances of meetings and conventions. They are given overall budgets by their organizations and must create a detailed budget, forecasting what each aspect of the event will cost. Additionally, some planners oversee meetings that contribute significantly to their organization's operating budget and must ensure that the event meets income goals.



Meeting and convention planners often work long hours before and during a meeting or convention.

An increasingly important part of the work is measuring how well the meeting's purpose was achieved, and planners begin this measurement as they outline the meeting's goals. Planners set their own specific goals after learning an organization's goals for a meeting or convention. They choose objectives for which success is measurable and define what will constitute achievement of each goal. The most obvious way to gauge their success is to have attendees fill out surveys about their experiences at the event. Planners can ask specific questions about what the attendees learned, how well organized the meeting or convention appeared, and how they felt about the overall experience. If the purpose of a meeting or convention is publicity, a good measure of success would be how much press coverage the event received. A more precise measurement of meeting success, and one that is gaining importance, is return on investment. Planners compare the costs and benefits of an event and show whether it was worthwhile to the organization. For example, if a company holds a meeting to motivate its employees and improve company morale, the planner might track employee turnover before and after the meeting.

An important part of all these different functions of meeting professionals is establishing and maintaining relationships. Meeting and convention planners interact with a variety of people and must communicate effectively. They must understand their organization's goals for the meeting or convention, be able to communicate their needs clearly to meeting site staff and other suppliers, maintain contact with many different people, and inform people about changes as they occur.

Some aspects of the work vary by the type of organization for which planners work. Those who work for associations must market their meetings to association members, convincing members that attending the meeting is worth their time and expense. Marketing is usually less important for corporate meeting planners because employees are generally required to attend company meetings. Corporate planners usually have shorter time frames in which to prepare their meetings. Planners who work in Federal, State, and local governments must learn how to operate within established government procedures, such as

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procedures and rules for procuring materials and booking lodging for government employees.

Convention service managers, meeting professionals who work in hotels, convention centers, and similar establishments, act as liaisons between the meeting facility and planners who work for associations, businesses, or governments. They present food service options to outside planners, coordinate special requests, suggest hotel services based on the planners' budgets, and otherwise help outside planners present effective meetings and conventions in their facilities.

Meeting planners in small organizations perform a wider range of duties, with perhaps one person coordinating an entire meeting. These planners usually need to multi-task even more than planners in larger organizations.

In large organizations or those that sponsor large meetings or conventions, meeting professionals are more likely to specialize in a particular aspect of meeting planning. Some specialties are conference coordinators, who handle most of the meeting logistics; registrars, who handle advance registration and payment, name badges, and the set-up of on-site registration; and education planners, who coordinate the meeting content, including speakers and topics. In organizations that hold very large or complex meetings, there may be several senior positions, such as manager of registration, education seminar coordinator, or conference services director, with the entire meeting planning department headed by a department director.

Work environment. The work of meeting and convention planners may be considered either stressful or energizing, but there is no question that it is fast-paced and demanding. Planners oversee multiple operations at one time, face numerous deadlines, and orchestrate the activities of several different groups of people. Meeting and convention planners spend the majority of their time in offices; but during meetings, they work on-site at the hotel, convention center, or other meeting location. They travel regularly to attend meetings and to visit prospective meeting sites. The extent of travel depends upon the type of organization for which the planner works. Local and regional organizations require mostly regional travel, while national and international organizations require travel to more distant locales, including travel abroad.

Work hours can be long and irregular, with planners working more than 40 hours per week in the time leading up to a meeting and fewer hours after finishing a meeting. During meetings or conventions, planners may work very long days, possibly starting as early as 5:00 a.m. and working until midnight. They are sometimes required to work on weekends.

Some physical activity is required, including long hours of standing and walking and some lifting and carrying of boxes of materials, exhibits, or supplies. Planners work with the public and with workers from diverse backgrounds. They may get to travel to beautiful hotels and interesting places and meet speakers and meeting attendees from around the world, and they usually enjoy a high level of autonomy.

Training, Other Qualifications, and Advancement

People with a variety of educational or work backgrounds may seek meeting and convention planning positions. Many migrate into the occupation after gaining planning experience. For example, an administrative assistant may begin planning small meetings and gradually move into a full-time position as a meeting and convention planner. Although there are some certification programs and college courses in meeting and convention planning available, most needed skills are learned through experience.

Education and training. Many employers prefer applicants who have a bachelor's degree, but this is not always required. The proportion of planners with a bachelor's degree is increasing because the work and responsibilities are becoming more complex.

Planners have backgrounds in a variety of disciplines, but some useful undergraduate majors are marketing, public relations, communications, business, and hotel or hospitality management. Individuals who have studied hospitality management may start out with greater responsibilities than those with other academic backgrounds.

Several universities offer bachelors or masters degrees with majors in meetings management. Additionally, meeting and convention planning continuing education programs are offered by a few universities and colleges. These programs are designed for career development of meeting professionals as well as for people wishing to enter the occupation. Some programs may require 40 to more than 100 classroom hours and may last anywhere from 1 semester to 2 years.

Most of the training is done informally on the job. Entry-level planners, depending upon their education, generally begin by performing small tasks under the supervision of senior meeting professionals. For example, they may issue requests for proposals and discuss the resulting proposals with higher level planners. They also may assist in registration, review of contracts, or the creation of meeting timelines, schedules, or objectives. They may start by planning small meetings, such as committee meetings. Those who start at small organizations have the opportunity to learn more quickly since they will be required to take on a larger number of tasks.

Other qualifications. Meeting and convention planners must have excellent written and verbal communications skills and interpersonal skills. They must be detail-oriented with excellent organizational skills, and they must be able to multi-task, meet tight deadlines, and maintain composure under pressure in a fast-paced environment. Quantitative and analytic skills are needed to formulate and follow budgets and to understand and negotiate contracts. The ability to speak multiple languages is a plus, since some planners must communicate with meeting attendees and speakers from around the world. Planners also need computer skills, such as the ability to use financial and registration software and the Internet. In the course of their careers, planners may work in a number of different, unrelated industries, and they must be able to learn independently about each new industry so they can coordinate programs that address the industry's important issues.

Some meeting and convention planners enter the occupation after working in hotel sales or as marketing or catering coordinators. These are effective ways to learn about meeting and convention planning because these hotel personnel work with numerous meeting planners, participate in negotiations for hotel services, and witness many different meetings. Workers who

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enter the occupation in these ways often start at a higher level than those with bachelor's degrees and no experience.

Certification and advancement. To advance in this occupation, planners must volunteer to take on more responsibility and find new and better ways of doing things in their organizations. The most important factors are demonstrated skill on the job, determination, and gaining the respect of others within the organization. Because formal education is increasingly important, those who enter the occupation may enhance their professional standing by enrolling in meeting planning courses offered by professional meeting and convention planning organizations, colleges, or universities. Education may improve work performance, and therefore may be an important factor in career development. However, advancement based solely on education is uncommon.

As meeting and convention planners prove themselves, they are given greater responsibilities. This may mean taking on a wider range of duties or moving to another planning specialty to gain experience in that area before moving to a higher level. For example, a planner may be promoted from conference coordinator, with responsibility for meeting logistics, to program coordinator, with responsibility for booking speakers and formatting the meeting's program. The next step up may be meeting manager, who supervises all parts of the meeting, and then director of meetings, and then possibly department director of meetings and education. Another path for promotion is to move from a small organization to a larger one, taking on responsibility for larger meetings and conventions.

The Convention Industry Council offers the Certified Meeting Professional (CMP) credential, a voluntary certification for meeting and convention planners. Although the CMP is not required, it is widely recognized in the industry and may help in career advancement. To qualify, candidates must have a minimum of 3 years of meeting management experience, full-time employment in a meeting management capacity, and proof of accountability for successfully completed meetings. Those who qualify must then pass an examination that covers topics such as adult learning, financial management, facilities and services, logistics, and meeting programs.

The Society of Government Meeting Professionals (SGMP) offers the Certified Government Meeting Professional credential. This certification is not required to work as a government meeting planner. It may, however, be helpful to those who want to demonstrate knowledge of issues specific to planning government meetings, such as regulations and policies governing procurement and travel. To qualify for certification, candidates must have at least 1 year of membership in SGMP. Membership requires employment as a meeting planner within Federal, State, or local government or for firm that works on government contracts. To become certified, members must take a 3-day course and pass an exam.

With significant experience, meeting planners may become independent meeting consultants, advance to vice president or executive director of an association, or start their own meeting planning firms.

Employment

Meeting and convention planners held about 51,000 jobs in 2006. About 27 percent worked for religious, grantmaking, civic, professional, and similar organizations; 17 percent worked in accommodation, including hotels and motels; 8 percent worked for educational services, public and private; 3 percent worked for governments; and 6 percent were self-employed. The rest were employed by convention and trade show organizing firms and in other industries as corporate meeting and convention planners.

Job Outlook

Employment of meeting and convention planners is expected to grow faster than the average for all occupations over the 2006-16 decade. Some additional job openings will arise from the need to replace workers who leave the workforce or transfer to other occupations. Opportunities will be best for individuals with a bachelors degree and some meeting planning experience.

Employment change. Employment of meeting and convention planners is expected to grow 20 percent over the 2006-16 decade, faster than the average for all occupations.

As businesses and organizations become increasingly international, meetings and conventions become even more important. In organizations that span the country or the globe, the periodic meeting is increasingly the only time the organization can bring all of its members together. Despite the proliferation of alternative forms of communication, such as e-mail, videoconferencing, and the Web, face-to-face interaction is still a necessity. In fact, new forms of communication foster interaction and connect individuals and groups that previously would not have collaborated. By increasing the number of human connections, electronic forms of communication actually increase the demand for meetings, which may offer the only opportunity for these people to interact in person.

Industries that are experiencing high growth tend to experience corresponding growth in meetings and conferences. For example, the medical and pharmaceutical sectors will experience large increases in meeting activity because of their high growth and their knowledge-intensive natures. These increases will spur employment growth of meeting professionals in medical and pharmaceutical associations. Professional associations hold conferences and conventions that offer the continuing education, training, and opportunities to exchange ideas that are vital to medical and pharmaceutical professionals.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Meeting and convention planners	13-1121	51,000	61,000	10,000	20

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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Job prospects. In addition to openings from employment growth, there will also be some job openings that arise due to the need to replace workers who leave the workforce or transfer to other occupations. Opportunities will be best for individuals with a bachelor's degree and some meeting planning experience.

Unlike workers in some occupations, meeting and convention planners often can change industries relatively easily, so they often are able to move to different industries in response to the growth or declines in particular sectors of the economy.

Demand for corporate meeting planners is highly susceptible to business cycle fluctuations because meetings are usually among the first expenses cut when budgets are tight. For associations, fluctuations are less pronounced because meetings are generally a source of revenue rather than an expense. However, since fewer people are able to attend association meetings during recessions, associations often reduce their meeting staff as well. Associations for industries such as health care, in which meeting attendance is required for professionals to maintain their licensure, are the least likely to experience cutbacks during downturns in the economy.

Earnings

Median annual earnings of wage and salary meeting and convention planners in May 2006 were $42,180. The middle 50 percent earned between $32,840 and $55,040. The lowest 10 percent earned less than $25,880, and the highest 10 percent earned more than $70,950. In 2006, median annual earnings in the industries employing the largest numbers of meeting and convention planners were as follows:

Business, professional, labor, political, and similar organizations	$45,850
Other support services	44,770
Local government	41,110
Colleges, universities, and professional schools	39,400
Traveler accommodation	38,270

Related Occupations

Meeting and convention planners work to communicate a particular message or impression about an organization, as do public relations specialists. They coordinate the activities of several operations to create a service for large numbers of people, using organizational, logistical, communication, budgeting, and interpersonal skills. Food service managers use the same skills for similar purposes. Like meeting and convention planners, producers and directors coordinate a range of activities to produce a television show or movie, negotiate contracts, and communicate with a wide variety of people. Travel agents also use similar skills, such as interacting with many people and coordinating travel arrangements, including hotel accommodations, transportation, and advice on destinations.

Sources of Additional Information

For information about meeting planner certification, contact:

➤ Convention Industry Council, 8201 Greensboro Dr., Suite 300, McLean, VA 22102.
Internet: **http://www.conventionindustry.org**

For information about the Certified Government Meeting Professional designation, contact:

➤ Society of Government Meeting Professionals, 908 King St., Lower Level, Alexandria, VA 22314.
Internet: **http://www.sgmp.org**

For information about internships and on-campus student meeting planning organizations, contact:

➤ Professional Convention Management Association, 2301 S. Lake Shore Dr., Suite 1001, Chicago, IL 60616-1419.
Internet: **http://www.pcma.org**

For information about meeting planning education, entering the profession, and career paths, contact:

➤ Meeting Professionals International, 3030 LBJ Fwy., Suite 1700, Dallas, TX 75244-5903.
Internet: **http://www.mpiweb.org**

For general career information about meeting and convention planners, see the *Occupational Outlook Quarterly* article "Meeting and convention planners," online at:
http://www.bls.gov/opub/ooq/2005/fall/art03.pdf

Tax Examiners, Collectors, and Revenue Agents

(O*NET 13-2081.00)

Significant Points

- Tax examiners, collectors, and revenue agents work for Federal, State, and local governments.
- Employment is expected to have little or no change, but the large number of retirements over the next 10 years should create many job openings.
- Competition will be greatest for positions with the Internal Revenue Service.

Nature of the Work

Taxes are one of the certainties of life, and as long as governments collect taxes, there will be jobs for tax examiners, collectors, and revenue agents. By reviewing tax returns, conducting audits, identifying taxes payable, and collecting overdue tax dollars, these workers ensure that governments obtain revenues from businesses and citizens.

Tax examiners do similar work whether they are employed at the Federal, State, or local government level. They review filed tax returns for accuracy and determine whether tax credits and deductions are allowed by law. Because many States assess individual income taxes based on the taxpayer's reported Federal adjusted gross income, tax examiners working for the Federal Government report any adjustments or corrections they make to the States. State tax examiners then determine whether the adjustments affect the taxpayer's State tax liability. At the local level, tax examiners often have additional duties, but an integral part of the work still includes the need to determine the factual basis for claims for refunds.

Tax examiners usually deal with the simplest tax returns—those filed by individual taxpayers with few deductions or those

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filed by small businesses. At the entry level, many tax examiners perform clerical duties, such as reviewing tax returns and entering them into a computer system for processing. If there is a problem, tax examiners may contact the taxpayer to resolve it.

Tax examiners also review returns for accuracy, checking taxpayers' math and making sure that the amounts that they report match those reported from other sources, such as employers and banks. In addition, examiners verify that Social Security numbers match names and that taxpayers have correctly interpreted the instructions on tax forms.

Much of a tax examiner's job involves making sure that tax credits and deductions claimed by taxpayers are legitimate. Tax examiners contact taxpayers by mail or telephone to address discrepancies and request supporting documentation. They may notify taxpayers of any overpayment or underpayment and either issue a refund or request further payment. If a taxpayer owes additional taxes, tax examiners adjust the total amount by assessing fees, interest, and penalties and notify the taxpayer of the total liability. Although most tax examiners deal with uncomplicated returns, some may work in more complex tax areas, such as pensions or business net operating losses.

Revenue agents specialize in tax-related accounting work for the U.S. Internal Revenue Service (IRS) and for equivalent agencies in State and local governments. Like tax examiners, they audit returns for accuracy. However, revenue agents handle complicated income, sales, and excise tax returns of businesses and large corporations. As a result, their work differs in a number of ways from that of tax examiners.

Entry-level Federal revenue agents usually audit tax returns of small businesses whose market specializations are similar. As they develop expertise in an industry, such as construction, retail sales, or finance, insurance, and real estate, revenue agents work with tax returns of larger corporations.

Many experienced revenue agents specialize; for example, they may focus exclusively on multinational businesses. But all revenue agents working for the Federal Government must keep abreast of the lengthy, complex, and frequently changing tax code. Computer technology has simplified the research process, allowing revenue agents Internet access to relevant legal bulletins, IRS notices, and tax-related court decisions. Revenue agents are increasingly using computers to analyze data and identify trends that help pinpoint tax offenders.

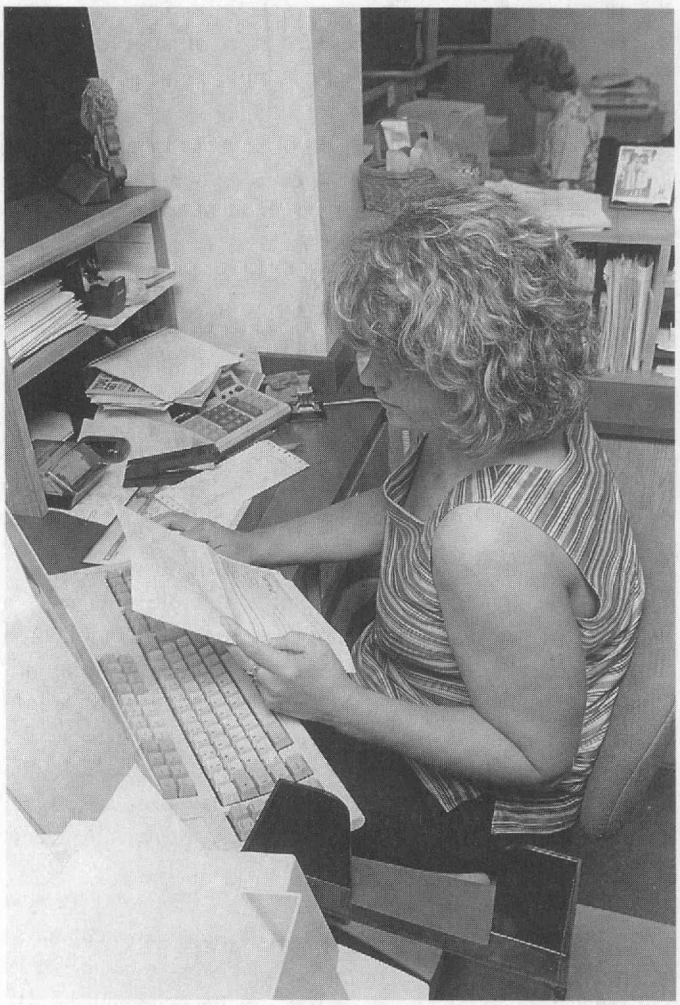
At the State level, revenue agents have duties similar to those of their counterparts in the Federal Government. State revenue agents use revenue adjustment reports forwarded by the IRS to determine whether adjustments made by Federal revenue agents affect a taxpayer's taxable income in the eyes of the States. In addition, State agents consider the sales and income taxes for their own States.

At the local level, revenue agents have varying titles and duties, but they still perform field audits or office audits of financial records for business firms. In some cases, local revenue agents also examine financial records of individuals. These local agents, like their State counterparts, rely on the information contained in Federal tax returns. However, local agents also must be knowledgeable enough to apply local tax laws regarding income, utility fees, or school taxes.

Collectors, also called *revenue officers* in the IRS, deal with delinquent accounts. The process of collecting a delinquent account starts with the revenue agent or tax examiner sending a report to the taxpayer. If the taxpayer makes no effort to resolve the delinquent account, the case is assigned to a collector. When a collector takes a case, he or she first sends the taxpayer a notice. The collector then works with the taxpayer on how to settle the debt.

In cases in which taxpayers fail to file a tax return, Federal collectors may request that the IRS prepare the return on a taxpayer's behalf. In other instances, collectors are responsible for verifying claims that delinquent taxpayers cannot pay their taxes. They investigate these claims by researching court information on the status of liens, mortgages, or financial statements; locating assets through third parties, such as neighbors or local departments of motor vehicles; and requesting legal summonses for other records. Ultimately, collectors must decide whether the IRS should take a lien—a claim on an asset such as a bank account, real estate, or an automobile—to settle a debt. Collectors also have the discretion to garnish wages—that is, take a portion of earned wages—to collect taxes owed.

A big part of a collector's job at the Federal level is imposing and following up on delinquent taxpayers' payment deadlines.



Little or no change in employment is projected, but expected retirements should create many job openings.

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For each case file, collectors must maintain records, including contacts, telephone numbers, and actions taken.

Like tax examiners and revenue agents, collectors use computers to maintain files. Computer technology also gives collectors access to data to help them identify high-risk debtors—those who are unlikely to pay or are likely to flee. Collectors at the IRS usually work independently. However, they call on experts when tax examiners or revenue agents find fraudulent returns, or when the seizure of a property will involve complex legal steps.

At the State level, collectors decide whether to take action on the basis of their own States' tax returns. Collection work may be handled over the telephone or turned over to a collector who specializes in obtaining settlements. These collectors contact people directly and have the authority to issue subpoenas and request seizures of property. At the local levels, collectors have less power than their State and Federal counterparts. Although they can start the processes leading to the seizure of property and garnishment of wages, they must go through the local court system.

Work environment. Tax examiners, collectors, and revenue agents work in clean, pleasant, and comfortable office settings. Sometimes travel is necessary. Revenue agents at both the Federal and State levels spend a significant portion of their time in the offices of private firms, accessing tax-related records. Some agents may be permanently stationed in the offices of large corporations with complicated tax structures. Agents at the local level usually work in city halls or municipal buildings. Collectors travel to local courthouses, county and municipal seats of government, businesses, and taxpayers' homes to look up records, search for assets, and settle delinquent accounts.

Stress can result from the need to work under a deadline in checking returns and evaluating taxpayer claims. Collectors also must face the unpleasant task of confronting delinquent taxpayers.

Tax examiners, collectors, and revenue agents generally work a 40-hour week, although some overtime might be needed during the tax season. State and local tax examiners, who may review sales, gasoline, and cigarette taxes instead of handling tax returns, may have a steadier workload year-round.

Training, Other Qualifications, and Advancement

Many tax examiners, collectors, and revenue agents have a bachelor's degree. But relevant experience, or a combination of postsecondary education and experience, is sufficient qualification for many jobs. Specialized experience is sufficient to qualify for many jobs in State and local government.

Education and training. As shown in the table below, a bachelor's degree was the most common level of educational attainment among tax examiners, collectors, and revenue agents in 2006.

	Percent
High school graduate or less	25
Some college, no degree	19
Associate degree	10
Bachelor's degree	39
Graduate degree	6

In the Federal Government, workers must have a bachelor's degree or a combination of some college education and related experience. But in State and local governments, workers often have an associate degree, some college-level business classes and specialized experience, or a high school diploma and specialized experience.

For more advanced entry-level positions, applicants often must have a bachelor's degree. Candidates may sometimes qualify without a bachelor's degree, however, if they can demonstrate experience working with tax records, tax laws and regulations, documents, financial accounts, or similar records.

Specific education and training requirements vary by occupational specialty.

Tax examiners usually must have a bachelor's degree in accounting or a related discipline or a combination of education and full-time accounting, auditing, or tax compliance work. Tax examiner candidates at the IRS must have a bachelor's degree or 1 year of full-time specialized experience, which could include full-time work in accounting, bookkeeping, or tax analysis. After they are hired, tax examiners receive some formal training. In addition, annual employer-provided updates keep tax examiners current with changes in procedures and regulations.

Collectors usually must have some combination of college education and experience in collections, management, customer service, or tax compliance, or as a loan officer or credit manager. A bachelor's degree is required for employment as a collector with the IRS. No additional experience is required, and experience may not be substituted for the degree. Degrees in business, finance, accounting, and criminal justice are good backgrounds.

Entry-level collectors receive formal and on-the-job training under an instructor's guidance before working independently. Collectors usually complete initial training by the end of their second year of service, but may receive advanced technical instruction as they gain seniority and take on more difficult cases. Also, collectors are encouraged to continue their professional education by attending meetings to exchange information about how changes in tax laws affect collection methods.

Revenue agents usually must have a bachelor's degree in accounting, business administration, economics, or a related discipline or a combination of education and full-time business administration, accounting, or auditing work. Revenue agents with the IRS must have either a bachelor's degree or 30 semester hours of accounting coursework along with specialized experience. Specialized experience includes full-time work in accounting, bookkeeping, or tax analysis.

Other qualifications. Tax examiners, collectors, and revenue agents work with confidential financial and personal information; therefore, trustworthiness is crucial for maintaining the confidentiality of individuals and businesses. Applicants for Federal Government jobs must submit to a background investigation.

Collectors need good interpersonal and communication skills because they deal directly with the public and because their reports are scrutinized when the tax agency must legally justify attempts to seize assets. They must be able to negotiate well

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-16	
				Number	Percent
Tax examiners, collectors, and revenue agents	13-2081	81,000	82,000	1,700	2

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

and deal effectively with others in potentially confrontational situations.

Revenue agents need strong analytical, organizational, and time management skills. They also must be able to work independently, because they spend so much time away from their home office, and they must keep current with changes in the tax code and laws.

Advancement. Advancement potential within Federal, State, and local agencies varies for tax examiners, revenue agents, and collectors. For related jobs outside government, experienced workers can take a licensing exam administered by the Federal Government to become enrolled agents—nongovernment tax professionals authorized to represent taxpayers before the IRS.

Collectors who demonstrate leadership skills and a thorough knowledge of collection activities may advance to supervisory or managerial collector positions, in which they oversee the activities of other collectors. It is only these higher level supervisors and managers who may authorize the more serious actions against individuals and businesses. The more complex collection attempts which usually are directed at larger businesses are reserved for collectors at these higher levels.

Newly hired revenue agents expand their accounting knowledge and remain up to date by consulting auditing manuals and other sources for detailed information about individual industries. Employers also continually offer training in new auditing techniques and tax-related issues and court decisions. As revenue agents gain experience, they may specialize in an industry, work with larger corporations, and cover increasingly complex tax returns. Some revenue agents also specialize in assisting in criminal investigations, auditing the books of known or suspected criminals such as drug dealers or money launderers. Some agents work with grand juries to help secure indictments. Others become international agents, assessing taxes on companies with subsidiaries abroad.

Employment

In 2006, tax examiners, revenue agents, and collectors held about 81,000 jobs at all levels of government.

About 44 percent worked for the Federal Government, 37 percent for State governments, and the remainder for local governments. In the IRS, tax examiners and revenue agents predominate because of the need to examine or audit tax returns. Collectors make up a smaller proportion, because most disputed tax liabilities do not require enforced collection.

Job Outlook

Little or no change in employment is expected, but the large number of retirements expected over the next 10 years should create many job openings at all levels of government.

Employment change. Employment of tax examiners, collectors, and revenue agents is projected to grow 2 percent during the 2006-16 decade, which is considered little or no change. Demand for tax examiners, revenue agents, and tax collectors will stem from changes in government policy toward tax enforcement and from growth in the number of businesses.

The Federal Government is expected to increase its tax enforcement efforts. Also, new technology and information sharing among tax agencies make it easier for agencies to pinpoint potential offenders, increasing the number of cases for audit and collection. These two factors should increase the demand for revenue agents and tax collectors.

The work of tax examiners is especially well suited to automation, adversely affecting demand for these workers in particular. In addition, more than 40 States and many local tax agencies contract out their tax collection functions to private-sector collection agencies in order to reduce costs, and this trend is likely to continue. The IRS has begun outsourcing some tax collection, but it is unclear whether the agency will continue or expand this practice. If IRS outsourcing continues, it will dampen growth in employment of revenue officers but is not expected to affect employment of revenue agents.

Job prospects. The large number of retirements expected over the next 10 years is expected to create many job openings at all levels of government. Both State and Federal tax agencies are turning their enforcement focus to higher income taxpayers and businesses, which file more complicated tax returns. Because of this, workers with knowledge of tax laws and experience working with complex tax issues will have the best opportunities.

Competition will be greatest for positions with the IRS. Opportunities at the Federal level will reflect the tightening or relaxation of budget constraints imposed on the IRS, the primary employer of these workers.

Employment at the State and local levels may fluctuate with the overall state of the economy. When the economy is contracting, State and local governments are likely to freeze hiring and lay off workers in response to budgetary constraints.

Earnings

In May 2006, median annual earnings for all tax examiners, collectors, and revenue agents were $45,620. The middle 50 percent earned between $34,840 and $62,530. The bottom 10 percent earned less than $27,290, and the top 10 percent earned more than $81,890. However, median earnings vary considerably, depending on the level of government. At the Federal level, May 2006 median annual earnings for tax examiners were $52,630; at the State level, they were $44,110; and at the local level, they were $33,120.

Earnings also vary by occupational specialty. For example, in the Federal Government in 2006, tax examiners earned an average of $38,290, revenue agents earned $82,204, and tax specialists earned $55,100.

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IRS employees receive family, vacation, and sick leave. Full-time permanent IRS employees are offered tax deferred retirement savings and investment plans with employer matching contributions, health insurance, and life insurance.

Related Occupations

Tax examiners, collectors, and revenue agents analyze and interpret financial data. Occupations with similar responsibilities include accountants and auditors, budget analysts, cost estimators, financial analysts and personal financial advisors, financial managers, and loan officers.

Sources of Additional Information

Information on obtaining positions as tax examiners, collectors, or revenue agents with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not tollfree, and charges may result.

State or local government personnel offices can provide information about tax examiner, collector, or revenue agent jobs at those levels of government.

For information about careers at the Internal Revenue Service, contact:

➤ Internal Revenue Service, 1111 Constitution Ave. NW., Washington, D.C. 20224. Internet: **http://www.jobs.irs.gov**

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Professional and Related Occupations

Computer and Mathematical Occupations

Actuaries

(O*NET 15-2011.00)

Significant Points

- A strong background in mathematics is essential; actuaries must pass a series of examinations to gain full professional status.
- About 6 out of 10 actuaries are employed in the insurance industry.
- Employment opportunities should remain good for those who qualify, because the stringent qualifying examination system restricts the number of candidates.

Nature of the Work

Through their knowledge of statistics, finance, and business, actuaries assess the risk of events occurring and help create policies that minimize risk and its financial impact on companies and clients. One of the main functions of actuaries is to help businesses assess the risk of certain events occurring and formulate policies that minimize the cost of that risk. For this reason, actuaries are essential to the insurance industry.

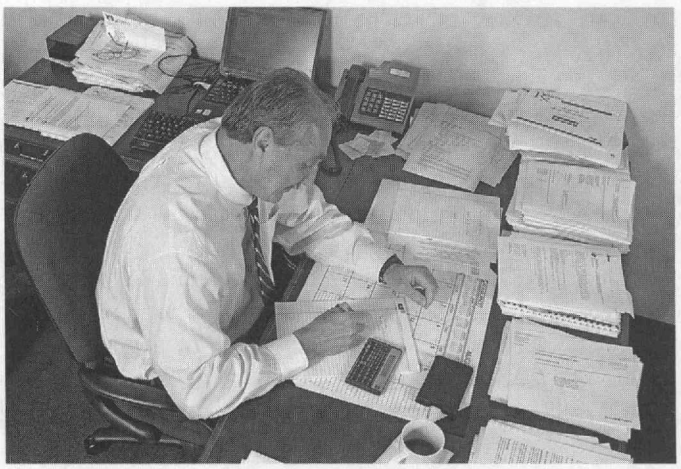
Actuaries assemble and analyze data to estimate the probability and likely cost of an event such as death, sickness, injury, disability, or loss of property. Actuaries also address financial questions, including those involving the level of pension contributions required to produce a certain retirement income level and the way in which a company should invest resources to maximize return on investments in light of potential risk. Using their broad knowledge of statistics, finance, and business, actuaries help design insurance policies, pension plans, and other financial strategies in a manner which will help ensure that the plans are maintained on a sound financial basis.

Most actuaries are employed in the insurance industry, specializing in either life and health insurance or property and casualty insurance. They produce probability tables or use more sophisticated dynamic modeling techniques that determine the likelihood that a potential event will generate a claim. From these tables, they estimate the amount a company can expect to pay in claims. For example, property and casualty actuaries calculate the expected number of claims resulting from automobile accidents, which varies depending on the insured person's age, sex, driving history, type of car, and other factors. Actuaries ensure that the price, or premium, charged for such insurance will enable the company to cover claims and other expenses. This premium must be profitable, yet competitive with other insurance companies. Within the life and health insurance fields, actuaries help to develop long-term-care insurance and annuity policies, the latter a growing investment tool for many individuals.

Actuaries in other financial service industries manage credit and help price corporate security offerings. They also devise new investment tools to help their firms compete with other financial service companies. Pension actuaries work under the provisions of the Employee Retirement Income Security Act (ERISA) of 1974 to evaluate pension plans covered by that Act and report on the plans' financial soundness to participants, sponsors, and Federal regulators. Actuaries working for the government help manage social programs such as Social Security and Medicare.

Actuaries may help determine company policy and may need to explain complex technical matters to company executives, government officials, shareholders, policyholders, or the public in general. They may testify before public agencies on proposed legislation that affects their businesses or explain changes in contract provisions to customers. They also may help companies develop plans to enter new lines of business or new geographic markets by forecasting demand in competitive settings.

Consulting actuaries provide advice to clients on a contract basis. The duties of most consulting actuaries are similar to those of other actuaries. For example, some may evaluate company pension plans by calculating the future value of employee and employer contributions and determining whether the amounts are sufficient to meet the future needs of retirees. Others help companies reduce their insurance costs by lowering the level of risk the companies take on. For example, they may provide advice on how to lessen the risk of injury on the job. Consulting actuaries sometimes testify in court regarding the value of potential lifetime earnings of a person who is disabled or killed in an accident, the current value of future pen-



Actuaries need a strong background in mathematics and statistics.

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sion benefits (in divorce cases), or other values arrived at by complex calculations. Some actuaries work in reinsurance, a field in which one insurance company arranges to share a large prospective liability policy with another insurance company in exchange for a percentage of the premium.

Work environment. Actuaries have desk jobs, and their offices usually are comfortable and pleasant. They often work at least 40 hours a week. Some actuaries—particularly consulting actuaries—may travel to meet with clients. Consulting actuaries also may experience more erratic employment and be expected to work more than 40 hours per week.

Training, Other Qualifications, and Advancement

Actuaries need a strong foundation in mathematics, statistics, and general business. They generally have a bachelor's degree and are required to pass a series of exams in order to become certified.

Education and training. Actuaries need a strong background in mathematics and general business. Usually, actuaries earn an undergraduate degree in mathematics, statistics or actuarial science, or a business-related field such as finance, economics or business. While in college, students should complete coursework in economics, applied statistics and corporate finance, which is a requirement for professional certification. Furthermore, many students obtain internships to gain experience in the profession prior to graduation. About 100 colleges and universities offer an actuarial science program, and most offer a degree in mathematics, statistics, economics, or finance.

Some companies hire applicants without specifying a major, provided that the applicant has a working knowledge of mathematics—including calculus, probability, and statistics—and has demonstrated this knowledge by passing one or two actuarial exams required for professional designation. Companies increasingly prefer well-rounded individuals who, in addition to having acquired a strong technical background, have some training in business and liberal arts and possess strong communication skills.

Beginning actuaries often rotate among different jobs in an organization, such as marketing, underwriting, financial reporting and product development, to learn various actuarial operations and phases of insurance work. At first, they prepare data for actuarial projects or perform other simple tasks. As they gain experience, actuaries may supervise clerks, prepare correspondence, draft reports, and conduct research. They may move from one company to another early in their careers as they advance to higher positions.

Licensure. Two professional societies sponsor programs leading to full professional status in their specialty: the Society of Actuaries (SOA) and the Casualty Actuarial Society (CAS). The SOA certifies actuaries in the fields of life insurance, health benefits systems, retirement systems, and finance and investment. The CAS gives a series of examinations in the property and casualty field, which includes car, homeowners, medical malpractice, workers compensation, and personal injury liability.

Three of the first four exams in the SOA and CAS examination series are jointly sponsored by the two societies and cover the same material. For this reason, students do not need to commit themselves to a specialty until they have taken the initial examinations, which test an individual's competence in probability, statistics, and other branches of mathematics and finance. The first few examinations help students evaluate their potential as actuaries. Many prospective actuaries begin taking the exams in college with the help of self-study guides and courses. Those who pass one or more examinations have better opportunities for employment at higher starting salaries than those who do not.

Many candidates find work as an actuary immediately after graduation and work through the certification process while gaining some experience in the field. In fact, many employers pay the examination fees and provide their employees time to study. As actuaries pass exams, they are often rewarded with a pay increase. Despite the fact that employers are supportive during the exam process, home study is necessary and many actuaries study for months to prepare for each exam.

The process for gaining certification in the Casualty Actuarial Society is predominantly exam based. To reach the first level of certification, the Associate or ACAS level, a candidate must complete seven exams, attend one course on professionalism and complete the coursework in applied statistics, corporate finance, and economics required by both the SOA and CAS. This process generally takes from 4 to 6 years. The next level, the Fellowship or FCAS level, requires passing two additional exams in advanced topics, including investment and assets and dynamic financial analysis and the valuation of insurance. Most actuaries reach the fellowship level 2 to 3 years after attaining Associate status.

The certification process of the Society of Actuaries blends exams with computer learning modules and coursework. After taking the initial exams, candidates must choose a specialty: group and health benefits, individual life and annuities, retirement benefits, pensions, investments or finance/enterprise risk management. To reach the Associate or ASA level, a candidate must complete the initial four exams, the coursework in applied statistics, corporate finance and economics required by the SOA and CAS, eight computer modules with two corresponding assessments and a course in professionalism. This process generally takes from 4 to 6 years. To attain the Fellowship or FSA level, a candidate must pass two additional exams within a chosen specialty and must complete three computer modules and a professionalism course. Attaining Fellowship status usually takes an additional 2 to 3 years after becoming an Associate.

Specific requirements apply to pension actuaries, who verify the financial status of defined benefit pension plans for the Federal Government. These actuaries must be enrolled by the Joint Board of the U.S. Treasury Department and the U.S. Department of Labor for the Enrollment of Actuaries. To qualify for enrollment, applicants must meet certain experience and examination requirements, as stipulated by the Board.

Other qualifications. In addition to knowledge of mathematics, computer skills are becoming increasingly important. Actuaries should be able to develop and use spreadsheets and databases, as well as standard statistical analysis software. Knowledge of computer programming languages, such as Visual Basic for Applications, SAS, or SQL, is also useful.

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To perform their duties effectively, actuaries must keep up with current economic and social trends and legislation, as well as with developments in health, business, and finance that could affect insurance or investment practices. Good communication and interpersonal skills also are important, particularly for prospective consulting actuaries.

Advancement. Advancement depends largely on job performance and the number of actuarial examinations passed. Actuaries with a broad knowledge of the insurance, pension, investment, or employee benefits fields can rise to administrative and executive positions in their companies. Actuaries with supervisory ability may advance to management positions in other areas, such as underwriting, accounting, data processing, marketing, and advertising. Increasingly, actuaries with knowledge of business are beginning to rise to high-level positions within their companies, such as Chief Risk Officer, Chief Financial Officer, or other executive level positions. These generally require that actuaries use their abilities for assessing risk and apply it to the entire company as a whole. Furthermore, some experienced actuaries move into consulting, often by opening their own consulting firm. Some actuaries transfer to college and university faculty positions. (See the section on teachers—postsecondary elsewhere in the *Handbook*.)

Employment

Actuaries held about 18,000 jobs in 2006. Over half of all actuaries were employed by insurance carriers. Approximately 21 percent work for professional, scientific and technical consulting services. Others worked for insurance agents and brokers and in the management of companies and enterprises industry. A relatively small number of actuaries are employed by government agencies.

Job Outlook

Employment of actuaries is expected to grow rapidly through 2016. Job opportunities should remain good for those who qualify, because the stringent qualifying examination system restricts the number of candidates.

Employment change. Employment of actuaries is expected to increase by about 24 percent over the 2006-16 period, which is much faster than the average for all other occupations. Employment growth in the insurance industry—the largest employer of actuaries—is expected to continue at a stable pace, while more significant job growth is likely in other industries, such as health care and consulting firms.

Steady demand by the insurance industry should ensure that actuarial jobs in this key industry will remain stable during the projection period. Although relatively few new jobs will be created, actuaries will continue to be needed to develop, price, and evaluate a variety of insurance products and calculate the costs of new risks. The demand for actuaries in life insurance has been growing rapidly as a result of the rise in popularity of annuities, a financial product offered primarily by life insurance companies. In addition, the risk of terrorism and natural disasters has created a large demand for actuaries in property insurance.

Some new employment opportunities for actuaries should also become available in the health-care field as health-care issues and Medicare reform continue to receive attention. Increased regulation of managed health-care companies and the desire to contain health-care costs will continue to provide job opportunities for actuaries, who will also be needed to evaluate the risks associated with new medical issues, such as genetic testing and the impact of new diseases. Others in this field are involved in drafting health-care legislation.

A significant proportion of new actuaries will find employment with consulting firms. Companies that may not find it cost effective to employ their own actuaries are increasingly hiring consulting actuaries to analyze various risks. Other areas with notable growth prospects are information services and accounting services. Also, because actuarial skills are increasingly seen as useful to other industries that deal with risk, such as the airline and the banking industries, additional job openings may be created in these industries.

Despite the increase in employment overall, there has been some decline in the demand for pension actuaries. This is due in large part to the decline of defined benefit plans, which required review by an actuary, in favor of investment based retirement funds, such as 401ks.

Job prospects. Opportunities for actuaries should be good, particularly for those who have passed at least one or two of the initial exams. In addition, a small number of jobs will open up each year to replace actuaries who leave the occupation to retire or transfer new jobs. Candidates with additional knowledge or experience, such as computer programming skills, will be particularly attractive to employers. Most jobs in this occupation are located in urban areas, but opportunities vary by geographic location.

Earnings

Median annual earnings of actuaries were $82,800 in May 2006. The middle 50 percent earned between $58,710 and $114,570. The lowest 10 percent had earnings of less than $46,470 while the top 10 percent earned more than $145,600.

According to the National Association of Colleges and Employers, annual starting salaries for graduates with a bachelor's degree in actuarial science averaged $53,754 in 2007.

Insurance companies and consulting firms give merit increases to actuaries as they gain experience and pass examinations. Some companies also offer cash bonuses for each professional designation achieved. A 2007 survey by Life Office Management Association, Inc. of the largest U.S. insurance and finan-

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Actuaries	15-2011	18,000	22,000	4,300	24

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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cial services companies indicated that the average base salary for an entry-level actuary was $53,111. Associate actuaries, who direct and provide leadership in the design, pricing, and implementation of insurance products, received an average salary of $109,167. Actuaries at the highest technical level without managerial responsibilities reportedly were paid an average of $125,946.

Related Occupations

Actuaries need a strong background in mathematics, statistics, and related fields. Other workers whose jobs involve such skills include accountants and auditors, budget analysts, economists, market and survey researchers, financial analysts and personal financial advisors, insurance underwriters, mathematicians, and statisticians.

Sources of Additional Information

Career information on actuaries specializing in pensions is available from:

➤ American Society of Pension Actuaries, 4245 N. Fairfax Dr., Suite 750, Arlington, VA 22203.
Internet: **http://www.aspa.org**

For information about actuarial careers in life and health insurance, employee benefits and pensions, and finance and investments, contact:

➤ Society of Actuaries (SOA), 475 N. Martingale Rd., Suite 600, Schaumburg, IL 60173-2226.
Internet: **http://www.soa.org**

For information about actuarial careers in property and casualty insurance, contact:

➤ Casualty Actuarial Society (CAS), 4350 N. Fairfaix Dr., Suite 250 Arlington, VA 22203.
Internet: **http://www.casact.org**

The SOA and CAS jointly sponsor a Web site for those interested in pursuing an actuarial career.
Internet: **http://www.BeAnActuary.org**

For general information on a career as an actuary, contact:

➤ American Academy of Actuaries, 1100 17th St.NW., 7th Floor, Washington, DC 20036.
Internet: **http://www.actuary.org**

Computer Programmers

(O*NET 15-1021.00)

Significant Points

- Almost 8 out of 10 computer programmers held an associate's degree or higher in 2006; nearly half held a bachelor's degree, and 2 out of 10 held a graduate degree.
- Employment of computer programmers is expected to decline by four percent through 2016.
- Job prospects will be best for applicants with a bachelor's degree and experience with a variety of programming languages and tools.

Nature of the Work

Computer programmers write, test, and maintain the detailed instructions, called programs, that computers follow to perform their functions. Programmers also conceive, design, and test logical structures for solving problems by computer. With the help of other computer specialists, they figure out which instructions to use to make computers do specific tasks. Many technical innovations in programming—advanced computing technologies and sophisticated new languages and programming tools, for example—have redefined the role of a programmer and elevated much of the programming work done today.

Job titles and descriptions may vary, depending on the organization, but computer programmers are individuals whose main job function is programming. Programmers usually write programs according to the specifications given by computer software engineers and systems analysts. (Sections on computer software engineers and on computer systems analysts appear elsewhere in the *Handbook*.) After engineers and analysts design software—describing how it will work—the programmer converts that design into a logical series of instructions that the computer can follow. The programmer codes these instructions in a conventional programming language such as COBOL; an artificial intelligence language such as Prolog; or one of the more advanced object-oriented languages, such as Java, C++, or ACTOR.

Different programming languages are used depending on the purpose of the program. Programmers generally know more than one programming language, and because many languages are similar, they often can learn new languages relatively easily. In practice, programmers often are referred to by the language they know, such as Java programmers, or by the type of function they perform or environment in which they work—for example, database programmers, mainframe programmers, or Web programmers.

Programmers also update, repair, modify, and expand existing programs. Some, especially those working on large projects that involve many programmers, use computer-assisted software engineering (CASE) tools to automate much of the coding process. These tools enable a programmer to concentrate on writing the unique parts of a program. Programmers working on smaller projects often use "programmer environments," applications that increase productivity by combining compiling, code walk through, code generation, test data generation, and debugging functions. Programmers also use libraries of basic code that can be modified or customized for a specific application. This approach yields more reliable and consistent programs and increases programmers' productivity by eliminating some routine steps.

Programs vary widely depending on the type of information they will access or generate. For example, the instructions involved in updating financial records are very different from those required to simulate flight for pilot training. Simple programs can be written in a few hours, but some programs draw data from many existing systems or use complex mathematical formulas. These programs may take more than a year to create. In most cases, several programmers work together as a team under a senior programmer's supervision.

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Programmers test a program by running it to ensure that the instructions are correct and that the program produces the desired outcome. If errors do occur, the programmer must make the appropriate change and recheck the program until it produces the correct results. This process is called testing and debugging. Programmers may continue to fix problems for as long as a program is used.

Programmers working on a mainframe, a large centralized computer, may prepare instructions for a computer operator who will run the program. (A section on computer operators appears elsewhere in the *Handbook*.) Programmers also may contribute to the instruction manual for a program.

Programmers in software development companies may work directly with experts from various fields to create specialized software—either programs designed for specific clients or packaged software for general use—ranging from games and educational software to programs for desktop publishing and financial planning. Programming of packaged software constitutes one of the most rapidly growing segments of the computer services industry.

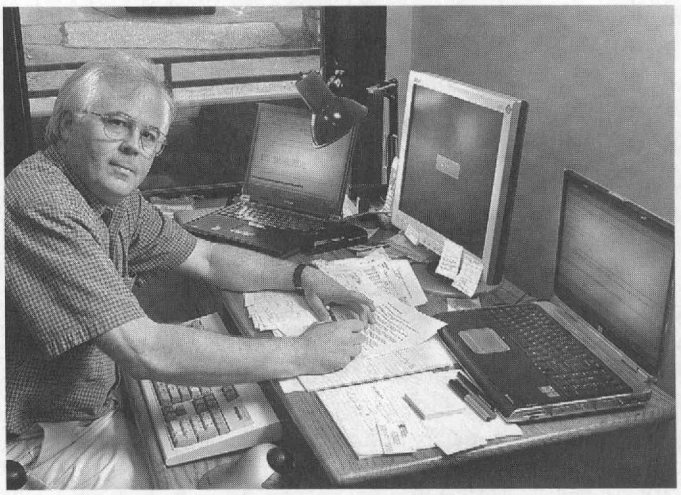
Increasingly, advanced software platforms are bridging the gap between computer programmers and computer users. New platforms, such as spreadsheet, accounting, and enterprise resource planning applications, have created demand for computer specialists who have first-hand knowledge of a user-base. These workers use such platforms to develop programs that meet the specific needs of this base. Computer programmers often are responsible for creating the software platform, and then fine-tuning the final program after it has been made.

Computer programmers often are grouped into two broad types—applications programmers and systems programmers. *Applications programmers* write programs to handle a specific job, such as a program to track inventory within an organization. They also may revise existing packaged software or customize generic applications purchased from vendors. *Systems programmers*, in contrast, write programs to maintain and control computer systems software for operating systems, networked systems, and database systems. These workers make changes in the instructions that determine how the network, workstations, and central processing unit of a system handle the various jobs they have been given, and how they communicate with peripheral equipment such as terminals, printers, and disk drives. Because of their knowledge of the entire computer system, systems programmers often help applications programmers determine the source of problems that may occur with their programs.

In some organizations, workers known as *programmer-analysts* are responsible for both the systems analysis and programming. (A more detailed description of the work of programmer-analysts is presented in the section on computer systems analysts elsewhere in the *Handbook*.)

Work environment. Programmers spend the majority of their time in front of a computer terminal, and work in clean, comfortable offices. Telecommuting is becoming more common, however, as technological advances allow more work to be done from remote locations.

Most computer programmers work about 40 hours per week. Long hours or weekend work may be required, however, to meet deadlines or fix unexpected technical problems. About four percent work part-time, compared with about 15 percent for all occupations.



Computer programmers write, test, and maintain the detailed instructions that computers follow.

Like other workers who spend long periods in front of a computer terminal typing at a keyboard, programmers are susceptible to eyestrain, back discomfort, and hand and wrist problems such as carpal tunnel syndrome.

Training, Other Qualifications, and Advancement

A bachelor's degree commonly is required for computer programming jobs, although a two-year degree or certificate may be adequate for some positions. Employers favor applicants who already have relevant programming skills and experience. Skilled workers who keep up to date with the latest technology usually have good opportunities for advancement.

Education and training. Most programmers have a bachelor's degree, but a two-year degree or certificate may be adequate for some jobs. Some computer programmers hold a college degree in computer science, mathematics, or information systems, whereas others have taken special courses in computer programming to supplement their degree in a field such as accounting, finance, or another area of business. In 2006, more than 68 percent of computer programmers had a bachelor's degree or higher, but as the level of education and training required by employers continues to rise, this proportion is expected to increase.

Employers who use computers for scientific or engineering applications usually prefer college graduates who have a degree in computer or information science, mathematics, engineering, or the physical sciences. Employers who use computers for business applications prefer to hire people who have had college courses in management information systems and business, and who possess strong programming skills. A graduate degree in a related field is required for some jobs.

Most systems programmers hold a four-year degree in computer science. Extensive knowledge of a variety of operating systems is essential for such workers. This includes being able to configure an operating system to work with different types of hardware and being able to adapt the operating system to best meet the needs of a particular organization. Systems program-

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mers also must be able to work with database systems, such as DB2, Oracle, or Sybase.

In addition to educational attainment, employers highly value relevant programming skills, as well as experience. Although knowledge of traditional programming languages still is important, employers are placing an emphasis on newer, object-oriented languages and tools such as C++ and Java. Additionally, employers seek people familiar with fourth- and fifth-generation languages that involve graphic user interface and systems programming. College graduates who are interested in changing careers or developing an area of expertise may return to a two-year community college or technical school for specialized training. In the absence of a degree, substantial specialized experience or expertise may be needed.

Entry-level or junior programmers may work alone on simple assignments after some initial instruction, or they may be assigned to work on a team with more experienced programmers. Either way, beginning programmers generally must work under close supervision.

Because technology changes so rapidly, programmers must continuously update their knowledge and skills by taking courses sponsored by their employer or by software vendors, or offered through local community colleges and universities.

Certification and other qualifications. When hiring programmers, employers look for people with the necessary programming skills who can think logically and pay close attention to detail. Programming calls for patience, persistence, and the ability to perform exacting analytical work, especially under pressure. Ingenuity and creativity are particularly important when programmers design solutions and test their work for potential failures. The ability to work with abstract concepts and to do technical analysis is especially important for systems programmers because they work with the software that controls the computer's operation.

Because programmers are expected to work in teams and interact directly with users, employers want programmers who are able to communicate with non-technical personnel. Business skills are also important, especially for those wishing to advance to managerial positions.

Certification is a way to demonstrate a level of competence and may provide a jobseeker with a competitive advantage. In addition to language-specific certificates, product vendors or software firms also offer certification and may require professionals who work with their products to be certified. Voluntary certification also is available through various other organizations.

Advancement. For skilled workers who keep up to date with the latest technology, prospects for advancement are good. In large organizations, programmers may be promoted to lead programmer and be given supervisory responsibilities. Some applications programmers may move into systems programming after they gain experience and take courses in systems software. With general business experience, programmers may become programmer-analysts or systems analysts, or may be promoted to managerial positions. Programmers with specialized knowledge and experience with a language or operating system may work in research and development and may even become computer software engineers. As employers increasingly contract with outside firms to do programming jobs, more opportunities should arise for experienced programmers with expertise in a specific area to work as consultants.

Employment

Computer programmers held about 435,000 jobs in 2006. Programmers are employed in almost every industry, but the largest concentration is in computer systems design and related services. Large numbers of programmers also work for software publishers, financial institutions, insurance carriers, educational institutions, government agencies, and management of companies and enterprises. Many computer programmers work independently as consultants on a temporary or contract basis, some of whom are self-employed. About 17,000 computer programmers were self-employed in 2006.

Job Outlook

Employment of computer programmers is expected to decline slowly. Job prospects should be best for those with a bachelor's degree and experience with a variety of programming languages and tools.

Employment change. Employment of computer programmers is expected to decline slowly, decreasing by 4 percent from 2006 to 2016. The consolidation and centralization of systems and applications, developments in packaged software, advances in programming languages and tools, and the growing ability of users to design, write, and implement more of their own programs mean that more programming functions can be performed by other types of information workers, such as computer software engineers.

Another factor contributing to employment decline will be the offshore outsourcing of programming jobs. Because they can transmit their programs digitally, computer programmers can perform their job function from anywhere in the world, allowing companies to employ workers in countries that have lower prevailing wages. Computer programmers are at a much higher risk of having their jobs outsourced abroad than are workers involved in more complex and sophisticated information technology functions, such as software engineering. Much of the work of computer programmers requires little localized or specialized knowledge and can be made routine once knowledge of a particular programming language is mastered—and computer programming languages have become known internationally.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Computer programmers	15-1021	435,000	417,000	-18,000	-4

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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Nevertheless, employers will continue to need some local programmers, especially those who have strong technical skills and who understand an employer's business and its programming requirements. This means that programmers will have to keep abreast of changing programming languages and techniques. Given the importance of networking and the expansion of client/server, Web-based, and wireless environments, organizations will look for programmers who can support data communications and help implement business and intranet strategies. Demand for programmers with strong object-oriented programming capabilities and technical specialization in areas such as client/server programming, wireless applications, multimedia technology, and graphic user interface likely will stem from the expansion of intranets, extranets, and Internet applications. Programmers also will be needed to create and maintain expert systems and embed these technologies in more products. Finally, a growing emphasis on cybersecurity will lead to increased demand for programmers who are familiar with digital security issues, and are skilled in using appropriate security technology.

Job prospects. Although employment is projected to decline, numerous job openings will result from the need to replace programmers who leave the labor force or transfer to other occupations. Prospects for these openings should be best for applicants with a bachelor's degree and experience with a variety of programming languages and tools. The languages that are in demand today include C++, Java, and other object-oriented languages, as well as newer, domain-specific languages that apply to computer networking, database management, and Internet application development. As technology evolves, however, and newer, more sophisticated tools emerge, programmers will need to update their skills in order to remain competitive. Obtaining vendor-specific or language-specific certification also can provide a competitive edge.

Jobs for both systems and applications programmers should be most plentiful in computer consulting businesses. These establishments are part of the computer systems design and related services industry, which is projected to be among the fastest growing industries in the economy over the 2006 to 2016 period.

Earnings

Median annual earnings of wage-and-salary computer programmers were $65,510 in May 2006. The middle 50 percent earned between $49,580 and $85,080 a year. The lowest 10 percent earned less than $38,460, and the highest 10 percent earned more than $106,610. Median annual earnings in the industries employing the largest numbers of computer programmers in May 2006 are shown below:

Software publishers	$79,270
Computer systems design and related services	67,880
Management of companies and enterprises	67,170
Insurance carriers	65,650

According to the National Association of Colleges and Employers, starting salary offers for computer programmers averaged $49,928 per year in 2007.

According to Robert Half Technology, a firm providing specialized staffing services, average annual starting salaries in 2007 ranged from $55,250 to $90,250 for applications development programmers/analysts, and from $60,250 to $94,750 for software developers. Average starting salaries for mainframe systems programmers ranged from $52,250 to $70,750.

Related Occupations

Other professional workers who deal extensively with data include computer software engineers, computer scientists and database administrators, computer systems analysts, statisticians, mathematicians, engineers, commercial and industrial designers, and operations research analysts.

Sources of Additional Information

State employment service offices can provide information about job openings for computer programmers. Municipal chambers of commerce are an additional source of information on an area's largest employers.

Further information about computer careers is available from:

➤ Association for Computing Machinery, 2 Penn Plaza, Suite 701, New York, NY 10121-0701.
Internet: **http://www.acm.org**

➤ Institute of Electrical and Electronics Engineers Computer Society, Headquarters Office, 1730 Massachusetts Ave. NW., Washington, DC 20036-1992.
Internet: **http://www.computer.org**

➤ National Workforce Center for Emerging Technologies, 3000 Landerholm Circle SE., Bellevue, WA 98007.
Internet: **http://www.nwcet.org**

➤ University of Washington Computer Science and Engineering Department, AC101 Paul G. Allen Center, Box 352350, 185 Stevens Way, Seattle, WA 98195-2350.
Internet: **http://www.cs.washington.edu/WhyCSE**

Computer Scientists and Database Administrators

(O*NET 15-1011.00, 15-1061.00, 15-1081.00, 15-1099.99)

Significant Points

- Education requirements range from an associate degree to a doctoral degree.
- Employment is expected to increase much faster than the average as organizations continue to expand their use of technology.
- Workers must be able to learn new technologies quickly for these constantly evolving occupations.

Nature of the Work

The rapid and widespread use of computers and information technology has generated a need for highly trained workers proficient in various job functions. These computer specialists include computer scientists, database administrators, and

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network systems and data communication analysts. Job tasks and occupational titles used to describe these workers evolve rapidly and continually, reflecting new areas of specialization or changes in technology, as well as the preferences and practices of employers.

Computer scientists work as theorists, researchers, or inventors. Their jobs are distinguished by the higher level of theoretical expertise and innovation they apply to complex problems and the creation or application of new technology. The areas of computer science research range from complex theory to hardware design to programming-language design. Some researchers work on multidisciplinary projects, such as developing and advancing uses of virtual reality, extending human-computer interaction, or designing robots. They may work on design teams with electrical engineers and other specialists.

Computer science researchers employed by academic institutions (covered in the statement on teachers—postsecondary, elsewhere in the *Handbook*) have job functions that are similar in many ways to those employed by other organizations. In general, researchers in academic settings have more flexibility to focus on pure theory, while those working in other organizations usually focus on projects that have the possibility of producing patents and profits. However, some researchers in non-academic settings have considerable latitude in determining the direction of their research.

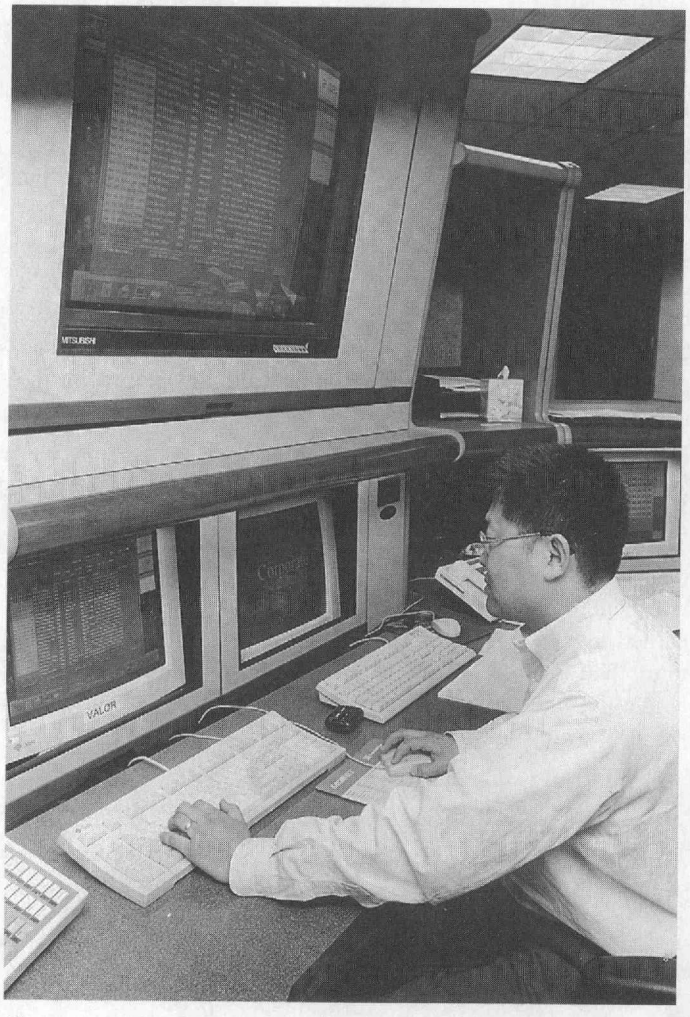
With the Internet and electronic business generating large volumes of data, there is a growing need to be able to store, manage, and extract data effectively. *Database administrators* work with database management systems software and determine ways to organize and store data. They identify user needs and set up new computer databases. In many cases, database administrators must integrate data from outdated systems into a new system. They also test and coordinate modifications to the system when needed, and troubleshoot problems when they occur. An organization's database administrator ensures the performance of the system, understands the platform on which the database runs, and adds new users to the system. Because many databases are connected to the Internet, database administrators also must plan and coordinate security measures with network administrators. With the growing volume of sensitive data and the increasing interconnectedness of computer networks, data integrity, backup systems, and database security have become increasingly important aspects of the job of database administrators.

Network systems and data communications analysts, also referred to as *network architects*, design, test, and evaluate systems such as local area networks (LANs), wide area networks (WANs), the Internet, intranets, and other data communications systems. Systems are configured in many ways and can range from a connection between two offices in the same building to globally distributed networks, voice mail, and e-mail systems of a multinational organization. Network systems and data communications analysts perform network modeling, analysis, and planning, often requiring both hardware and software solutions. For example, a network may involve the installation of several pieces of hardware, such as routers and hubs, wireless adaptors, and cables, while also requiring the installation and configuration of software, such as network drivers. Analysts also may research related products and make necessary hardware and software recommendations.

Telecommunications specialists focus on the interaction between computer and communications equipment. These workers design voice and data communication systems, supervise the installation of the systems, and provide maintenance and other services to clients after the systems are installed.

The growth of the Internet and the expansion of the World Wide Web (the graphical portion of the Internet) have generated a variety of occupations related to the design, development, and maintenance of Web sites and their servers. For example, *webmasters* are responsible for all technical aspects of a Web site, including performance issues such as speed of access, and for approving the content of the site. *Internet developers* or *Web developers*, also called *Web designers*, are responsible for day-to-day site creation and design.

Work environment. Computer scientists and database administrators normally work in offices or laboratories in comfortable surroundings. They typically work about 40 hours a week, the same as many other professional or office workers. However, evening or weekend work may be necessary to meet deadlines or to solve specific problems. Telecommuting is increasingly common for many computer professionals as networks expand, allowing more work to be done from remote locations through modems, laptops, electronic mail, and the Internet. However,



Computer scientists work at the very forefront of technology.

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some work still must be done in the office for security or other reasons.

Like other workers who spend long periods in front of a computer terminal typing on a keyboard, computer scientists and database administrators are susceptible to eyestrain, back discomfort, and hand and wrist problems such as carpal tunnel syndrome or cumulative trauma disorder.

Training, Other Qualifications, and Advancement

Rapidly changing technology requires an increasing level of skill and education on the part of workers in these occupations. Employers look for professionals with an ever-broader background and range of skills, including technical knowledge and also communication and other interpersonal skills.

Education and training. While there is no universally accepted way to prepare for a job as a network systems analyst, computer scientist, or database administrator, most employers place a premium on some formal college education. A bachelor's degree is a prerequisite for many jobs; however, some jobs may require only a 2-year degree. Relevant work experience also is very important. For more technically complex jobs, persons with graduate degrees are preferred. Most computer scientist positions require a Ph.D. degree, as their main job function is research. Computer scientists having only a bachelor's or master's degree are generally limited in their ability to advance.

For database administrator and network systems and data communication analyst positions, most employers seek applicants who have bachelor's degrees in computer science, information science, or management information systems (MIS). MIS programs usually are part of the business school or college and differ considerably from computer science programs, emphasizing business and management-oriented coursework and business computing courses. Employers increasingly prefer applicants with a master's degree in business administration (MBA) with a concentration in information systems, as more firms move their business to the Internet. For some network systems and data communication analysts, such as webmasters, an associate degree or certificate is sufficient, although more advanced positions might require a computer-related bachelor's degree.

Most community colleges and many independent technical institutes and proprietary schools offer an associate's degree in computer science or a related information technology field. Many of these programs may be geared more toward meeting the needs of local businesses and are more occupation specific than are 4-year degree programs. Some jobs may be better suited to the level of training that such programs offer. Employers usually look for people who have broad knowledge and experience related to computer systems and technologies, strong problem-solving and analytical skills, and good interpersonal skills. Courses in computer science or systems design offer good preparation for a job in these computer occupations. For jobs in a business environment, employers usually want systems analysts to have business management or closely related skills, while a background in the physical sciences, applied mathematics, or engineering is preferred for work in scientifically oriented organizations. Art or graphic design skills may be desirable for webmasters or Web developers.

Despite employers' preference for those with technical degrees, individuals with post-secondary degrees in a variety of other subjects may find employment in these occupations. Given the rapid pace of technological change, a degree generally has more value as a demonstration of an individual's ability to learn, rather than as a certification of a certain skill set. Generally speaking, coursework in computer science and an undergraduate degree are sufficient qualifications, especially if the applicant has a reasonable amount of experience.

Certification and other qualifications. Computer scientists and database administrators must be able to think logically and have good communication skills. Because they often deal with a number of tasks simultaneously, the ability to concentrate and pay close attention to detail also is important. Although computer specialists sometimes work independently, they frequently work in teams on large projects. As a result, they must be able to communicate effectively with computer personnel, such as programmers and managers, as well as with users or other staff who may have no technical computer background.

Jobseekers can enhance their employment opportunities by earning certifications, most of which are offered through private companies, with many related to specific products. Many employers regard these certifications as the industry standard. For example, one method of acquiring enough knowledge to get a job as a database administrator is to become certified in database management with a certain software package. Voluntary certification also is available through various organizations associated with computer specialists. Professional certification may afford a jobseeker a competitive advantage.

Because technology is so closely connected to the functioning of businesses, many workers in these occupations come from elsewhere in the business or industry to become computer specialists. This background can be very useful, in that it helps them to better understand how their networking and database tools are being used within the organization.

Advancement. Computer scientists may advance into managerial or project leadership positions. Many having advanced degrees choose to leave private industry for academic positions. Database administrators may advance into managerial positions, such as chief technology officer, on the basis of their experience managing data and enforcing security. Computer specialists with work experience and considerable expertise in a particular subject or a certain application may find lucrative opportunities as independent consultants or may choose to start their own computer consulting firms.

Technological advances come so rapidly in the computer field that continuous study is necessary to keep one's skills up to date. Employers, hardware and software vendors, colleges and universities, and private training institutions offer continuing education. Additional training may come from professional development seminars offered by professional computing societies.

Employment

Computer scientists and database administrators held about 542,000 jobs in May 2006, including about 58,000 who were

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self-employed. Employment was distributed among the detailed occupations as follows:

Network systems and data communication analysts	262,000
Computer specialists, all other	136,000
Database administrators	119,000
Computer and information scientists, research	25,000

Although they are increasingly employed in every sector of the economy, the greatest concentration of these workers is in the computer systems design and related services industry. Firms in this industry provide services related to the commercial use of computers on a contract basis, including custom computer programming services; computer systems integration design services; computer facilities management services, including computer systems or data processing facilities support services for clients; and other computer-related services, such as disaster recovery services and software installation. Many computer scientists and database administrators are employed by Internet service providers; Web search portals; and data processing, hosting, and related services firms. Others work for government, manufacturers of computer and electronic products, insurance companies, financial institutions, and universities.

A growing number of computer specialists, such as network and data communications analysts, are employed on a temporary or contract basis; many of these individuals are self-employed, working independently as contractors or consultants. For example, a company installing a new computer system may need the services of several network systems and data communication analysts just to get the system running. Because not all of the analysts would be needed once the system is functioning, the company might contract for such employees with a temporary help agency or consulting firm, or with the network systems analysts themselves. Such jobs may last from several months to 2 years or more. This growing practice enables companies to bring in people with the exact skills they need to complete a particular project, rather than having to spend time or money training or retraining existing workers. Often, experienced consultants then train a company's in-house staff as a project develops.

Job Outlook

Computer scientists and database administrators are projected to be one of the fastest growing occupations over the next decade. Strong employment growth combined with a limited supply of qualified workers will result in excellent employment prospects for this occupation and a high demand for their skills.

Employment change. The computer scientists and database administrators occupation is expected to grow 37 percent from 2006 to 2016, much faster than average for all occupations. Employment of these computer specialists is expected to grow as organizations continue to adopt and integrate increasingly sophisticated technologies. Job increases will be driven by very rapid growth in computer systems design and related services, which is projected to be one of the fastest growing industries in the U.S. economy.

The demand for networking to facilitate the sharing of information, the expansion of client-server environments, and the need for computer specialists to use their knowledge and skills in a problem-solving capacity will be major factors in the rising demand for computer scientists and database administrators. Firms will continue to seek out computer specialists who are able to implement the latest technologies and are able to apply them to meet the needs of businesses as they struggle to maintain a competitive advantage.

As computers continue to become more central to business functions, more sophisticated and complex technology is being implemented across all organizations, fueling demand for computer scientists and database administrators. There is growing demand for network systems and data communication analysts to help firms maximize their efficiency with available technology. Expansion of electronic commerce—doing business on the Internet—and the continuing need to build and maintain databases that store critical information on customers, inventory, and projects are fueling demand for database administrators familiar with the latest technology. Because of the increasing reliance on the Internet among businesses, information security is an increasing concern.

The development of new technologies leads to demand for various kinds of workers. The expanding integration of Internet technologies into businesses, for example, has resulted in a growing need for specialists who can develop and support Internet and intranet applications. The growth of electronic commerce means that more establishments use the Internet to conduct their business online. It also means more security specialists are needed to protect their systems. The spread of such new technologies translates into a need for information technology professionals who can help organizations use technology to communicate with employees, clients, and consumers. Explosive growth in these areas also is expected to fuel demand for specialists who are knowledgeable about network, data, and communications security.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Computer scientists and database administrators	—	542,000	742,000	200,000	37
Computer and information scientists, research	15-1011	25,000	31,000	5,400	22
Database administrators	15-1061	119,000	154,000	34,000	29
Network systems and data communications analysts	15-1081	262,000	402,000	140,000	53
Computer specialists, all other	15-1099	136,000	157,000	21,000	15

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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Job prospects. Computer scientists and database administrators should continue to enjoy excellent job prospects. As technology becomes more sophisticated and complex, however, these positions will demand a higher level of skill and expertise from their employees. Individuals with an advanced degree in computer science or computer engineering or with an MBA with a concentration in information systems should enjoy favorable employment prospects. College graduates with a bachelor's degree in computer science, computer engineering, information science, or MIS also should enjoy favorable prospects, particularly if they have supplemented their formal education with practical experience. Because employers continue to seek computer specialists who can combine strong technical skills with good business skills, individuals with a combination of experience inside and outside the IT arena will have the best job prospects.

In addition to growth, many job openings will arise from the need to replace workers who move into managerial positions or other occupations or who leave the labor force.

Earnings

Median annual earnings of computer and information scientists, research, were $93,950 in May 2006. The middle 50 percent earned between $71,930 and $118,100. The lowest 10 percent earned less than $53,590, and the highest 10 percent earned more than $144,880. Median annual earnings of computer and information scientists employed in computer systems design and related services in May 2006 were $95,340.

Median annual earnings of database administrators were $64,670 in May 2006. The middle 50 percent earned between $48,560 and $84,830. The lowest 10 percent earned less than $37,350, and the highest 10 percent earned more than $103,010. In May 2006, median annual earnings of database administrators employed in computer systems design and related services were $72,510, and for those in management of companies and enterprises, earnings were $67,680.

Median annual earnings of network systems and data communication analysts were $64,600 in May 2006. The middle 50 percent earned between $49,510 and $82,630. The lowest 10 percent earned less than $38,410, and the highest 10 percent earned more than $101,740. Median annual earnings in the industries employing the largest numbers of network systems and data communications analysts in May 2006 are shown below:

Wired telecommunications carriers	$72,480
Management of companies and enterprises	68,490
Management, scientific, and technical consulting services	67,830
Computer systems design and related services	67,080
State government	52,020

Median annual earnings of all other computer specialists were $68,570 in May 2006. Median annual earnings of all other computer specialists employed in computer systems design and related services were $67,370, and, for those in management of companies and enterprises, earnings were $63,610 in May 2006.

Robert Half International, a firm providing specialized staffing services, noted the following salary ranges for computer-related occupations in their 2007 Salary Guide:

Database manager	$84,750 - $116,000
Network architect	78,000 - 112,250
Database developer	73,500 - 103,000
Senior web developer	71,000 - 102,000
Database administratort	70,250 - 102,000
Network manager	68,750 - 93,000
Web developer	54,750 - 81,500
LAN/WAN administrator	51,000 - 71,500
Web administrator	49,750 - 74,750
Web designer	47,000 - 71,500
Telecommunications specialist	47,500 - 69,500

Related Occupations

Others who work with large amounts of data are computer programmers, computer software engineers, computer and information systems managers, engineers, mathematicians, statisticians, and actuaries.

Sources of Additional Information

Further information about computer careers is available from:

➤ Association for Computing Machinery (ACM), 1515 Broadway, New York, NY 10036.
Internet: **http://www.acm.org**

➤ Institute of Electrical and Electronics Engineers Computer Society, Headquarters Office, 1730 Massachusetts Ave. NW., Washington, DC 20036-1992.
Internet: **http://www.computer.org**

➤ Software & Information Industry Association, 1090 Vermont Ave. NW., 6th floor, Washington, DC 20005.
Internet: **http://www.siia.net**

Computer Software Engineers

(O*NET 15-1031.00, 15-1032.00)

Significant Points

- Computer software engineers are one of the occupations projected to grow the fastest and add the most new jobs over the 2006-16 decade.
- Excellent job prospects are expected for applicants with at least bachelor's degree in computer engineering or computer science and with practical work experience.
- Computer software engineers must continually strive to acquire new skills in conjunction with the rapid changes that occur in computer technology.

Nature of the Work

Computer software engineers apply the principles of computer science and mathematical analysis to the design, development, testing, and evaluation of the software and systems that make

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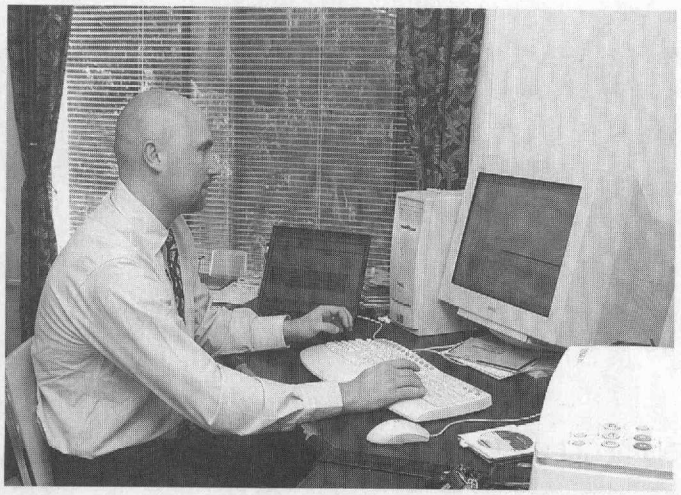
computers work. The tasks performed by these workers evolve quickly, reflecting new areas of specialization or changes in technology, as well as the preferences and practices of employers. (A separate section on computer hardware engineers appears in the engineers section of the *Handbook.*)

Software engineers can be involved in the design and development of many types of software, including computer games, word processing and business applications, operating systems and network distribution, and compilers, which convert programs to machine language for execution on a computer.

Computer software engineers begin by analyzing users' needs, and then design, test, and develop software to meet those needs. During this process they create the detailed sets of instructions, called algorithms, that tell the computer what to do. They also may be responsible for converting these instructions into a computer language, a process called programming or coding, but this usually is the responsibility of *computer programmers.* (A separate section on computer programmers appears elsewhere in the *Handbook.*) Computer software engineers must be experts in operating systems and middleware to ensure that the underlying systems will work properly.

Computer applications software engineers analyze users' needs and design, construct, and maintain general computer applications software or specialized utility programs. These workers use different programming languages, depending on the purpose of the program. The programming languages most often used are C, C++, and Java, with Fortran and COBOL used less commonly. Some software engineers develop both packaged systems and systems software or create customized applications.

Computer systems software engineers coordinate the construction, maintenance, and expansion of an organization's computer systems. Working with the organization, they coordinate each department's computer needs—ordering, inventory, billing, and payroll recordkeeping, for example—and make suggestions about its technical direction. They also might set up the organization's intranets—networks that link computers within the organization and ease communication among various departments.



Computer software engineers design, create, and modify computer applications and systems.

Systems software engineers also work for companies that configure, implement, and install the computer systems of other organizations. These workers may be members of the marketing or sales staff, serving as the primary technical resource for sales workers. They also may help with sales and provide customers with technical support. Since the selling of complex computer systems often requires substantial customization to meet the needs of the purchaser, software engineers help to identify and explain needed changes. In addition, systems software engineers are responsible for ensuring security across the systems they are configuring.

Computer software engineers often work as part of a team that designs new hardware, software, and systems. A core team may comprise engineering, marketing, manufacturing, and design people, who work together to release a product.

Work environment. Computer software engineers normally work in clean, comfortable offices or in laboratories in which computer equipment is located. Software engineers who work for software vendors and consulting firms frequently travel overnight to meet with customers. Telecommuting is also becoming more common, allowing workers to do their jobs from remote locations.

Most software engineers work at least 40 hours a week, but about 17 percent work more than 50 hours a week. Software engineers also may have to work evenings or weekends to meet deadlines or solve unexpected technical problems.

Like other workers who spend long hours typing at a computer, software engineers are susceptible to eyestrain, back discomfort, and hand and wrist problems such as carpal tunnel syndrome.

Training, Other Qualifications, and Advancement

Most employers prefer applicants who have at least a bachelor's degree and experience with a variety of computer systems and technologies. In order to remain competitive, computer software engineers must continually strive to acquire the latest technical skills. Advancement opportunities are good for those with relevant experience.

Education and training. Most employers prefer applicants who have at least a bachelor's degree and broad knowledge of, and experience with, a variety of computer systems and technologies. The usual college major for applications software engineers is computer science or software engineering. Systems software engineers often study computer science or computer information systems. Graduate degrees are preferred for some of the more complex jobs. In 2006, about 80 percent of workers had a bachelor's degree or higher.

Academic programs in software engineering may offer the program as a degree option or in conjunction with computer science degrees. Because of increasing emphasis on computer security, software engineers with advanced degrees in areas such as mathematics and systems design will be sought after by software developers, government agencies, and consulting firms.

Students seeking software engineering jobs enhance their employment opportunities by participating in internships or co-ops. These experiences provide students with broad knowledge and experience, making them more attractive to employers. In-

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experienced college graduates may be hired by large computer and consulting firms that train new employees in intensive, company-based programs.

Certification and other qualifications. Systems software vendors offer certification and training programs, but most training authorities say that program certification alone is not sufficient for the majority of software engineering jobs.

People interested in jobs as computer software engineers must have strong problem-solving and analytical skills. They also must be able to communicate effectively with team members, other staff, and the customers they meet. Because they often deal with a number of tasks simultaneously, they must be able to concentrate and pay close attention to detail.

As technology advances, employers will need workers with the latest skills. Computer software engineers must continually strive to acquire new skills if they wish to remain in this dynamic field. To help keep up with changing technology, workers may take continuing education and professional development seminars offered by employers, software vendors, colleges and universities, private training institutions, and professional computing societies. Computer software engineers also need skills related to the industry in which they work. Engineers working for a bank, for example, should have some expertise in finance so that they understand banks' computer needs.

Advancement. As with most occupations, advancement opportunities for computer software engineers increase with experience. Entry-level computer software engineers are likely to test designs. As they become more experienced, engineers may begin helping to design and develop software. Eventually, they may advance to become a project manager, manager of information systems, or chief information officer, especially if they have business skills and training. Some computer software engineers with several years of experience or expertise find lucrative opportunities working as systems designers or independent consultants.

Employment

Computer software engineers held about 857,000 jobs in 2006. Approximately 507,000 were computer applications software engineers, and about 350,000 were computer systems software engineers. Although they are employed in most industries, the largest concentration of computer software engineers—more than 29 percent—is in computer systems design and related services. Many computer software engineers also work for establishments in other industries, such as software publishers, government agencies, manufacturers of computers and related electronic equipment, financial institutions, insurance providers, and management of companies and enterprises.

An increasing number of computer software engineers work as independent consultants on a temporary or contract basis, many of whom are self-employed. About 17,000 computer software engineers were self-employed in 2006.

Job Outlook

Job prospects should be excellent, as computer software engineers are expected to be among the fastest-growing occupations through the year 2016.

Employment change. Employment of computer software engineers is projected to increase by 38 percent over the 2006 to 2016 period, which is much faster than the average for all occupations. This occupation will generate about 324,000 new jobs, over the projections decade, one of the largest employment increases of any occupation.

Employment growth will result as businesses and other organizations adopt and integrate new technologies and seek to maximize the efficiency of their computer systems. Competition among businesses will continue to create incentive for sophisticated technological innovations, and organizations will need more computer software engineers to implement these changes.

Demand for computer software engineers will also increase as computer networking continues to grow. For example, expanding Internet technologies have spurred demand for computer software engineers who can develop Internet, intranet, and World Wide Web applications. Likewise, electronic data-processing systems in business, telecommunications, government, and other settings continue to become more sophisticated and complex. Implementing, safeguarding, and updating computer systems and resolving problems will fuel the demand for growing numbers of systems software engineers.

New growth areas will also continue to arise from rapidly evolving technologies. The increasing uses of the Internet, the proliferation of Web sites, and mobile technology such as wireless Internet have created a demand for a wide variety of new products. As individuals and businesses rely more on handheld computers and wireless networks, it will be necessary to integrate current computer systems with this new, more mobile technology.

In addition, information security concerns have given rise to new software needs. Concerns over "cyber security" should result in businesses and government continuing to invest heavily in software that protects their networks and vital electronic infrastructure from attack. The expansion of this technology in the next 10 years will lead to an increased need for computer engineers to design and develop the software and systems to run these new applications and integrate them into older systems.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Computer software engineers	15-1030	857,000	1,181,000	324,000	38
Computer software engineers, applications	15-1031	507,000	733,000	226,000	45
Computer software engineers, systems software	15-1032	350,000	449,000	99,000	28

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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As with other information technology jobs, outsourcing of software development to other countries may temper somewhat employment growth of computer software engineers. Firms may look to cut costs by shifting operations to foreign countries with lower prevailing wages and highly educated workers. Jobs in software engineering are less prone to being offshored than are jobs in other computer specialties, however, because software engineering requires innovation and intense research and development.

Job prospects. As a result of rapid employment growth over the 2006 to 2016 decade, job prospects for computer software engineers should be excellent. Those with practical experience and at least a bachelor's degree in computer engineering or computer science should have the best opportunities. Employers will continue to seek computer professionals with strong programming, systems analysis, interpersonal, and business skills. In addition to jobs created through employment growth, many job openings will result from the need to replace workers who move into managerial positions, transfer to other occupations, or leave the labor force. Consulting opportunities for computer software engineers also should continue to grow as businesses seek help to manage, upgrade, and customize their increasingly complicated computer systems.

Earnings

In May 2006, median annual earnings of wage-and-salary computer applications software engineers were $79,780. The middle 50 percent earned between $62,830 and $98,470. The lowest 10 percent earned less than $49,350, and the highest 10 percent earned more than $119,770. Median annual earnings in the industries employing the largest numbers of computer applications software engineers in May 2006 were as follows:

Software publishers	$84,560
Computer systems design and related services	78,850
Management, scientific, and technical consulting services	78,850
Management of companies and enterprises	78,580
Insurance carriers	74,230

In May 2006, median annual earnings of wage-and-salary computer systems software engineers were $85,370. The middle 50 percent earned between $67,620 and $105,330. The lowest 10 percent earned less than $53,580, and the highest 10 percent earned more than $125,750. Median annual earnings in the industries employing the largest numbers of computer systems software engineers in May 2006 are as follows:

Research and development in the physical, engineering, and life sciences	$97,220
Scientific research and development services	97,180
Computer and peripheral equipment manufacturing	93,240
Software publishers	87,450
Computer systems design and related services	84,660
Data processing, hosting, and related services	78,270

According to the National Association of Colleges and Employers, starting salary offers for graduates with a bachelor's degree in computer engineering averaged $56,201 in 2007. Starting salary offers for graduates with a bachelor's degree in computer science averaged $53,396.

According to Robert Half Technology, starting salaries for software engineers in software development ranged from $66,500 to $99,750 in 2007. For network engineers, starting salaries ranged from $65,750 to $90,250.

Related Occupations

Other workers who use mathematics and logic extensively include computer systems analysts, computer scientists and database administrators, computer programmers, computer hardware engineers, computer support specialists and systems administrators, engineers, commercial and industrial designers, statisticians, mathematicians, and actuaries.

Sources of Additional Information

Additional information on a career in computer software engineering is available from the following organizations:

➤ Association for Computing Machinery (ACM), 2 Penn Plaza, Suite 701, NY 10121-0701.
Internet: **http://www.acm.org**

➤ Institute of Electronics and Electrical Engineers Computer Society, Headquarters Office, 1730 Massachusetts Ave. N.W., Washington, DC 20036-1992.
Internet: **http://www.computer.org**

➤ National Workforce Center for Emerging Technologies, 3000 Landerholm Circle S.E., Bellevue, WA 98007.
Internet: **http://www.nwcet.org**

➤ University of Washington Computer Science and Engineering Department, AC101 Paul G. Allen Center, Box 352350, 185 Stevens Way, Seattle, WA 98195-2350.
Internet: **http://www.cs.washington.edu/WhyCSE**

Computer Support Specialists and Systems Administrators

(O*NET 15-1041.00, 15-1071.00, 15-1071.01)

Significant Points

- Growth in computer support specialist jobs will be about as fast as the average, while growth in network and computer system administrator jobs will be much faster than average
- There are many paths of entry to these occupations.
- Job prospects should be best for college graduates with relevant skills and experience; certifications and practical experience are essential for people without degrees.

Nature of the Work

In the last decade, computers have become an integral part of everyday life at home, work, school, and nearly everywhere else. Of course, almost every computer user encounters a problem occasionally, whether it is the annoyance of a forgotten password or the disaster of a crashing hard drive. The explosive use

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of computers has created demand for specialists who provide advice to users, as well as for the day-to-day administration, maintenance, and support of computer systems and networks.

Computer support specialists provide technical assistance, support, and advice to customers and other users. This occupational group includes *technical support specialists* and *help-desk technicians*. These troubleshooters interpret problems and provide technical support for hardware, software, and systems. They answer telephone calls, analyze problems by using automated diagnostic programs, and resolve recurring difficulties. Support specialists work either within a company that uses computer systems or directly for a computer hardware or software vendor. Increasingly, these specialists work for help-desk or support services firms, for which they provide computer support to clients on a contract basis.

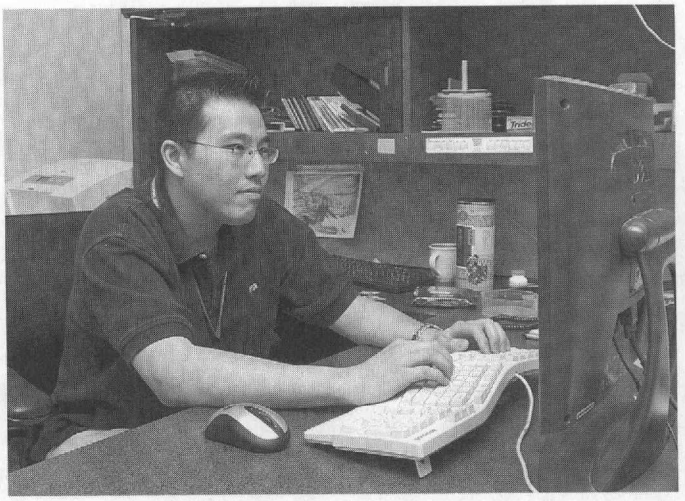
Technical support specialists respond to inquiries from their organizations' computer users and may run automatic diagnostics programs to resolve problems. They also install, modify, clean, and repair computer hardware and software. In addition, they may write training manuals and train computer users in how to use new computer hardware and software. These workers also oversee the daily performance of their company's computer systems and evaluate how useful software programs are.

Help-desk technicians respond to telephone calls and e-mail messages from customers looking for help with computer problems. In responding to these inquiries, help-desk technicians must listen carefully to the customer, ask questions to diagnose the nature of the problem, and then patiently walk the customer through the problem-solving steps.

Help-desk technicians deal directly with customer issues and companies value them as a source of feedback on their products. They are consulted for information about what gives customers the most trouble, as well as other customer concerns. Most computer support specialists start out at the help desk.

Network and *computer systems administrators* design, install, and support an organization's computer systems. They are responsible for local-area networks (LAN), wide-area networks (WAN), network segments, and Internet and intranet systems. They work in a variety of environments, including professional offices, small businesses, government organizations, and large corporations. They maintain network hardware and software, analyze problems, and monitor networks to ensure their availability to system users. These workers gather data to identify customer needs and then use the information to identify, interpret, and evaluate system and network requirements. Administrators also may plan, coordinate, and implement network security measures.

Systems administrators are responsible for maintaining network efficiency. They ensure that the design of an organization's computer system allows all of the components, including computers, the network, and software, to work properly together. Furthermore, they monitor and adjust the performance of existing networks and continually survey the current computer site to determine future network needs. Administrators also troubleshoot problems reported by users and by automated network monitoring systems and make recommendations for future system upgrades.



Computer support specialists provide technical assistance, support, and advice to computer users.

In some organizations, *computer security specialists* may plan, coordinate, and implement the organization's information security. These workers educate users about computer security, install security software, monitor networks for security breaches, respond to cyber attacks, and, in some cases, gather data and evidence to be used in prosecuting cyber crime. The responsibilities of computer security specialists have increased in recent years as cyber attacks have become more common. This and other growing specialty occupations reflect an increasing emphasis on client-server applications, the expansion of Internet and intranet applications, and the demand for more end-user support.

Work environment. Computer support specialists and systems administrators normally work in well-lighted, comfortable offices or computer laboratories. They usually work about 40 hours a week, but if their employer requires computer support over extended hours, they may be "on call" for rotating evening or weekend work. Overtime may be necessary when unexpected technical problems arise. Like other workers who type on a keyboard for long periods, computer support specialists and systems administrators are susceptible to eyestrain, back discomfort, and hand and wrist problems such as carpal tunnel syndrome.

Computer support specialists and systems administrators constantly interact with customers and fellow employees as they answer questions and give advice. Those who work as consultants are away from their offices much of the time, sometimes spending months working in a client's office.

As computer networks expand, more computer support specialists and systems administrators may be able to provide technical support from remote locations. This capability would reduce or eliminate travel to the customer's workplace. Systems administrators also can administer and configure networks and servers remotely, although this practice is not as common as it is among computer support specialists.

Training, Other Qualifications, and Advancement

A college degree is required for some computer support specialist positions, but certification and relevant experience may be sufficient for others. A bachelor's degree is required for many network and computer systems administrator positions.

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For both occupations, strong analytical and communication skills are essential.

Education and training. Due to the wide range of skills required, there are many paths of entry to a job as a computer support specialist or systems administrator. Training requirements for computer support specialist positions vary, but many employers prefer to hire applicants with some formal college education. A bachelor's degree in computer science or information systems is a prerequisite for some jobs; other jobs, however, may require only a computer-related associate degree. And for some jobs, relevant computer experience and certifications may substitute for formal education. For systems administrator jobs, many employers seek applicants with bachelor's degrees, although not necessarily in a computer-related field.

A number of companies are becoming more flexible about requiring a college degree for support positions. In the absence of a degree, however, certification and practical experience are essential. Certification training programs, offered by a variety of vendors and product makers, may help some people to qualify for entry-level positions.

Other qualifications. People interested in becoming a computer support specialist or systems administrator must have strong problem-solving, analytical, and communication skills because troubleshooting and helping others are vital parts of the job. The constant interaction with other computer personnel, customers, and employees requires computer support specialists and systems administrators to communicate effectively on paper, via e-mail, over the phone, or in person. Strong writing skills are useful in preparing manuals for employees and customers.

Advancement. Beginning computer support specialists usually work for organizations that deal directly with customers or in-house users. Support specialists may advance into positions in which they use what they have learned from customers to improve the design and efficiency of future products. Job promotions usually depend more on performance than on formal education. Eventually, some computer support specialists become software engineers, designing products rather than assisting users. Computer support specialists in hardware and software companies often enjoy great upward mobility; advancement sometimes comes within months of becoming employed.

Entry-level network and computer systems administrators are involved in routine maintenance and monitoring of computer systems, typically working behind the scenes in an organization. After gaining experience and expertise, they often are able to advance to more senior-level positions. For example, senior network and computer systems administrators may make presentations to executives and managers on the security of the company computer network. They also may translate the needs of an organization into a set of technical requirements based on the available technology. As with support specialists, administrators may become software engineers involved in system and network design.

As technology continues to improve, computer support specialists and systems administrators must strive to acquire new skills. Many continuing education programs are provided by employers, hardware and software vendors, colleges and universities, and private training institutions. Professional development seminars offered by computing services firms also can enhance skills and advancement opportunities.

Employment

Computer support specialists and systems administrators held about 862,000 jobs in 2006. Of these, approximately 552,000 were computer support specialists and about 309,000 were network and computer systems administrators. Although they worked in a wide range of industries, about 23 percent of all computer support specialists and systems administrators were employed in professional, scientific, and technical services industries, principally computer systems design and related services. Substantial numbers of these workers were also employed in administrative and support services companies, financial institutions, insurance companies, government agencies, educational institutions, software publishers, telecommunications organizations, health care organizations, and management of companies and enterprises.

Employers of computer support specialists and systems administrators range from startup companies to established industry leaders. As computer networks become an integral part of business, industries not typically associated with computers—such as construction—increasingly need computer support workers.

Job Outlook

Employment of computer support specialists and systems administrators is expected to increase faster than the average. Job prospects should be best for those with a college degree and relevant experience.

Employment change. Employment of computer support specialists and systems administrators is expected to increase by 18 percent from 2006 to 2016, which is much faster than the average for all occupations. In addition, this occupation is expected to add 155,000 jobs over the projection decade.

Employment of computer support specialists is expected to increase by 13 percent from 2006 to 2016, which is about as fast as the average for all occupations. Demand for these workers

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Computer support specialists and systems administrators	—	862,000	1,016,000	155,000	18
Computer support specialists	15-1041	552,000	624,000	71,000	13
Network and computer systems administrators	15-1071	309,000	393,000	83,000	27

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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will result as organizations and individuals continue to adopt increasingly sophisticated technology. Job growth will continue to be driven by the ongoing expansion of the computer system design and related services industry, which is projected to remain one of the fastest-growing industries in the U.S. economy. Growth will not be as explosive as during the previous decade, however, because the information technology industry is maturing and because some of these jobs are expected to be outsourced offshore where prevailing wages are lower. Physical location is not as important for computer support specialists as it is for other occupations because these workers can provide assistance remotely and support services are provided around the clock across time zones.

Job growth among computer support specialists reflects the rapid evolution of technology. As computers and software become more complex, support specialists will be needed to provide technical assistance to customers and other users. The adoption of new mobile technologies, such as the wireless Internet, will continue to create a need for these workers to familiarize and educate computer users. Consulting jobs for computer support specialists also should continue to increase as businesses seek help managing, upgrading, and customizing ever more complex computer systems.

Employment of network and computer systems administrators is expected to increase by 27 percent from 2006 to 2016, which is much faster than the average for all occupations. Computer networks have become an integral part of business, and demand for these workers will increase as firms continue to invest in new technologies. The wide use of electronic commerce and the increasing adoption of mobile technologies mean that more establishments will use the Internet to conduct business online. This growth translates into a need for systems administrators who can help organizations use technology to communicate with employees, clients, and consumers.

Demand for computer security specialists will grow as businesses and government continue to invest heavily in "cyber security," protecting vital computer networks and electronic infrastructures from attack. The information security field is expected to generate many new system administrator jobs over the next decade as firms across all industries place a high priority on safeguarding their data and systems.

Employment of network and computer systems administrators, however, may be tempered somewhat by offshore outsourcing, as firms transfer work to countries with lower-prevailing wages and highly skilled work forces. Systems administrators may increasingly be able to manage computer systems from remote locations as technology advances.

Job prospects. Job prospects should be best for college graduates who possess the latest technological skills, particularly graduates who have supplemented their formal education with relevant work experience. Employers will continue to seek computer specialists who possess strong fundamental computer skills combined with good interpersonal and communication skills. Due to the demand for computer support specialists and systems administrators over the next decade, those who have strong computer skills but do not have a college degree should continue to qualify for some entry-level positions.

Earnings

Median annual earnings of wage-and-salary computer support specialists were $41,470 in May 2006. The middle 50 percent earned between $32,110 and $53,640. The lowest 10 percent earned less than $25,290, and the highest 10 percent earned more than $68,540. Median annual earnings in the industries employing the largest numbers of computer support specialists in May 2006 were as follows:

Software publishers	$46,270
Management of companies and enterprises	42,770
Computer systems design and related services	42,510
Colleges, universities, and professional schools	40,130
Elementary and secondary schools	37,880

Median annual earnings of wage-and-salary network and computer systems administrators were $62,130 in May 2006. The middle 50 percent earned between $48,520 and $79,160. The lowest 10 percent earned less than $38,610, and the highest 10 percent earned more than $97,080. Median annual earnings in the industries employing the largest numbers of network and computer systems administrators in May 2006 were as follows:

Wired telecommunications carriers	$70,790
Computer systems design and related services	66,680
Management of companies and enterprises	66,020
Colleges, universities, and professional schools	54,590
Elementary and secondary schools	53,750

According to Robert Half Technology, starting salaries in 2007 ranged from $27,500 to $37,000 for help-desk workers. Starting salaries for desktop support analysts ranged from $46,500 to $65,250. For systems administrators, starting salaries ranged from $50,000 to $75,750.

Related Occupations

Other computer specialists include computer programmers, computer software engineers, computer systems analysts, and computer scientists and database administrators. Other workers who respond to customer inquiries are customer service representatives.

Sources of Additional Information

For additional information about a career as a computer support specialist, contact:

➤ Association of Support Professionals, 122 Barnard Ave., Watertown, MA 02472.

For additional information about a career as a systems administrator, contact:

➤ The League of Professional System Administrators, 15000 Commerce Parkway, Suite C, Mount Laurel, NJ 08054.
Internet: **http://lopsa.org/**

➤ National Workforce Center for Emerging Technologies, 3000 Landerholm Circle SE., Bellevue, WA 98007.
Internet: **http://www.nwcet.org**

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Computer Systems Analysts

(O*NET 15-1051.00)

Significant Points

- Employers generally prefer applicants who have at least a bachelor's degree in computer science, information science, or management information systems (MIS).
- Employment is expected to increase much faster than the average and more new jobs are expected to arise than in all but a few other occupations.
- Very good job prospects are expected as organizations continue to adopt increasingly sophisticated technologies.

Nature of the Work

All organizations rely on computer and information technology to conduct business and operate efficiently. Computer systems analysts help organizations to use technology effectively and to incorporate rapidly changing technologies into their existing systems. The work of computer systems analysts evolves rapidly, reflecting new areas of specialization and changes in technology.

Computer systems analysts solve computer problems and use computer technology to meet the needs of an organization. They may design and develop new computer systems by choosing and configuring hardware and software. They may also devise ways to apply existing systems' resources to additional tasks. Most systems analysts work with specific types of computer systems—for example, business, accounting, or financial systems or scientific and engineering systems—that vary with the kind of organization. Analysts who specialize in helping an organization select the proper system software and infrastructure are often called *system architects*. Analysts who specialize in developing and fine-tuning systems often are known as *systems designers*.

To begin an assignment, systems analysts consult managers and users to define the goals of the system. Analysts then design a system to meet those goals. They specify the inputs that the system will access, decide how the inputs will be processed, and format the output to meet users' needs. Analysts use techniques such as structured analysis, data modeling, information engineering, mathematical model building, sampling, and cost accounting to make sure their plans are efficient and complete. They also may prepare cost-benefit and return-on-investment analyses to help management decide whether implementing the proposed technology would be financially feasible.

When a system is approved, systems analysts determine what computer hardware and software will be needed to set it up. They coordinate tests and observe the initial use of the system to ensure that it performs as planned. They prepare specifications, flow charts, and process diagrams for computer programmers to follow; then they work with programmers to "debug," or eliminate errors, from the system. Systems analysts who do more in-depth testing may be called *software quality assurance analysts*. In addition to running tests, these workers diagnose problems, recommend solutions, and determine whether program requirements have been met.



Computer systems analysts use information technology to help meet the needs of an organization.

In some organizations, *programmer-analysts* design and update the software that runs a computer. They also create custom applications tailored to their organization's tasks. Because they are responsible for both programming and systems analysis, these workers must be proficient in both areas. (A separate section on computer programmers appears elsewhere in the *Handbook*.) As this dual proficiency becomes more common, analysts are increasingly working with databases, object-oriented programming languages, client–server applications, and multimedia and Internet technology.

One challenge created by expanding computer use is the need for different computer systems to communicate with each other. Systems analysts work to make the computer systems within an organization, or across organizations, compatible so that information can be shared. Many systems analysts are involved with these "networking" tasks, connecting all the computers internally, in an individual office, department, or establishment, or externally, as when setting up e-commerce networks to facilitate business among companies.

Work environment. Computer systems analysts work in offices or laboratories in comfortable surroundings. They usually work about 40 hours a week—about the same as many other professional or office workers. Evening or weekend work may be necessary, however, to meet deadlines or solve specific problems. Many analysts telecommute, using computers to work from remote locations.

Like other workers who spend long periods typing on a computer, computer systems analysts are susceptible to eyestrain, back discomfort, and hand and wrist problems such as carpal tunnel syndrome or cumulative trauma disorder.

Training, Other Qualifications, and Advancement

Training requirements for computer systems analysts vary depending on the job, but many employers prefer applicants who have a bachelor's degree. Relevant work experience also is very important. Advancement opportunities are good for those with the necessary skills and experience.

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Education and training. When hiring computer systems analysts, employers usually prefer applicants who have at least a bachelor's degree. For more technically complex jobs, people with graduate degrees are preferred.

The level and type of education that employers require reflects changes in technology. Employers often scramble to find workers capable of implementing the newest technologies. Workers with formal education or experience in information security, for example, are currently in demand because of the growing use of computer networks, which must be protected from threats.

For jobs in a technical or scientific environment, employers often seek applicants who have at least a bachelor's degree in a technical field, such as computer science, information science, applied mathematics, engineering, or the physical sciences. For jobs in a business environment, employers often seek applicants with at least a bachelor's degree in a business-related field such as management information systems (MIS). Increasingly, employers are seeking individuals who have a master's degree in business administration (MBA) with a concentration in information systems.

Despite the preference for technical degrees, however, people who have degrees in other majors may find employment as systems analysts if they also have technical skills. Courses in computer science or related subjects combined with practical experience can qualify people for some jobs in the occupation.

Employers generally look for people with expertise relevant to the job. For example, systems analysts who wish to work for a bank should have some expertise in finance, and systems analysts who wish to work for a hospital should have some knowledge of health management.

Technological advances come so rapidly in the computer field that continuous study is necessary to remain competitive. Employers, hardware and software vendors, colleges and universities, and private training institutions offer continuing education to help workers attain the latest skills. Additional training may come from professional development seminars offered by professional computing societies.

Other qualifications. Employers usually look for people who have broad knowledge and experience related to computer systems and technologies, strong problemsolving and analytical skills, and the ability to think logically. In addition, because they often deal with a number of tasks simultaneously, the ability to concentrate and pay close attention to detail is important. Although these workers sometimes work independently, they frequently work in teams on large projects. Therefore, they must have good interpersonal skills and be able to communicate effectively with computer personnel, users, and other staff who may have no technical background.

Advancement. With experience, systems analysts may be promoted to senior or lead systems analyst. Those who possess leadership ability and good business skills also can become computer and information systems managers or can advance into other management positions such as manager of information systems or chief information officer. Those with work experience and considerable expertise in a particular subject or application may find lucrative opportunities as independent consultants, or may choose to start their own computer consulting firms.

Employment

Computer systems analysts held about 504,000 jobs in 2006. Although they are increasingly employed in every sector of the economy, the greatest concentration of these workers is in the computer systems design and related services industry. Computer systems analysts are also employed by governments; insurance companies; financial institutions; hospitals; management, scientific, and technical consulting services firms; data processing services firms; professional and commercial equipment wholesalers; universities; and management of companies and enterprises.

A growing number of systems analysts are employed on a temporary or contract basis; many of these individuals are self-employed, working independently as contractors or consultants. About 29,000 computer systems analysts were self-employed in 2006.

Job Outlook

Employment is expected to grow much faster than the average for all occupations. As a result of this rapid growth, job prospects should be very good.

Employment change. Employment of computer systems analysts is expected to grow by 29 percent from 2006 to 2016, which is much faster than the average for all occupations. In addition, the 146,000 new jobs that are expected to arise over the projections decade will be substantial. Demand for these workers will increase as organizations continue to adopt and integrate increasingly sophisticated technologies. Job growth will not be as rapid as during the preceding decade, however, as the information technology sector matures and as routine work is increasingly outsourced offshore to foreign countries with lower prevailing wages.

The growth of electronic commerce and the integration of Internet technologies into business have resulted in a growing need for specialists who can develop and support Internet and intranet applications. Moreover, falling prices of computer hardware and software should continue to induce more businesses to expand their computerized operations and incorporate new technologies.

The demand for computer networking within organizations will also drive demand for computer systems analysts. The introduction of the wireless Internet, known as WiFi, and of personal mobile computers has created a need for new systems

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Computer systems analysts	15-1051	504,000	650,000	146,000	29

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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that can integrate these technologies into existing networks. Explosive growth in these areas is expected to fuel demand for analysts who are knowledgeable about systems integration and network, data, and communications security.

As more sophisticated and complex technology is implemented across all organizations, demand for systems analysts will remain strong. These workers will be called upon to solve problems and to integrate new technologies with existing ones. Also, the increasing importance being placed on "cyber-security"—the protection of electronic information—will result in a need for workers skilled in information security.

As with other information technology jobs, employment growth may be tempered somewhat as some computer systems analyst jobs are outsourced offshore. Firms may look to cut costs by shifting operations to foreign countries with lower prevailing wages and highly educated workers who have strong technical skills.

Job prospects. Job prospects should be very good. Job openings will occur as a result of strong job growth and from the need to replace workers who move into managerial positions or other occupations, or who leave the labor force. As technology becomes more sophisticated and complex, employers demand a higher level of skill and expertise from their employees. Individuals with an advanced degree in computer science or computer engineering or with an MBA with a concentration in information systems should have the best prospects. College graduates with a bachelor's degree in computer science, computer engineering, information science, or management information systems also should enjoy very good prospects, particularly if they have supplemented their formal education with practical experience. Because employers continue to seek computer specialists who can combine strong technical skills with good interpersonal and business skills, graduates with non-computer-science degrees who have had courses in computer programming, systems analysis, and other information technology subjects also should continue to find jobs in computer fields.

Earnings

Median annual earnings of wage-and-salary computer systems analysts were $69,760 in May 2006. The middle 50 percent earned between $54,320 and $87,600 a year. The lowest 10 percent earned less than $42,780, and the highest 10 percent earned more than $106,820. Median annual earnings in the industries employing the largest numbers of computer systems analysts in May 2006 were:

Professional and commercial equipment and supplies merchant wholesalers	$81,080
Computer systems design and related services	71,680
Management of companies and enterprises	71,090
Insurance carriers	69,990
State government	61,340

According to the National Association of Colleges and Employers, starting offers for graduates with a bachelor's degree in computer science averaged $53,396. Starting offers for graduates with a bachelor's degree in information sciences and systems averaged $50,852. For those with a degree in management information systems/business data processing, starting offers averaged $47,648.

According to Robert Half Technology, starting salaries for systems analysts ranged from $64,000 to $87,000 in 2007. Starting salaries for business systems analysts ranged from $61,250 to $86,500. Starting salaries for developer/programmer analysts ranged from $55,250 to $90,250.

Related Occupations

Other workers who use computers extensively and who use logic and creativity to solve business and technical problems include computer programmers, computer software engineers, computer and information systems managers, engineers, mathematicians, statisticians, operations research analysts, management analysts, and actuaries.

Sources of Additional Information

Further information about computer careers is available from:

➤ Association for Computing Machinery (ACM), 2 Penn Plaza, Suite 701,New York, NY 10121-0701.
Internet: **http://www.acm.org**

➤ Institute of Electrical and Electronics Engineers Computer Society, Headquarters Office, 1730 Massachusetts Ave. NW., Washington, DC 20036-1992.
Internet: **http://www.computer.org**

➤ National Workforce Center for Emerging Technologies, 3000 Landerholm Circle SE., Bellevue, WA 98007.
Internet: **http://www.nwcet.org**

➤ University of Washington Computer Science and Engineering Department, AC101 Paul G. Allen Center, Box 352350, 185 Stevens Way, Seattle, WA 98195-2350.
Internet: **http://www.cs.washington.edu/WhyCSE**

Mathematicians

(O*NET 15–2021.00)

Significant Points

- A Ph.D. in mathematics usually is the minimum educational requirement, except in the Federal Government.
- Master's degree and Ph.D. holders with a strong background in mathematics and a related field, such as computer science or engineering, should have better employment opportunities in related occupations.
- Average employment growth is expected for mathematicians.

Nature of the Work

Mathematics is one of the oldest and most fundamental sciences. Mathematicians use mathematical theory, computational techniques, algorithms, and the latest computer technology to solve economic, scientific, engineering, physics, and business problems. The work of mathematicians falls into two broad classes—theoretical (pure) mathematics and applied mathemat-

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ics. These classes, however, are not sharply defined and often overlap.

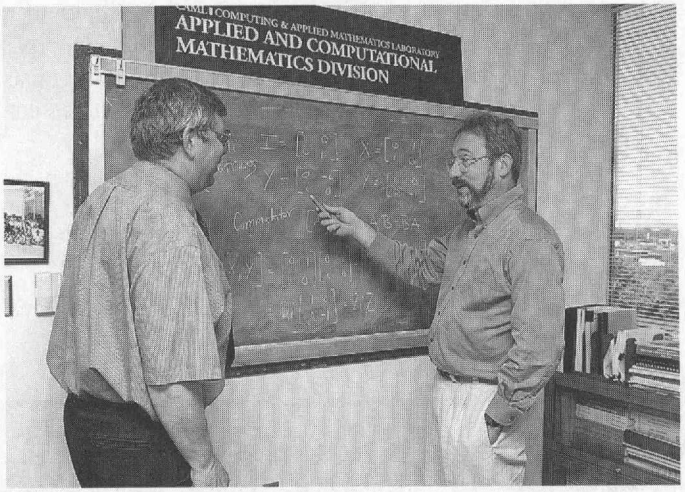
Theoretical mathematicians advance mathematical knowledge by developing new principles and recognizing previously unknown relationships between existing principles of mathematics. Although these workers seek to increase basic knowledge without necessarily considering its practical use, such pure and abstract knowledge has been instrumental in producing or furthering many scientific and engineering achievements. Many theoretical mathematicians are employed as university faculty, dividing their time between teaching and conducting research. (See the statement on teachers—postsecondary elsewhere in the *Handbook*.)

Applied mathematicians, on the other hand, use theories and techniques, such as mathematical modeling and computational methods, to formulate and solve practical problems in business, government, engineering, and the physical, life, and social sciences. For example, they may analyze the most efficient way to schedule airline routes between cities, the effects and safety of new drugs, the aerodynamic characteristics of an experimental automobile, or the cost-effectiveness of alternative manufacturing processes.

Applied mathematicians working in industrial research and development may develop or enhance mathematical methods when solving a difficult problem. Some mathematicians, called cryptanalysts, analyze and decipher encryption systems—codes—designed to transmit military, political, financial, or law enforcement-related information.

Applied mathematicians start with a practical problem, envision its separate elements, and then reduce the elements to mathematical variables. They often use computers to analyze relationships among the variables and solve complex problems by developing models with alternative solutions.

Individuals with titles other than mathematician do much of the work in applied mathematics. In fact, because mathematics is the foundation on which so many other academic disciplines are built, the number of workers using mathematical techniques is much greater than the number formally called mathematicians. For example, engineers, computer scientists, physicists, and economists are among those who use mathematics extensively. Some professionals, including statisticians, actuaries, and operations research analysts, are actually specialists in a particular branch of mathematics. (For more information, see the statements on actuaries, operations research analysts, and statisticians elsewhere in the *Handbook*.) Applied mathematicians are frequently required to collaborate with other workers in their organizations to find common solutions to problems.



Applied mathematicians start with a practical problem, envision its separate elements, and then reduce the elements to mathematical variables.

Work environment. Mathematicians usually work in comfortable offices. They often are part of interdisciplinary teams that may include economists, engineers, computer scientists, physicists, technicians, and others. Deadlines, overtime work, special requests for information or analysis, and prolonged travel to attend seminars or conferences may be part of their jobs.

Mathematicians who work in academia usually have a mix of teaching and research responsibilities. These mathematicians may conduct research alone or in close collaboration with other mathematicians. Collaborators may work together at the same institution or from different locations, using technology such as e-mail to communicate. Mathematicians in academia also may be aided by graduate students.

Training, Other Qualifications, and Advancement

A Ph.D. degree in mathematics usually is the minimum educational requirement for prospective mathematicians, except in the Federal Government.

Education and training. In the Federal Government, entry-level job candidates usually must have at least a bachelor's degree with a major in mathematics or 24 semester hours of mathematics courses. Outside the Federal Government, bachelor's degree holders in mathematics usually are not qualified for most jobs, and many seek advanced degrees in mathematics or a related discipline.

Most colleges and universities offer a bachelor's degree in mathematics. Courses usually required for this degree include calculus, differential equations, and linear and abstract algebra. Additional courses might include probability theory and statistics, mathematical analysis, numerical analysis, topology, discrete mathematics, and mathematical logic. Many colleges and universities advise or require students majoring in mathematics to take courses in a closely related field, such as computer science, engineering, life science, physical science, or economics. A double major in mathematics and another related discipline is particularly desirable to many employers. High school students who are prospective college mathematics majors should take as many mathematics courses as possible while in high school.

In private industry, candidates for mathematician jobs typically need a Ph.D., although there may be opportunities for those with a master's degree. Most of the positions designated for mathematicians are in research and development laboratories, as part of technical teams.

In 2007, there were more than 300 graduate programs, offering both master's and doctoral degrees, in pure or applied mathematics around the country. In graduate school, students conduct research and take advanced courses, usually specializing in a subfield of mathematics.

Other qualifications. For jobs in applied mathematics, training in the field in which mathematics will be used is very important. Mathematics is used extensively in physics, actuarial science, statistics, engineering, and operations research. Com-

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puter science, business and industrial management, economics, finance, chemistry, geology, life sciences, and behavioral sciences are likewise dependent on applied mathematics. Mathematicians also should have substantial knowledge of computer programming, because most complex mathematical computation and much mathematical modeling are done on a computer.

Mathematicians need to have good reasoning to identify, analyze, and apply basic principles to technical problems. Communication skills also are important, as mathematicians must be able to interact and discuss proposed solutions with people who may not have extensive knowledge of mathematics.

Advancement. Bachelor's degree holders who meet State certification requirements may become primary or secondary school mathematics teachers. (For additional information, see the statement on teachers—preschool, kindergarten, elementary, middle, and secondary elsewhere in the *Handbook*.)

The majority of those with a master's degree in mathematics who work in private industry do so not as mathematicians but in related fields such as computer science, where they have titles such as computer programmer, systems analyst, or systems engineer.

Employment

Mathematicians held about 3,000 jobs in 2006. Many people with mathematical backgrounds also worked in other occupations. For example, there were about 54,000 jobs as postsecondary mathematical science teachers in 2006.

Many mathematicians work for Federal or State governments. The U.S. Department of Defense is the primary Federal employer, accounting for about 37 percent of the mathematicians employed by the Federal Government. Many of the other mathematicians employed by the Federal Government work for the National Aeronautics and Space Administration (NASA).

In the private sector, major employers include scientific research and development services and management, scientific, and technical consulting services. Some mathematicians also work for software publishers, insurance companies, and in aerospace or pharmaceutical manufacturing.

Job Outlook

Employment of mathematicians is expected to grow as fast as the average. However, keen competition for jobs is expected.

Employment change. Employment of mathematicians is expected to increase by 10 percent during the 2006–16 decade, as fast as the average for all occupations. Advancements in technology usually lead to expanding applications of mathematics, and more workers with knowledge of mathematics will be required in the future. However, jobs in industry and government often require advanced knowledge of related scientific disciplines in addition to mathematics. The most common fields in which mathematicians study and find work are computer science and software development, physics, engineering, and operations research. More mathematicians also are becoming involved in financial analysis.

Job prospects. Job competition will remain keen because employment in this occupation is relatively small and few new jobs are expected. Master's degree and Ph.D. holders with a strong background in mathematics and a related discipline, such as engineering or computer science, and who apply mathematical theory to real-world problems will have the best job prospects in related occupations.

Holders of a master's degree in mathematics will face very strong competition for jobs in theoretical research. Because the number of Ph.D. degres awarded in mathematics continues to exceed the number of available university positions—especially those that are tenure tracked—many graduates will need to find employment in industry and government.

Additionally, employment in theoretical mathematical research is sensitive to general economic fluctuations and to changes in government spending. Job prospects will be greatly influenced by changes in public and private funding for research and development.

Earnings

Median annual earnings of mathematicians were $86,930 in May 2006. The middle 50 percent earned between $62,970 and $106,250. The lowest 10 percent had earnings of less than $43,500, while the highest 10 percent earned more than $132,190.

In early 2007, the average annual salary for mathematicians employed by the Federal Government in supervisory, nonsupervisory, and managerial positions was $93,539; for mathematical statisticians, $96,121; and for cryptanalysts, the average was $90,435.

Related Occupations

Other occupations that require extensive knowledge of mathematics or, in some cases, a degree in mathematics include actuaries, statisticians, computer programmers, computer systems analysts, computer scientists and database administrators, computer software engineers, and operations research analysts. A strong background in mathematics also facilitates employment as teachers—postsecondary; teachers—preschool, kindergarten, elementary, middle, and secondary; engineers; economists; market and survey researchers; financial analysts and personal financial advisors; and physicists and astronomers.

Sources of Additional Information

For more information about careers and training in mathematics, especially for doctoral-level employment, contact:

➤ American Mathematical Society, 201 Charles St., Providence, RI 02904-2294. Internet: **http://www.ams.org**

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Mathematicians	15-2021	3,000	3,300	300	10

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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For specific information on careers in applied mathematics, contact:

➤ Society for Industrial and Applied Mathematics, 3600 University City Science Center, Philadelphia, PA 19104-2688. Internet: **http://www.siam.org**

Information on obtaining positions as mathematicians with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not tollfree, and charges may result. For advice on how to find and apply for Federal jobs, see the *Occupational Outlook Quarterly* article "How to get a job in the Federal Government," online at: **http://www.bls.gov/opub/ooq/2004/summer/art01.pdf**

Operations Research Analysts

(O*NET 15-2031.00)

Significant Points

- While a bachelor's degree is the minimum requirement, employers generally prefer applicants with at least a master's degree in operations research or a closely related field.
- Computer programming skills and keeping up to date with technological advances and improvements in analytical methods are essential.
- Employment growth is projected to be as fast as the average for all occupations.
- Individuals with a master's or Ph.D. degree in operations research or a closely related subject should find opportunities in a number of occupations that use their computer, mathematical, and problem-solving skills.

Nature of the Work

"Operations research" and "management science" are terms that are used interchangeably to describe the discipline of using advanced analytical techniques to make better decisions and to solve problems. The procedures of operations research were first formalized by the military. They have been used in wartime to effectively deploy radar, search for enemy submarines, and get supplies to where they are most needed. In peacetime and in private enterprises, operations research is used in planning business ventures and analyzing options by using statistical analysis, data and computer modeling, linear programming, and other mathematical techniques.

Large organizations are very complex. They must effectively manage money, materials, equipment, and people. Operations research analysts find better ways to coordinate these elements by applying analytical methods from mathematics, science, and engineering. Analysts often find many possible solutions for meeting the goals of a project. These potential solutions are presented to managers, who choose the course of action that they think best.

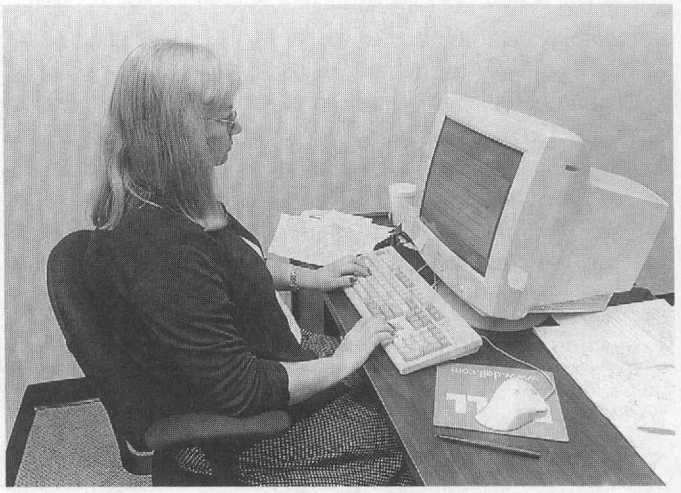
Operations research analysts are often involved in top-level strategizing, planning, and forecasting. They help to allocate resources, measure performance, schedule, design production facilities and systems, manage the supply chain, set prices, coordinate transportation and distribution, or analyze large databases.

The duties of the operations research analyst vary according to the structure and management of the organization they are assisting. Some firms centralize operations research in one department; others use operations research in each division. Operations research analysts also may work closely with senior managers to identify and solve a variety of problems. Analysts often have one area of specialization, such as working in the transportation or the financial services industry.

Operations research analysts start a project by listening to managers describe a problem. Then, analysts ask questions and formally define the problem. For example, an operations research analyst for an auto manufacturer may be asked to determine the best inventory level for each of the parts needed on a production line and to ascertain the optimal number of windshields to be kept in stock. Too many windshields would be wasteful and expensive, whereas too few could halt production.

Analysts would study the problem, breaking it into its components. Then they would gather information from a variety of sources. To determine the optimal inventory, operations research analysts might talk with engineers about production levels, discuss purchasing arrangements with buyers, and examine storage-cost data provided by the accounting department.

Relevant information in hand, the analysts determine the most appropriate analytical technique. Techniques used may include a Monte Carlo simulation, linear and nonlinear programming, dynamic programming, queuing and other stochastic-process models, Markov decision processes, econometric methods, data envelopment analysis, neural networks, expert systems, decision analysis, and the analytic hierarchy process. Nearly all of these techniques involve the construction of a mathemati-



Operations research analysts need strong computer, mathematical, and problem-solving skills.

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cal model that attempts to describe the system being studied. So, the problem of the windshields, for example, would be described as a set of equations that try to model real-world conditions.

The use of models enables the analyst to explicitly describe the different components and clarify the relationships among them. The descriptions can be altered to examine what may happen to the system under different circumstances. In most cases, a computer program is developed to numerically evaluate the model.

Usually the model chosen is modified and run repeatedly to obtain different solutions. A model for airline flight scheduling, for example, might stipulate such things as connecting cities, the amount of fuel required to fly the routes, projected levels of passenger demand, varying ticket and fuel prices, pilot scheduling, and maintenance costs. By assessing different possible schedules, the analyst is able to determine the best flight schedule consistent with particular assumptions.

Based on the results of the analysis, the operations research analyst presents recommendations to managers. The analyst may need to modify and rerun the computer program to consider different assumptions before presenting the final recommendation. Once managers reach a decision, the analyst usually works with others in the organization to ensure the plan's successful implementation.

Work environment. Operations research analysts generally work regular hours in an office environment. However, because they work on projects that are of immediate interest to top managers, operations research analysts often are under pressure to meet deadlines and may work more than 40 hours a week.

Training, Other Qualifications, and Advancement

A college degree in operations research generally is required. Computer programming skills are essential.

Education and training. Employers generally prefer applicants with at least a master's degree in operations research or a closely related field—such as computer science, engineering, business, mathematics, information systems, or management science—coupled with a bachelor's degree in computer science or a quantitative discipline such as economics, mathematics, or statistics. Dual graduate degrees in operations research and computer science are especially attractive to employers. There are more than 130 programs in operations research and related studies in colleges and universities across the United States.

Continuing education is important for operations research analysts. Keeping up to date with technological advances and improvements in analytical methods is vital for maintaining their problem-solving skills.

Other qualifications. Computers are the most important tools used by operations research analysts, so analysts must have training and experience in programming. Analysts typically also need to be proficient in database collection and management, and the development and use of sophisticated software packages.

Operations research analysts must be able to think logically, work well with people, and write and speak well.

Advancement. Beginning analysts usually perform routine work under the supervision of more experienced analysts. As novices gain knowledge and experience, they are assigned more complex tasks and are given greater autonomy to design models and solve problems.

Operations research analysts can advance by becoming technical specialists or supervisors on more complicated projects. Analysts also gain valuable insights into the industry where they work and may assume higher level managerial or administrative positions. Operations research analysts with significant experience or expertise may become consultants, and some open their own consulting practices.

Employment

Operations research analysts held about 58,000 jobs in 2006. Major employers include computer systems design firms; insurance carriers and other financial institutions; telecommunications companies; management, scientific, and technical consulting services firms; and Federal, State, and local governments. Most operations research analysts in the Federal Government work for the Department of Defense, and many in private industry work directly or indirectly on national defense.

Job Outlook

Employment of operations research analysts is projected to grow as fast as the average for all occupations. Individuals with a master's or Ph.D. degree in operations research or a closely related subject should find job opportunities in a number of occupations that use their computer, mathematical, and problem-solving skills.

Employment change. Employment of operations research analysts is expected to grow 11 percent, as fast as the average for all occupations between 2006 and 2016. Demand for operations research analysis should continue to grow. Organizations increasingly will be faced with the pressure of growing domestic and international competition and must work to make their operations as effective as possible. As a result, businesses increasingly will rely on operations research analysts to optimize profits by improving productivity and reducing costs. As new technology is introduced into the marketplace, operations research analysts will be needed to determine how to use the technology in the best way.

Additionally, technological advancements have extended the availability of data access and storage, making information more readily available. Advancements in computing capabilities and analytical software have made it cheaper and faster

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Operations research analysts	15-2031	58,000	65,000	6,200	11

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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for analysts to solve problems. As problem solving becomes cheaper and faster with technological advances, more firms will have the ability to employ or consult with analysts.

Job prospects. Graduates with degrees in operations research or closely related fields should find opportunities in a number of occupations where their computer, mathematical, and problem-solving skills are needed—operations research analyst, systems analyst, computer scientist, or management analyst, for example. In addition to job growth, some openings will result from the need to replace analysts retiring or leaving the occupation permanently for other reasons. Analysts who keep up with the latest technological advancements and software will have the best opportunities.

Jobs for operations research analysts exist in almost every industry because of the diversity of applications for their work. As businesses and government agencies continue to contract out jobs to cut costs, opportunities for operations research analysts will be best in management, scientific, and technical consulting firms. Opportunities in the military exist as well, but will depend on the size of future military budgets. Military leaders rely on operations research analysts to test and evaluate the accuracy and effectiveness of new weapons systems and strategies. (See the *Handbook* statement on job opportunities in the Armed Forces.)

Earnings

Median annual earnings of operations research analysts were $64,650 in May 2006. The middle 50 percent earned between $48,820 and $85,760. The lowest 10 percent had earnings of less than $38,760, while the highest 10 percent earned more than $108,290. Median annual earnings of operations research analysts working in management, scientific, and technical consulting services were $69,870.

The average annual salary for operations research analysts in the Federal Government in nonsupervisory, supervisory, and managerial positions was $91,207 in 2007.

Employer-sponsored training is often another part of an analyst's compensation. Some analysts attend advanced university classes on these subjects at their employer's expense.

Related Occupations

Operations research analysts apply advanced analytical methods to large, complicated problems. Economists, computer systems analysts, mathematicians, and engineers also use advanced analysis and often apply the principles of operations research. Workers in other occupations that also stress advanced analysis include computer scientists and database administrators, computer programmers, statisticians, and market and survey researchers. Because its goal is improved organizational effectiveness, operations research also is closely allied to managerial occupations such as computer and information systems managers, and management analysts.

Sources of Additional Information

For information on career opportunities and a list of degree programs for operations research analysts, contact:

➤ Institute for Operations Research and the Management Sciences, 7240 Parkway Dr., Suite 310, Hanover, MD 21076. Internet: **http://www.informs.org**

For information on operations research careers and degree programs in the Armed Forces, contact:

➤ Military Operations Research Society, 1703 N. Beauregard St., Suite 450, Alexandria, VA 22311. Internet: **http://www.mors.org**

Information on obtaining positions as operations research analysts with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result. For advice on how to find and apply for Federal jobs, see the *Occupational Outlook Quarterly* article "How to get a job in the Federal Government," online at: **http://www.bls.gov/opub/ooq/2004/summer/art01.pdf**.

Statisticians

(O*NET 15-2041.00)

Significant Points

- About 30 percent of statisticians work for Federal, State, and local governments; other employers include scientific research and development services and finance and insurance firms.
- A master's degree in statistics or mathematics is the minimum educational requirement for most jobs as a statistician.
- Employment of statisticians is projected to grow about as fast as average.
- Individuals with a degree in statistics should have opportunities in a variety of fields.

Nature of the Work

Statistics is the scientific application of mathematical principles to the collection, analysis, and presentation of numerical data. Statisticians apply their mathematical and statistical knowledge to the design of surveys and experiments; the collection, processing, and analysis of data; and the interpretation of the experiment and survey results. Opinion polls, statements of accuracy on scales and other measuring devises, and information about average earnings in an occupation are all usually the work of statisticians.

Statisticians may apply their knowledge of statistical methods to a variety of subject areas, such as biology, economics, engineering, medicine, public health, psychology, marketing, education, and sports. Many economic, social, political, and military decisions cannot be made without statistical techniques, such as the design of experiments to gain Federal approval of a newly manufactured drug. Statistics might be needed to show whether the seemingly good results of a drug were likely be-

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Individuals with a degree in statistics should have opportunities in a variety of fields.

cause of the drug rather than just the effect of random variation in patient outcomes.

One technique that is especially useful to statisticians is sampling—obtaining information about a population of people or group of things by surveying a small portion of the total. For example, to determine the size of the audience for particular programs, television-rating services survey only a few thousand families, rather than all viewers. Statisticians decide where and how to gather the data, determine the type and size of the sample group, and develop the survey questionnaire or reporting form. They also prepare instructions for workers who will collect and tabulate the data. Finally, statisticians analyze, interpret, and summarize the data using computer software.

In business and industry, statisticians play an important role in quality control and in product development and improvement. In an automobile company, for example, statisticians might design experiments to determine the failure time of engines exposed to extreme weather conditions by running individual engines until failure and breakdown. Working for a pharmaceutical company, statisticians might develop and evaluate the results of clinical trials to determine the safety and effectiveness of new medications. At a computer software firm, statisticians might help construct new statistical software packages to analyze data more accurately and efficiently. In addition to product development and testing, some statisticians also are involved in deciding what products to manufacture, how much to charge for them, and to whom the products should be marketed. Statisticians also may manage assets and liabilities, determining the risks and returns of certain investments.

Statisticians also are employed by nearly every government agency. Some government statisticians develop surveys that measure population growth, consumer prices, or unemployment. Other statisticians work for scientific, environmental, and agricultural agencies and may help figure out the average level of pesticides in drinking water, the number of endangered species living in a particular area, or the number of people afflicted with a particular disease. Statisticians also are employed in national defense agencies, determining the accuracy of new weapons and the likely effectiveness of defense strategies.

Because statistical specialists are employed in so many work areas, specialists who use statistics often have different professional designations. For example, a person using statistical methods to analyze economic data may have the title econometrician, while statisticians in public health and medicine may hold titles such as biostatistician or biometrician.

Work environment. Statisticians generally work regular hours in an office environment. Sometimes, they may work more hours to meet deadlines.

Some statisticians travel to provide advice on research projects, supervise and set up surveys, or gather statistical data. While advanced communications devices such as e-mail and teleconferencing are making it easier for statisticians to work with clients in different areas, there still are situations that require the statistician to be present, such as during meetings or while gathering data.

Training, Other Qualifications, and Advancement

A master's degree in statistics or mathematics is the minimum educational requirement, but research and academic jobs generally require a Ph.D., Federal Government jobs require at least a bachelor's degree.

Education and training. A master's degree in statistics or mathematics usually is the minimum educational requirement for most statistician jobs. Research and academic positions usually require a Ph.D. in statistics. Beginning positions in industrial research often require a master's degree combined with several years of experience.

Jobs with the Federal Government require at least a bachelor's degree. The training required for employment as an entry-level statistician in the Federal Government is a bachelor's degree, including at least 15 semester hours of statistics or a combination of 15 hours of mathematics and statistics, if at least 6 semester hours are in statistics. Qualifying as a mathematical statistician in the Federal Government requires 24 semester hours of mathematics and statistics, with a minimum of 6 semester hours in statistics and 12 semester hours in an area of advanced mathematics, such as calculus, differential equations, or vector analysis.

In 2007, more than 200 universities offered a degree program in statistics, biostatistics, or mathematics. Many other schools also offered graduate-level courses in applied statistics for students majoring in biology, business, economics, education, engineering, psychology, and other fields. Acceptance into graduate statistics programs does not require an undergraduate degree in statistics, although good training in mathematics is essential.

Many schools also offered degrees in mathematics, operations research, and other fields that include a sufficient number of courses in statistics to qualify graduates for some entry-level positions with the Federal Government. Required subjects for statistics majors include differential and integral calculus, statistical methods, mathematical modeling, and probability theory. Additional recommended courses for undergraduates include linear algebra, design and analysis of experiments, applied multivariate analysis, and mathematical statistics.

Because computers are used extensively for statistical applications, a strong background in computer science is highly recommended. For positions involving quality and productivity improvement, training in engineering or physical science is use-

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ful. A background in biological, chemical, or health science is important for positions involving the preparation and testing of pharmaceutical or agricultural products. Courses in economics and business administration are helpful for many jobs in market research, business analysis, and forecasting.

Advancements in technology have made a great impact on statistics. Statistical modeling continues to become quicker and easier because of increased computational power and new analytical methods or software. Continuing education is important for statisticians; they need to stay abreast emerging technologies to perform well.

Other qualifications. Good communications skills are important for prospective statisticians in industry, who often need to explain technical matters to persons without statistical expertise. An understanding of business and the economy also is valuable for those who plan to work in private industry.

Advancement. Beginning statisticians generally are supervised by an experienced statistician. With experience, they may advance to positions with more technical responsibility and, in some cases, supervisory duties. Opportunities for promotion are greater for people with advanced degrees. Master's and Ph.D. degree holders usually enjoy independence in their work and may engage in research; develop statistical methods; or, after a number of years of experience in a particular area, become statistical consultants.

Employment

Statisticians held about 22,000 jobs in 2006. About 20 percent of these jobs were in the Federal Government, where statisticians were concentrated in the Departments of Commerce, Agriculture, and Health and Human Services. Another 10 percent were found in State and local governments, including State colleges and universities. Most of the remaining jobs were in private industry, especially in scientific research and development services, insurance carriers, and pharmaceutical and medicine manufacturing.

Job Outlook

Average employment growth is projected. Individuals with a degree in statistics should have opportunities in a variety of fields.

Employment change. Employment of statisticians is projected to grow 9 percent from 2006 to 2016, about as fast as the average for all occupations. The demand for individuals with a background is statistics is expected to grow, although some jobs will be in occupations with titles other than "statistician."

The use of statistics is widespread and growing. Statistical models aid in decision making in both private industry and government. There will always be a demand for the skills statistical modeling provides. Technological advances are expected to spur demand for statisticians. Ever faster computer processing allows statisticians to analyze greater amounts of data much more quickly, and to gather and sort through large amounts of data that would not have been analyzed in the past. As these processes continue to become more efficient and less expensive, an increasing number of employers will want to employ statisticians to take advantage of the new information available.

Biostatisticians should experience employment growth, primarily because of the booming pharmaceuticals business. As pharmaceutical companies develop new treatments and medical technologies, biostatisticians will be needed to do research and clinical trials.

Job prospects. Individuals with a degree in statistics should have opportunities in a variety of fields. For example, many jobs involve the analysis and interpretation of data from economics, biological science, psychology, computer software engineering, education, and other disciplines. Additional job openings will become available as statisticians transfer to other occupations, retire, or leave the workforce for other reasons.

Among graduates with a master's degree in statistics, those with a strong background in an allied field, such as finance, biology, engineering, or computer science, should have the best prospects of finding jobs related to their field of study.

Those who meet State certification requirements may become high school statistics teachers, for example. (For additional information, see the statement on teachers—preschool, kindergarten, elementary, middle, and secondary elsewhere in the *Handbook*.)

Earnings

Median annual wage-and-salary earnings of statisticians were $65,720 in May 2006. The middle 50 percent earned between $48,480 and $87,850. The lowest 10 percent earned less than $37,010, while the highest 10 percent earned more than $108,630.

The average annual salary for statisticians in the Federal Government was $85,690 in 2007, while mathematical statisticians averaged $96,121.

Some employers offer tuition reimbursement.

Related Occupations

People in diverse occupations work with statistics. Among these are actuaries; mathematicians; operations research analysts; computer scientists and database administrators; computer systems analysts; computer programmers; computer software engineers; engineers; economists, market and survey researchers, and other social scientists; and financial analysts and personal financial advisors. Some statisticians also work as secondary school teachers or postsecondary teachers.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Statisticians	15-2041	22,000	24,000	1,900	9

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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Sources of Additional Information

For information about career opportunities in statistics, contact:

➤ American Statistical Association, 1429 Duke St., Alexandria, VA 22314. Internet: **http://www.amstat.org**

For more information on doctoral-level careers and training in mathematics, a field closely related to statistics, contact:

➤ American Mathematical Society, 201 Charles St., Providence, RI 02904. Internet: **http://www.ams.org**

Information on obtaining positions as statisticians with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result. For advice on how to find and apply for Federal jobs, see the *Occupational Outlook Quarterly* article "How to get a job in the Federal Government," online at: **http://www.bls.gov/opub/ooq/2004/summer/art01.pdf**.

Architects, Surveyors, and Cartographers

Architects, Except Landscape and Naval

(O*NET 17-1011.00)

Significant Points

- About 1 in 5 architects are self-employed—more than 2 times the proportion for all occupations.
- Licensing requirements include a professional degree in architecture, at least 3 years of practical work training, and passing all divisions of the Architect Registration Examination.
- Architecture graduates may face competition, especially for jobs in the most prestigious firms.

Nature of the Work

People need places in which to live, work, play, learn, worship, meet, govern, shop, and eat. These places may be private or public; indoors or out; rooms, buildings, or complexes, and architects design them. Architects are licensed professionals trained in the art and science of building design who develop the concepts for structures and turn those concepts into images and plans.

Architects create the overall aesthetic and look of buildings and other structures, but the design of a building involves far more than its appearance. Buildings also must be functional, safe, and economical and must suit the needs of the people who use them. Architects consider all these factors when they design buildings and other structures.

Architects may be involved in all phases of a construction project, from the initial discussion with the client through the entire construction process. Their duties require specific skills—designing, engineering, managing, supervising, and communicating with clients and builders. Architects spend a great deal of time explaining their ideas to clients, construction contractors, and others. Successful architects must be able to communicate their unique vision persuasively.

The architect and client discuss the objectives, requirements, and budget of a project. In some cases, architects provide various predesign services: conducting feasibility and environmental impact studies, selecting a site, preparing cost analysis and land-use studies, or specifying the requirements the design must meet. For example, they may determine space requirements by researching the numbers and types of potential users of a building. The architect then prepares drawings and a report presenting ideas for the client to review.

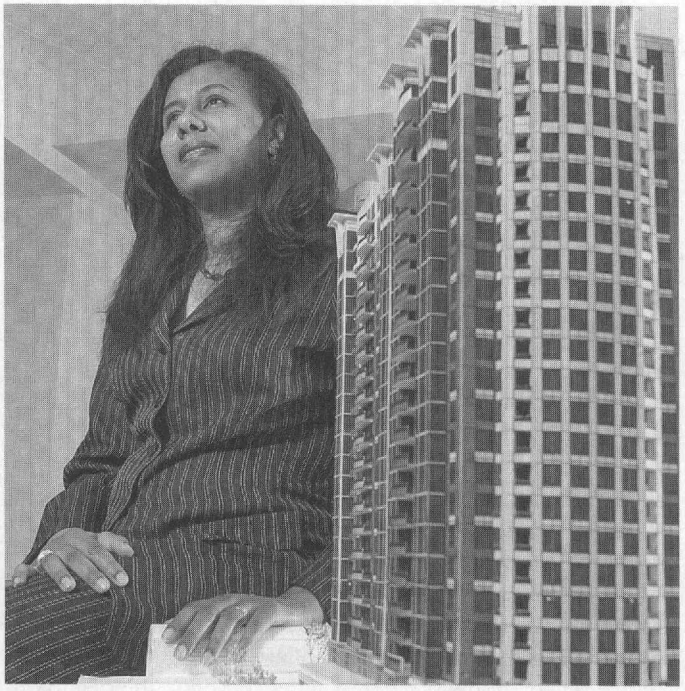
After discussing and agreeing on the initial proposal, architects develop final construction plans that show the building's appearance and details for its construction. Accompanying these plans are drawings of the structural system; air-conditioning, heating, and ventilating systems; electrical systems; communications systems; plumbing; and, possibly, site and landscape plans. The plans also specify the building materials and, in some cases, the interior furnishings. In developing designs, architects follow building codes, zoning laws, fire regulations, and other ordinances, such as those requiring easy access by people who are disabled. Computer-aided design and drafting (CADD) and Building Information Modeling (BIM) technology has replaced traditional paper and pencil as the most common method for creating design and construction drawings. Continual revision of plans on the basis of client needs and budget constraints is often necessary.

Architects may also assist clients in obtaining construction bids, selecting contractors, and negotiating construction contracts. As construction proceeds, they may visit building sites to make sure that contractors follow the design, adhere to the schedule, use the specified materials, and meet work quality standards. The job is not complete until all construction is finished, required tests are conducted, and construction costs are paid. Sometimes, architects also provide postconstruction services, such as facilities management. They advise on energy efficiency measures, evaluate how well the building design adapts to the needs of occupants, and make necessary improvements.

Often working with engineers, urban planners, interior designers, landscape architects, and other professionals, architects in fact spend a great deal of their time coordinating information from, and the work of, other professionals engaged in the same project.

They design a wide variety of buildings, such as office and apartment buildings, schools, churches, factories, hospitals, houses, and airport terminals. They also design complexes such

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Architects design buidings.

as urban centers, college campuses, industrial parks, and entire communities.

Architects sometimes specialize in one phase of work. Some specialize in the design of one type of building—for example, hospitals, schools, or housing. Others focus on planning and predesign services or construction management and do minimal design work.

Work environment. Usually working in a comfortable environment, architects.spend most of their time in offices consulting with clients, developing reports and drawings, and working with other architects and engineers. However, they often visit construction sites to review the progress of projects. Although most architects work approximately 40 hours per week, they often have to work nights and weekends to meet deadlines.

Training, Other Qualifications, and Advancement

There are three main steps in becoming an architect. First is the attainment of a professional degree in architecture. Second is work experience through an internship, and third is licensure through the passing of the Architect Registration Exam.

Education and training. In most States, the professional degree in architecture must be from one of the 114 schools of architecture that have degree programs accredited by the National Architectural Accrediting Board. However, State architectural registration boards set their own standards, so graduation from a non-accredited program may meet the educational requirement for licensing in a few States.

Three types of professional degrees in architecture are available: a 5-year bachelor's degree, which is most common and is intended for students with no previous architectural training; a 2-year master's degree for students with an undergraduate degree in architecture or a related area; and a 3- or 4-year master's degree for students with a degree in another discipline.

The choice of degree depends on preference and educational background. Prospective architecture students should consider the options before committing to a program. For example, although the 5-year bachelor of architecture offers the fastest route to the professional degree, courses are specialized, and if the student does not complete the program, transferring to a program in another discipline may be difficult. A typical program includes courses in architectural history and theory, building design with an emphasis on CADD, structures, technology, construction methods, professional practice, math, physical sciences, and liberal arts. Central to most architectural programs is the design studio, where students apply the skills and concepts learned in the classroom, creating drawings and three-dimensional models of their designs.

Many schools of architecture also offer postprofessional degrees for those who already have a bachelor's or master's degree in architecture or other areas. Although graduate education beyond the professional degree is not required for practicing architects, it may be required for research, teaching, and certain specialties.

All State architectural registration boards require architecture graduates to complete a training period—usually at least 3 years—before they may sit for the licensing exam. Every State, with the exception of Arizona, has adopted the training standards established by the Intern Development Program, a branch of the American Institute of Architects and the National Council of Architectural Registration Boards (NCARB). These standards stipulate broad training under the supervision of a licensed architect. Most new graduates complete their training period by working as interns at architectural firms. Some States allow a portion of the training to occur in the offices of related professionals, such as engineers or general contractors. Architecture students who complete internships while still in school can count some of that time toward the 3-year training period.

Interns in architectural firms may assist in the design of one part of a project, help prepare architectural documents or drawings, build models, or prepare construction drawings on CADD. Interns also may research building codes and materials or write specifications for building materials, installation criteria, the quality of finishes, and other, related details.

Licensure. All States and the District of Columbia require individuals to be licensed (registered) before they may call themselves architects and contract to provide architectural services. During the time between graduation and becoming licensed, architecture school graduates generally work in the field under the supervision of a licensed architect who takes legal responsibility for all work. Licensing requirements include a professional degree in architecture, a period of practical training or internship, and a passing score on all divisions of the Architect Registration Examination. The examination is broken into nine divisions consisting of either multiple choice or graphical questions. The eligibility period for completion of all divisions of the exam varies by State.

Most States also require some form of continuing education to maintain a license, and many others are expected to adopt mandatory continuing education. Requirements vary by State but usually involve the completion of a certain number of credits annually or biennially through workshops, formal university classes, conferences, self-study courses, or other sources.

Other qualifications. Architects must be able to communicate their ideas visually to their clients. Artistic and drawing ability is helpful, but not essential, to such communication.

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More important are a visual orientation and the ability to understand spatial relationships. Other important qualities for anyone interested in becoming an architect are creativity and the ability to work independently and as part of a team. Computer skills are also required for writing specifications, for 2- and 3-dimensional drafting using CADD programs, and for financial management.

Certification and advancement. A growing number of architects voluntarily seek certification by the National Council of Architectural Registration Boards. Certification is awarded after independent verification of the candidate's educational transcripts, employment record, and professional references. Certification can make it easier to become licensed across States. In fact, it is the primary requirement for reciprocity of licensing among State Boards that are NCARB members. In 2007, approximately one-third of all licensed architects had this certification.

After becoming licensed and gaining experience, architects take on increasingly responsible duties, eventually managing entire projects. In large firms, architects may advance to supervisory or managerial positions. Some architects become partners in established firms, while others set up their own practices. Some graduates with degrees in architecture also enter related fields, such as graphic, interior, or industrial design; urban planning; real estate development; civil engineering; and construction management.

Employment

Architects held about 132,000 jobs in 2006. Approximately 7 out of 10 jobs were in the architectural, engineering, and related services industry—mostly in architectural firms with fewer than five workers. A small number worked for residential and nonresidential building construction firms and for government agencies responsible for housing, community planning, or construction of government buildings, such as the U.S. Departments of Defense and Interior, and the General Services Administration. About 1in 5 architects are self-employed.

Job Outlook

Employment of architects is expected to grow faster than the average for all occupations through 2016. Keen competition is expected for positions at the most prestigious firms, and opportunities will be best for those architects who are able to distinguish themselves with their creativity.

Employment change. Employment of architects is expected to grow by 18 percent between 2006 and 2016, which is faster than the average for all occupations. Employment of architects is strongly tied to the activity of the construction industry. Strong growth is expected to come from nonresidential construction as demand for commercial space increases. Residential construction, buoyed by low interest rates, is also expected to grow as more people become homeowners. If interest rates rise significantly, home building may fall off, but residential construction makes up only a small part of architects' work.

Current demographic trends also support an increase in demand for architects. As the population of Sunbelt States continues to grow, the people living there will need new places to live and work. As the population continues to live longer and baby-boomers begin to retire, there will be a need for more healthcare facilities, nursing homes, and retirement communities. In education, buildings at all levels are getting older and class sizes are getting larger. This will require many school districts and universities to build new facilities and renovate existing ones.

In recent years, some architecture firms have outsourced the drafting of construction documents and basic design for large-scale commercial and residential projects to architecture firms overseas. This trend is expected to continue and may have a negative impact on employment growth for lower level architects and interns who would normally gain experience by producing these drawings.

Job prospects. Besides employment growth, additional job openings will arise from the need to replace the many architects who are nearing retirement, and others who transfer to other occupations or stop working for other reasons. Internship opportunities for new architectural students are expected to be good over the next decade, but more students are graduating with architectural degrees and some competition for entry-level jobs can be anticipated. Competition will be especially keen for jobs at the most prestigious architectural firms as prospective architects try to build their reputation. Prospective architects who have had internships while in school will have an advantage in obtaining intern positions after graduation. Opportunities will be best for those architects that are able to distinguish themselves from others with their creativity.

Prospects will also be favorable for architects with knowledge of "green" design. Green design, also known as sustainable design, emphasizes energy efficiency, renewable resources such as energy and water, waste reduction, and environmentally friendly design, specifications, and materials. Rising energy costs and increased concern about the environment has led to many new buildings being built green.

Some types of construction are sensitive to cyclical changes in the economy. Architects seeking design projects for office and retail construction will face especially strong competition for jobs or clients during recessions, and layoffs may ensue in less successful firms. Those involved in the design of institutional buildings, such as schools, hospitals, nursing homes, and correctional facilities, will be less affected by fluctuations in the economy. Residential construction makes up a small portion of work for architects, so major changes in the housing market would not be as significant as fluctuations in the nonresidential market.

Despite good overall job opportunities some architects may not fare as well as others. The profession is geographically

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Architects, except landscape and naval	17-1011	132,000	155,000	23,000	18

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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sensitive, and some parts of the Nation may have fewer new building projects. Also, many firms specialize in specific buildings, such as hospitals or office towers, and demand for these buildings may vary by region. Architects may find it increasingly necessary to gain reciprocity in order to compete for the best jobs and projects in other States.

Earnings

Median annual earnings of wage-and-salary architects were $64,150 in May 2006. The middle 50 percent earned between $49,780 and $83,450. The lowest 10 percent earned less than $39,420, and the highest 10 percent earned more than $104,970. Those just starting their internships can expect to earn considerably less.

Earnings of partners in established architectural firms may fluctuate because of changing business conditions. Some architects may have difficulty establishing their own practices and may go through a period when their expenses are greater than their income, requiring substantial financial resources.

Many firms pay tuition and fees toward continuing education requirements for their employees.

Related Occupations

Architects design buildings and related structures. Construction managers, like architects, also plan and coordinate activities concerned with the construction and maintenance of buildings and facilities. Others who engage in similar work are landscape architects, civil engineers, urban and regional planners, and designers, including interior designers, commercial and industrial designers, and graphic designers.

Sources of Additional Information

Information about education and careers in architecture can be obtained from:

➤ The American Institute of Architects, 1735 New York Ave. NW., Washington, DC 20006. Internet: **http://www.aia.org**

➤ Intern Development Program, National Council of Architectural Registration Boards, Suite 1100K, 1801 K St. NW., Washington, D.C. 20006.
Internet: **http://www.ncarb.org**

Landscape Architects

(O*NET 17-1012.00)

Significant Points

- Almost 19 percent of all landscape architects are self-employed—more than 2 times the proportion for all occupations.
- 49 States require landscape architects to be licensed.
- New graduates can expect to face competition for jobs in the largest and most prestigious landscape architecture firms, but there should be good job opportunities overall as demand for landscape architecture services increases.

Nature of the Work

Everyone enjoys attractively designed residential areas, public parks and playgrounds, college campuses, shopping centers, golf courses, and parkways. Landscape architects design these areas so that they are not only functional, but also beautiful, and compatible with the natural environment. They plan the location of buildings, roads, and walkways, and the arrangement of flowers, shrubs, and trees. They also design and plan the restoration of natural places disturbed by humans such as wetlands, stream corridors, mined areas and forested land.

Landscape architects work for many types of organizations—from real estate development firms starting new projects to municipalities constructing airports or parks—and they often are involved with the development of a site from its conception. Working with architects, surveyors, and engineers, landscape architects help determine the best arrangement of roads and buildings. They also collaborate with environmental scientists, foresters, and other professionals to find the best way to conserve or restore natural resources. Once these decisions are made, landscape architects create detailed plans indicating new topography, vegetation, walkways, and other landscaping details, such as fountains and decorative features.

In planning a site, landscape architects first study the project holistically. They also consider the purpose of the project and the funds available. They analyze the natural elements of the site, such as the climate, soil, slope of the land, drainage, and vegetation; observe where sunlight falls on the site at different times of the day; and assess the effect of existing buildings, roads, walkways, and utilities.

After studying and analyzing the site, landscape architects prepare a preliminary design. To address the needs of the client as well as the conditions at the site, they frequently make changes before a final design is approved. They also take into account any local, State, or Federal regulations, such as those protecting wetlands or historic resources. In preparing designs, computer-aided design (CAD) has become an essential tool for most landscape architects. Many landscape architects also use video simulation to help clients envision the proposed ideas and plans. For larger scale site planning, landscape architects also use geographic information systems (GIS) technology, a computer mapping system.

Throughout all phases of planning and design, landscape architects consult with other professionals, such as civil engineers, hydrologists, or architects, involved in the project. Once the design is complete, they prepare a proposal for the client. They produce detailed plans of the site, including written reports, sketches, models, photographs, land-use studies, and cost estimates, and submit them for approval by the client and by regulatory agencies. When the plans are approved, landscape architects prepare working drawings showing all existing and proposed features. They also outline in detail the methods of construction and draw up a list of necessary materials. Landscape architects then monitor the implementation of their design, while general contractors or landscape contractors usually direct the actual construction of the site and installation of plantings.

Some landscape architects work on a variety of projects. Others specialize in a particular area, such as street and highway beautification, waterfront improvement projects, parks and

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playgrounds, or shopping centers. Still others work in regional planning and resource management; feasibility, environmental impact, and cost studies; or site construction. Increasingly, landscape architects work in environmental remediation, such as preservation and restoration of wetlands or abatement of stormwater run-off in new developments. Historic landscape preservation and restoration is another area where landscape architects increasingly play a role.

Landscape architects who work for government agencies do site and landscape design for government buildings, parks, and other public lands, as well as park and recreation planning in national parks and forests. In addition, they prepare environmental impact statements and studies on environmental issues such as public land-use planning. Some restore degraded land, such as mines or landfills. Others use their skills in traffic-calming, the "art" of slowing traffic through the use of traffic design, enhancement of the physical environment, and greater attention to aesthetics.

Work environment. Landscape architects spend most of their time in offices creating plans and designs, preparing models and cost estimates, doing research, or attending meetings with clients and other professionals involved in a design or planning project. The remainder of their time is spent at the site. During the design and planning stage, landscape architects visit and analyze the site to verify that the design can be incorporated into the landscape. After the plans and specifications are completed, they may spend additional time at the site observing or supervising the construction. Those who work in large national or regional firms may spend considerably more time out of the office, traveling to sites.

Salaried employees in both government and landscape architectural firms usually work regular hours. However, they may occasionally work overtime to meet a project deadline. Hours of self-employed landscape architects vary depending on the demands of their projects.



Landscape architects consult with clients and other professionals throughout the plannining and design of a project.

Training, Other Qualifications, and Advancement

Almost every state requires landscape architects to be licensed. While requirements vary among the states, they usually include a degree in landscape architecture from an accredited school, work experience, and the passage of the Landscape Architect Registration Exam.

Education and training. A bachelor's or master's degree in landscape architecture usually is necessary for entry into the profession. There are two undergraduate professional degrees: a Bachelor of Landscape Architecture (BLA) and a Bachelor of Science in Landscape Architecture (BSLA). These usually require four or five years of study in design, construction techniques, art, history, natural and social sciences. There are generally two types of graduate degree programs. For those who hold an undergraduate degree in a field other than landscape architecture and intend to become landscape architecture practitioners, the Master of Landscape Architecture (MLA) typically takes three years of full-time study. Those who hold undergraduate degrees in landscape architecture can earn their MLA in two years.

In 2007, 61 colleges and universities offered 79 undergraduate and graduate programs in landscape architecture that were accredited by the Landscape Architecture Accreditation Board of the American Society of Landscape Architects. Courses required in these programs usually include subjects such as surveying, landscape design and construction, landscape ecology, site design, and urban and regional planning. Other courses include history of landscape architecture, plant and soil science, geology, professional practice, and general management. The design studio is another important aspect of many curriculums. Whenever possible, students are assigned real projects, providing them with valuable hands-on experience. While working on these projects, students become proficient in the use of computer-aided design, geographic information systems, and video simulation.

Licensure and certification. As of January 2008, 49 states required landscape architects to be licensed. Licensing is based on the Landscape Architect Registration Examination (L.A.R.E.), sponsored by the Council of Landscape Architectural Registration Boards and administered in two portions, graphic and multiple choice. Admission to the exam usually requires a degree from an accredited school plus 1 to 4 years of work experience under the supervision of a licensed landscape architect, although standards vary from State to State. For those without an accredited landscape architecture degree, most states provide alternative paths to qualify to take the L.A.R.E., usually requiring more work experience. Currently, 15 States require that a State examination be passed in addition to the L.A.R.E. to satisfy registration requirements. State examinations focus on laws, environmental regulations, plants, soils, climate, and any other characteristics unique to the State.

Because requirements for licensure are not uniform, landscape architects may find it difficult to transfer their registration from one State to another. However, those who meet the national standards of graduating from an accredited program, serving 3 years of internship under the supervision of a registered landscape architect, and passing the L.A.R.E. can satisfy requirements in most States. By meeting national requirements, a landscape architect can also obtain certification from

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the Council of Landscape Architectural Registration Boards which can be useful in obtaining reciprocal licensure in other states.

In States where licensure is required, new hires may be called "apprentices" or "intern landscape architects" until they become licensed. Their duties vary depending on the type and size of the employing firm. They may do project research or prepare working drawings, construction documents, or base maps of the area to be designed. Some are allowed to participate in the actual design of a project. However, interns must perform all work under the supervision of a licensed landscape architect. Additionally, all drawings and specifications must be signed and sealed by the licensed landscape architect, who takes legal responsibility for the work. After gaining experience and becoming licensed, landscape architects usually can carry a design through all stages of development.

Many States require some form of continuing education to maintain a license. Requirements usually involve the completion of workshops, seminars, formal university classes, conferences, self-study courses, or other classes.

The Federal Government does not require its landscape architects to be licensed. Candidates for entry positions with the Federal Government should have a bachelor's or master's degree in landscape architecture.

Other qualifications. People planning a career in landscape architecture should appreciate nature, enjoy working with their hands, and possess strong analytical skills. Creative vision and artistic talent also are desirable qualities. Good oral communication skills are essential. Landscape architects must be able to convey their ideas to other professionals and clients and to make presentations before large groups. Strong writing skills also are valuable, as is knowledge of computer applications of all kinds, including word processing, desktop publishing, and spreadsheets. Landscape architects use these tools to develop presentations, proposals, reports, and land impact studies for clients, colleagues, and superiors. Landscape architects must also be able to draft and design using CAD software. Many employers recommend that prospective landscape architects complete at least one summer internship with a landscape architecture firm to hone their technical skills and to gain an understanding of the day-to-day operations of the business, including how to win clients, generate fees, and work within a budget.

Advancement. After several years, landscape architects may become project managers, taking on the responsibility for meeting schedules and budgets, in addition to overseeing the project design. Later, they may become associates or partners of a firm, with a proprietary interest in the business.

Many landscape architects are self-employed. Self-discipline, business acumen, and good marketing skills are important qualities for those who choose to open their own business. Even with these qualities, however, some may struggle while building a client base.

Those with landscape architecture training also qualify for jobs closely related to landscape architecture, and may, after gaining some experience, become construction supervisors, land or environmental planners, or landscape consultants.

Employment

Landscape architects held about 28,000 jobs in 2006. More than 1 out of 2 landscape architects were employed in architectural, engineering, and related services. State and local governments employed approximately 6 percent of all landscape architects. About 2 out of 10 landscape architects were self-employed.

Employment of landscape architects is concentrated in urban and suburban areas throughout the country; some landscape architects work in rural areas, particularly those employed by the Federal Government to plan and design parks and recreation areas.

Job Outlook

Employment of landscape architects is expected to grow faster than the average for all occupations through the year 2016. There should be good job prospects for landscape architects overall, but opportunities may depend on geographic location and local real estate and construction markets.

Employment change. Employment of landscape architects is expected to increase by 16 percent during the 2006-16 decade, which is faster than the average for all occupations. Employment will grow because the expertise of landscape architects will be sought after in the planning and development of new construction to meet the needs of a growing population. With land costs rising and the public desiring more beautiful spaces, the importance of good site planning and landscape design is growing.

New construction will spur demand for landscape architects to help plan sites that meet with environmental regulations and zoning laws and integrate new structures with the natural environment in the least disruptive way. For example, landscape architects will be needed to manage stormwater run-off to avoid pollution of waterways and conserve water resources. Landscape architects also will be increasingly involved in preserving and restoring wetlands and other environmentally sensitive sites.

Continuation of the Safe, Accountable, Flexible, Efficient, Transportation, Equity Act: A Legacy for Users also is expected to spur employment for landscape architects, particularly in State and local governments. This Act, known as SAFE-TEA-LU, provides funds for surface transportation and transit programs, such as interstate highway construction and maintenance, pedestrian and bicycle trails, and safe routes to schools.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Landscape architects	17-1012	28,000	32,000	4,600	16

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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In addition to the work related to new development and construction, landscape architects are expected to be involved in historic preservation, land reclamation, and refurbishment of existing sites. Additionally, landscape architects will be needed to create security perimeters that are better integrated with their surroundings for many of the Nation's landmarks, monuments, and buildings.

Job prospects. In addition to growth, the need to replace landscape architects who retire or leave the labor force will produce some additional job openings.

Opportunities will vary by year and geographic region, depending on local economic conditions. During a recession, when real estate sales and construction slow down, landscape architects may face greater competition for jobs and sometimes layoffs. But because landscape architects can work on many different types of projects, they may have steadier work than other design professionals when traditional construction slows.

New graduates can expect to face competition for jobs in the largest and most prestigious landscape architecture firms, but there should be good job opportunities overall as demand for landscape architecture services increases. Many employers prefer to hire entry-level landscape architects who have internship experience, which significantly reduces the amount of on-the-job training required. Opportunities will be best for landscape architects who develop strong technical skills—such as computer design—communication skills, and knowledge of environmental codes and regulations. Those with additional training or experience in urban planning increase their opportunities for employment in landscape architecture firms that specialize in site planning as well as landscape design.

Earnings

In May 2006, median annual earnings for landscape architects were $55,140. The middle 50 percent earned between $42,720 and $73,240. The lowest 10 percent earned less than $34,230 and the highest 10 percent earned over $95,420. Architectural, engineering, and related services employed more landscape architects than any other group of industries, and there the median annual earnings were $56,060 in May 2006.

Related Occupations

Landscape architects use their knowledge of design, construction, land-use planning, and environmental issues to develop a landscape project. Others whose work requires similar skills are architects, except landscape and naval; surveyors, cartographers, photogrammetrists, and surveying technicians; civil engineers; and urban and regional planners. Landscape architects also must know how to grow and use plants in the landscape. Some conservation scientists and foresters and biological scientists also study plants and do related work. Environmental scientists and hydrologists, and geoscientists, like many landscape architects, work in the area of environmental remediation.

Sources of Additional Information

Additional information, including a list of colleges and universities offering accredited programs in landscape architecture, is available from:

➤ American Society of Landscape Architects, Career Information, 636 Eye St.NW., Washington, DC 20001-3736. Internet: **http://www.asla.org**

General information on registration or licensing requirements is available from:

➤ Council of Landscape Architectural Registration Boards, 3949 Pender Dr., Suite 120, Vienna, VA 22030. Internet: **http://www.clarb.org**

Surveyors, Cartographers, Photogrammetrists, and Surveying and Mapping Technicians

(O*NET 17-1021.00, 17-1022.00, 17-3031.00, 17-3031.01, 17-3031.02)

Significant Points

- About 7 out of 10 jobs were in architectural, engineering, and related services.
- Opportunities will be best for surveyors, cartographers, and photogrammetrists who have a bachelor's degree and strong technical skills.
- Overall employment of surveyors, cartographers, photogrammetrists, and surveying technicians is expected to grow much faster than the average for all occupations through the year 2016.

Nature of the Work

Surveyors, cartographers, and photogrammetrists are responsible for measuring and mapping the Earth's surface. *Surveyors* establish official land, airspace, and water boundaries. They write descriptions of land for deeds, leases, and other legal documents; define airspace for airports; and take measurements of construction and mineral sites. Other surveyors provide data about the shape, contour, location, elevation, or dimension of land or land features. *Cartographers and photogrammetrists* collect, analyze, interpret, and map geographic information from surveys and from data and photographs collected using airplanes and satellites. *Surveying and mapping technicians* assist these professionals by collecting data in the field, making calculations, and helping with computer-aided drafting. Collectively, these occupations play key roles in the field of geospatial information.

Surveyors measure distances, directions, and angles between points and elevations of points, lines, and contours on, above, and below the Earth's surface. In the field, they select known survey reference points and determine the precise location of important features in the survey area using specialized equipment. Surveyors also research legal records, look for evidence of previous boundaries, and analyze data to determine the location of boundary lines. They are sometimes called to provide expert testimony in court about their work. Surveyors also record their results, verify the accuracy of data, and prepare plots, maps, and reports.

Some surveyors perform specialized functions closer to those of cartographers and photogrammetrists than to those of traditional surveyors. For example, *geodetic surveyors* use high-accuracy techniques, including satellite observations, to measure

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large areas of the earth's surface. *Geophysical prospecting surveyors* mark sites for subsurface exploration, usually to look for petroleum. *Marine or hydrographic surveyors* survey harbors, rivers, and other bodies of water to determine shorelines, the topography of the bottom, water depth, and other features.

Surveyors use the Global Positioning System (GPS) to locate reference points with a high degree of precision. To use this system, a surveyor places a satellite signal receiver—a small instrument mounted on a tripod—on a desired point, and another receiver on a point for which the geographic position is known. The receiver simultaneously collects information from several satellites to establish a precise position. The receiver also can be placed in a vehicle for tracing out road systems. Because receivers now come in different sizes and shapes, and because the cost of receivers has fallen, much more surveying work can be done with GPS. Surveyors then interpret and check the results produced by the new technology.

Field measurements are often taken by a survey party that gathers the information needed by the surveyor. A typical survey party consists of a party chief and one or more surveying technicians and helpers. The party chief, who may be either a surveyor or a senior surveying technician, leads day-to-day work activities. Surveying technicians assist the party chief by adjusting and operating surveying instruments, such as the total station, which measures and records angles and distances simultaneously. Surveying technicians or assistants position and hold the vertical rods, or targets, that the operator sights on to measure angles, distances, or elevations. They may hold measuring tapes if electronic distance-measuring equipment is not used. Surveying technicians compile notes, make sketches, and enter the data obtained from surveying instruments into computers either in the field or at the office. Survey parties also may include laborers or helpers who perform less-skilled duties, such as clearing brush from sight lines, driving stakes, or carrying equipment.

Photogrammetrists and cartographers measure, map, and chart the Earth's surface. Their work involves everything from performing geographical research and compiling data to producing maps. They collect, analyze, and interpret both spatial data—such as latitude, longitude, elevation, and distance—and nonspatial data—for example, population density, land-use patterns, annual precipitation levels, and demographic characteristics. Their maps may give both physical and social characteristics of the land. They prepare maps in either digital or graphic form, using information provided by geodetic surveys and remote sensing systems including aerial cameras, satellites, and LIDAR.

LIDAR—light-imaging detection and ranging—uses lasers attached to planes and other equipment to digitally map the topography of the Earth. It is often more accurate than traditional surveying methods and also can be used to collect other forms of data, such as the location and density of forests. Data developed by LIDAR can be used by surveyors, cartographers, and photogrammetrists to provide spatial information to specialists in geology, seismology, forestry, and construction, and other fields.

Geographic Information Systems (GIS) have become an integral tool for surveyors, cartographers and photogrammetrists, and surveying and mapping technicians. Workers use GIS to assemble, integrate, analyze, and display data about location in a digital format. They also use GIS to compile information from a variety of sources. GIS typically are used to make maps which combine information useful for environmental studies, geology, engineering, planning, business marketing, and other disciplines. As more of these systems are developed, many mapping specialists are being called *geographic information specialists*.

Work environment. Surveyors and surveying technicians usually work an 8-hour day, 5 days a week and may spend a lot of time outdoors. Sometimes, they work longer hours during the summer, when weather and light conditions are most suitable for fieldwork. Construction-related work may be limited during times of inclement weather.

Surveyors and technicians engage in active, sometimes strenuous, work. They often stand for long periods, walk considerable distances, and climb hills with heavy packs of instruments and other equipment. They also can be exposed to all types of weather. Traveling is sometimes part of the job, and land surveyors and technicians may commute long distances, stay away from home overnight, or temporarily relocate near a survey site. Surveyors also work indoors while planning surveys, searching court records for deed information, analyzing data, and preparing reports and maps.

Cartographers and photogrammetrists spend most of their time in offices using computers. However, certain jobs may require extensive field work to verify results and acquire data.



Surveyors use sophisticated equipment to take measurements.

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Training, Other Qualifications, and Advancement

Most surveyors, cartographers, and photogrammetrists have a bachelor's degree in surveying or a related field. Every State requires that surveyors be licensed.

Education and training. In the past, many people with little formal training started as members of survey crews and worked their way up to become licensed surveyors, but this has become increasingly difficult to do. Now, most surveyors need a bachelor's degree. A number of universities offer bachelor's degree programs in surveying, and many community colleges, technical institutes, and vocational schools offer 1-, 2-, and 3-year programs in surveying or surveying technology.

Cartographers and photogrammetrists usually have a bachelor's degree in cartography, geography, surveying, engineering, forestry, computer science, or a physical science, although a few enter these positions after working as technicians. With the development of GIS, cartographers and photogrammetrists need more education and stronger technical skills—including more experience with computers—than in the past.

Most cartographic and photogrammetric technicians also have specialized postsecondary education. High school students interested in surveying and cartography should take courses in algebra, geometry, trigonometry, drafting, mechanical drawing, and computer science.

Licensure. All 50 States and all U.S. territories license surveyors. For licensure, most State licensing boards require that individuals pass a written examination given by the National Council of Examiners for Engineering and Surveying (NCEES). Most States also require surveyors to pass a written examination prepared by the State licensing board.

Licensing happens in stages. After passing a first exam, the Fundamentals of Surveying, most candidates work under the supervision of an experienced surveyor for 4 years and then for licensure take a second exam, the Principles and Practice of Surveyors.

Specific requirements for training and education vary among the States. An increasing number of States require a bachelor's degree in surveying or in a closely related field, such as civil engineering or forestry, regardless of the number of years of experience. Some States require the degree to be from a school accredited by the Accreditation Board for Engineering and Technology. Many States also have a continuing education requirement.

Additionally a number of States require cartographers and photogrammetrists to be licensed as surveyors, and some States have specific licenses for photogrammetrists.

Other qualifications. Surveyors, cartographers, and photogrammetrists should be able to visualize objects, distances, sizes, and abstract forms. They must work with precision and accuracy because mistakes can be costly.

Members of a survey party must be in good physical condition because they work outdoors and often carry equipment over difficult terrain. They need good eyesight, coordination, and hearing to communicate verbally and using hand signals. Surveying is a cooperative operation, so good interpersonal skills and the ability to work as part of a team is important. Good office skills also are essential because surveyors must be able to research old deeds and other legal papers and prepare reports that document their work.

Certification and advancement. High school graduates with no formal training in surveying usually start as apprentices. Beginners with postsecondary school training in surveying usually can start as technicians or assistants. With on-the-job experience and formal training in surveying—either in an institutional program or from a correspondence school—workers may advance to senior survey technician, then to party chief. Depending on State licensing requirements, in some cases they may advance to licensed surveyor.

The National Society of Professional Surveyors, a member organization of the American Congress on Surveying and Mapping, has a voluntary certification program for surveying technicians. Technicians are certified at four levels requiring progressive amounts of experience and the passing of written examinations. Although not required for State licensure, many employers require certification for promotion to positions with greater responsibilities.

The American Society for Photogrammetry and Remote Sensing has voluntary certification programs for technicians and professionals in photogrammetry, remote sensing, and GIS. To qualify for these professional distinctions, individuals must meet work experience and training standards and pass a written examination. The professional recognition these certifications can help workers gain promotions.

Employment

Surveyors, cartographers, photogrammetrists, and surveying technicians held about 148,000 jobs in 2006. Employment was distributed by occupational specialty as follows:

Surveying and mapping technicians	76,000
Surveyors	60,000
Cartographers and photogrammetrists	12,000

The architectural, engineering, and related services industry—including firms that provided surveying and mapping services to other industries on a contract basis—provided 7 out of 10 jobs for these workers. Federal, State, and local governmental agencies provided about 14 percent of these jobs. Major Federal Government employers are the U.S. Geological Survey (USGS), the Bureau of Land Management (BLM), the National Geodetic Survey, the National Geospatial Intelligence Agency, and the Army Corps of Engineers. Most surveyors in State and local government work for highway departments or urban planning and redevelopment agencies. Construction, mining and utility companies also employ surveyors, cartographers, photogrammetrists, and surveying technicians.

Job Outlook

Surveyors, cartographers, photogrammetrists, and surveying and mapping technicians should have favorable job prospects. These occupations should experience much faster than average employment growth.

Employment change. Overall employment of surveyors, cartographers, photogrammetrists, and surveying and mapping technicians is expected to increase by 21 percent from 2006 to 2016, which is much faster than the average for all occupations. Increasing demand for fast, accurate, and complete geographic information will be the main source of growth for these occupations.

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Surveyors, cartographers, photogrammetrists, and surveying technicians	—	148,000	179,000	31,000	21
Cartographers and photogrammetrists	17-1021	12,000	15,000	2,500	20
Surveyors	17-1022	60,000	74,000	14,000	24
Surveying and mapping technicians	17-3031	76,000	90,000	15,000	19

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

An increasing number of firms are interested in geographic information and its applications. For example, GIS can be used to create maps and information used in emergency planning, security, marketing, urban planning, natural resource exploration, construction, and other applications. Also, the increased popularity of online mapping systems has created a higher demand for and awareness of geographic information among consumers.

Job prospects. In addition to openings from growth, job openings will continue to arise from the need to replace workers who transfer to other occupations or who leave the labor force altogether. Many of the workers in these occupations are approaching retirement age.

Opportunities for surveyors, cartographers, and photogrammetrists should remain concentrated in engineering, surveying, mapping, building inspection, and drafting services firms. However, employment may fluctuate from year to year with construction activity or with mapping needs for land and resource management.

Opportunities should be stronger for professional surveyors than for surveying and mapping technicians. Advancements in technology, such as total stations and GPS, have made surveying parties smaller than they once were. Additionally, cartographers, photogrammetrists, and technicians who produce more basic GIS data may face competition for jobs from offshore firms and contractors.

As technologies become more complex, opportunities will be best for surveyors, cartographers, and photogrammetrists who have a bachelor's degree and strong technical skills. Increasing demand for geographic data, as opposed to traditional surveying services, will mean better opportunities for cartographers and photogrammetrists who are involved in the development and use of geographic and land information systems.

Earnings

Median annual earnings of cartographers and photogrammetrists were $48,240 in May 2006. The middle 50 percent earned between $37,480 and $65,240. The lowest 10 percent earned less than $30,910 and the highest 10 percent earned more than $80,520.

Median annual earnings of surveyors were $48,290 in May 2006. The middle 50 percent earned between $35,720 and $63,990. The lowest 10 percent earned less than $26,690 and the highest 10 percent earned more than $79,910. Median annual earnings of surveyors employed in architectural, engineering, and related services were $47,570 in May 2006.

Median annual earnings of surveying and mapping technicians were $32,340 in May 2006. The middle 50 percent earned between $25,070 and $42,230. The lowest 10 percent earned less than $20,020, and the highest 10 percent earned more than $53,310. Median annual earnings of surveying and mapping technicians employed in architectural, engineering, and related services were $30,670 in May 2006, while those employed by local governments had median annual earnings of $37,550.

Related Occupations

Surveying is related to the work of civil engineers, architects, and landscape architects because an accurate survey is the first step in land development and construction projects. Cartographic and geodetic surveying are related to the work of environmental scientists and geoscientists, who study the earth's internal composition, surface, and atmosphere. Cartography also is related to the work of geographers and urban and regional planners, who study and decide how the earth's surface is being and may be used.

Sources of Additional Information

For career information on surveyors, cartographers, photogrammetrists, and surveying technicians, contact:

➤ American Congress on Surveying and Mapping, Suite 403, 6 Montgomery Village Ave., Gaithersburg, MD 20879. Internet: **http://www.acsm.net**

Information about career opportunities, licensure requirements, and the surveying technician certification program is available from:

➤ National Society of Professional Surveyors, Suite 403, 6 Montgomery Village Ave., Gaithersburg, MD 20879.

For information on a career as a geodetic surveyor, contact:

➤ American Association of Geodetic Surveying (AAGS), Suite 403, 6 Montgomery Village Ave., Gaithersburg, MD 20879.

For career information on photogrammetrists, photogrammetric technicians, remote sensing scientists and image-based cartographers or geographic information system specialists, contact:

➤ ASPRS: Imaging and Geospatial Information Society, 5410 Grosvenor Lane., Suite 210, Bethesda, MD 20814-2160. Internet: **http://www.asprs.org**

General information on careers in photogrammetry, mapping, and surveying is available from:

➤ MAPPS: Management Association for Private Photogrammetric Surveyors, 1760 Reston Parkway, Suite 515, Reston, VA 20190. Internet: **http://www.mapps.org**

Information on about careers in remote sensing, photogrammetry, surveying, GIS, and other geography-related disciplines also is available from the Spring 2005 Occupational Outlook Quarterly article, "Geography Jobs", available online at: **http://www.bls.gov/opub/ooq/2005/spring/art01.pdf**

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Engineers

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Significant Points

- Overall job opportunities in engineering are expected to be good, but will vary by specialty.
- A bachelor's degree in engineering is required for most entry-level jobs.
- Starting salaries are among the highest of all college graduates.
- Continuing education is critical for engineers as technology evolves.

Nature of the Work

Engineers apply the principles of science and mathematics to develop economical solutions to technical problems. Their work is the link between scientific discoveries and the commercial applications that meet societal and consumer needs.

Many engineers develop new products. During this process, they consider several factors. For example, in developing an industrial robot, engineers precisely specify the functional requirements; design and test the robot's components; integrate the components to produce the final design; and evaluate the design's overall effectiveness, cost, reliability, and safety. This process applies to the development of many different products, such as chemicals, computers, power plants, helicopters, and toys.

In addition to design and development, many engineers work in testing, production, or maintenance. These engineers supervise production in factories, determine the causes of component failure, and test manufactured products to maintain quality. They also estimate the time and cost to complete projects. Supervisory engineers are responsible for major components or entire projects. (See the statement on engineering and natural sciences managers elsewhere in the *Handbook*.)

Engineers use computers extensively to produce and analyze designs; to simulate and test how a machine, structure, or system operates; to generate specifications for parts; and to monitor product quality and control process efficiency. Nanotechnology, which involves the creation of high-performance materials and components by integrating atoms and molecules, also is introducing entirely new principles to the design process.

Most engineers specialize. Following are details on the 17 engineering specialties covered in the Federal Government's Standard Occupational Classification (SOC) system. Numerous other specialties are recognized by professional societies, and each of the major branches of engineering has numerous subdivisions. Civil engineering, for example, includes structural and transportation engineering, and materials engineering includes ceramic, metallurgical, and polymer engineering. Engineers also may specialize in one industry, such as motor vehicles, or in one type of technology, such as turbines or semiconductor materials.

- Aerospace engineers design, develop, and test aircraft, spacecraft, and missiles and supervise the manufacture of these products. Those who work with aircraft are called *aeronautical engineers*, and those working specifically with spacecraft are *astronautical engineers*. Aerospace engineers develop new technologies for use in aviation, defense systems, and space exploration, often specializing in areas such as structural design, guidance, navigation and control, instrumentation and communication, or production methods. They also may specialize in a particular type of aerospace product, such as commercial aircraft, military fighter jets, helicopters, spacecraft, or missiles and rockets, and may become experts in aerodynamics, thermodynamics, celestial mechanics, propulsion, acoustics, or guidance and control systems.
- Agricultural engineers apply knowledge of engineering technology and science to agriculture and the efficient use of biological resources. Because of this, they are also referred to as *biological and agricultural engineers*. They design agricultural machinery, equipment, sensors, processes, and structures, such as those used for crop storage. Some engineers specialize in areas such as power systems and machinery design; structures and environment engineering; and food and bioprocess engineering. They develop ways to conserve soil and water and to improve the processing of agricultural products. Agricultural engineers often work in research and development, production, sales, or management.
- Biomedical engineers develop devices and procedures that solve medical and health-related problems by combining their knowledge of biology and medicine with engineering principles and practices. Many do research, along with life scientists, chemists, and medical scientists, to develop and evaluate systems and products such as artificial organs, prostheses (artificial devices that replace missing body parts), instrumentation, medical information systems, and health management and care delivery systems. Biomedical engineers may also design devices used in various medical procedures, imaging systems such as magnetic resonance imaging (MRI), and devices for automating insulin injections or controlling body functions. Most engineers in this specialty need a sound background in another engineering specialty, such as mechanical or electronics engineering, in addition to specialized biomedical training. Some specialties within biomedical engineering include biomaterials, biomechanics, medical imaging, rehabilitation engineering, and orthopedic engineering.
- Chemical engineers apply the principles of chemistry to solve problems involving the production or use of chemicals and biochemicals. They design equipment and processes for large-scale chemical manufacturing, plan and test methods of

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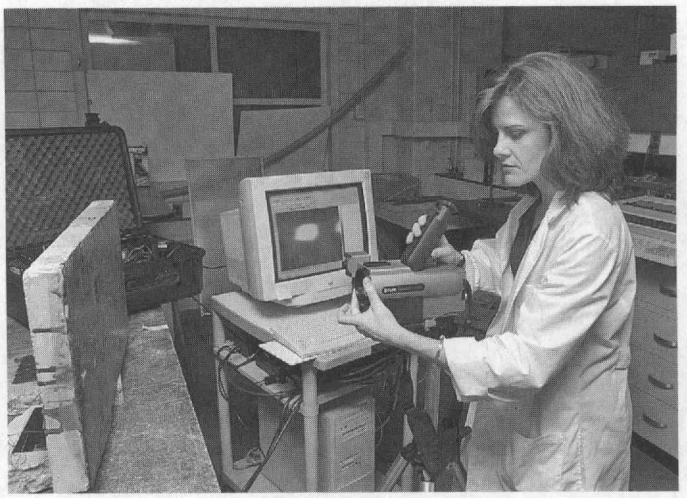
manufacturing products and treating byproducts, and supervise production. Chemical engineers also work in a variety of manufacturing industries other than chemical manufacturing, such as those producing energy, electronics, food, clothing, and paper. They also work in health care, biotechnology, and business services. Chemical engineers apply principles of physics, mathematics, and mechanical and electrical engineering, as well as chemistry. Some may specialize in a particular chemical process, such as oxidation or polymerization. Others specialize in a particular field, such as nanomaterials, or in the development of specific products. They must be aware of all aspects of chemicals manufacturing and how the manufacturing process affects the environment and the safety of workers and consumers.

- Civil engineers design and supervise the construction of roads, buildings, airports, tunnels, dams, bridges, and water supply and sewage systems. They must consider many factors in the design process, from the construction costs and expected lifetime of a project to government regulations and potential environmental hazards such as earthquakes and hurricanes. Civil engineering, considered one of the oldest engineering disciplines, encompasses many specialties. The major ones are structural, water resources, construction, environmental, transportation, and geotechnical engineering. Many civil engineers hold supervisory or administrative positions, from supervisor of a construction site to city engineer. Others may work in design, construction, research, and teaching.

- Computer hardware engineers research, design, develop, test, and oversee the manufacture and installation of computer hardware. Hardware includes computer chips, circuit boards, computer systems, and related equipment such as keyboards, modems, and printers. (Computer software engineers—often simply called computer engineers—design and develop the software systems that control computers. These workers are covered elsewhere in the *Handbook*.) The work of computer hardware engineers is very similar to that of electronics engineers in that they may design and test circuits and other electronic components, but computer hardware engineers do that work only as it relates to computers and computer-related equipment. The rapid advances in computer technology are largely a result of the research, development, and design efforts of these engineers.

- Electrical engineers design, develop, test, and supervise the manufacture of electrical equipment. Some of this equipment includes electric motors; machinery controls, lighting, and wiring in buildings; automobiles; aircraft; radar and navigation systems; and power generation, control, and transmission devices used by electric utilities. Although the terms "electrical" and "electronics" engineering often are used interchangeably in academia and industry, electrical engineers have traditionally focused on the generation and supply of power, whereas electronics engineers have worked on applications of electricity to control systems or signal processing. Electrical engineers specialize in areas such as power systems engineering or electrical equipment manufacturing.

- Electronics engineers, except computer are responsible for a wide range of technologies, from portable music players to the global positioning system (GPS), which can continuously provide the location, for example, of a vehicle. Electronics engineers design, develop, test, and supervise the manufacture of electronic equipment such as broadcast and communications systems. Many electronics engineers also work in areas closely related to computers. However, engineers whose work is related exclusively to computer hardware are considered computer hardware engineers. Electronics engineers specialize in areas such as communications, signal processing, and control systems or have a specialty within one of these areas—control systems or aviation electronics, for example.



Engineers sometimes perform tests in laboratories.

- Environmental engineers develop solutions to environmental problems using the principles of biology and chemistry. They are involved in water and air pollution control, recycling, waste disposal, and public health issues. Environmental engineers conduct hazardous-waste management studies in which they evaluate the significance of the hazard, advise on treatment and containment, and develop regulations to prevent mishaps. They design municipal water supply and industrial wastewater treatment systems. They conduct research on the environmental impact of proposed construction projects, analyze scientific data, and perform quality-control checks. Environmental engineers are concerned with local and worldwide environmental issues. They study and attempt to minimize the effects of acid rain, global warming, automobile emissions, and ozone depletion. They may also be involved in the protection of wildlife. Many environmental engineers work as consultants, helping their clients to comply with regulations, to prevent environmental damage, and to clean up hazardous sites.

- Health and safety engineers, except mining safety engineers and inspectors prevent harm to people and property by applying knowledge of systems engineering and mechanical, chemical, and human performance principles. Using this specialized knowledge, they identify and measure potential hazards, such as the risk of fires or the dangers involved in handling of toxic chemicals. They recommend appropriate loss prevention measures according to the probability of harm and potential damage. Health and safety engineers develop procedures and designs to reduce the risk of illness, injury, or damage. Some work in manufacturing industries to ensure the designs of new products do not create unnecessary hazards. They must be able

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to anticipate, recognize, and evaluate hazardous conditions, as well as develop hazard control methods.

• Industrial engineers determine the most effective ways to use the basic factors of production—people, machines, materials, information, and energy—to make a product or provide a service. They are primarily concerned with increasing productivity through the management of people, methods of business organization, and technology. To maximize efficiency, industrial engineers carefully study the product requirements and design manufacturing and information systems to meet those requirements with the help of mathematical methods and models. They develop management control systems to aid in financial planning and cost analysis, and design production planning and control systems to coordinate activities and ensure product quality. They also design or improve systems for the physical distribution of goods and services and determine the most efficient plant locations. Industrial engineers develop wage and salary administration systems and job evaluation programs. Many industrial engineers move into management positions because the work is closely related to the work of managers.

• Marine engineers and naval architects are involved in the design, construction, and maintenance of ships, boats, and related equipment. They design and supervise the construction of everything from aircraft carriers to submarines, and from sailboats to tankers. Naval architects work on the basic design of ships, including hull form and stability. Marine engineers work on the propulsion, steering, and other systems of ships. Marine engineers and naval architects apply knowledge from a range of fields to the entire design and production process of all water vehicles. Other workers who operate or supervise the operation of marine machinery on ships and other vessels sometimes may be called marine engineers or, more frequently, ship engineers, but they do different work and are covered under water transportation occupations elsewhere in the *Handbook*.

• Materials engineers are involved in the development, processing, and testing of the materials used to create a range of products, from computer chips and aircraft wings to golf clubs and snow skis. They work with metals, ceramics, plastics, semiconductors, and composites to create new materials that meet certain mechanical, electrical, and chemical requirements.



Some engineers, such as these mining engineers, work part of their time outdoors.

They also are involved in selecting materials for new applications. Materials engineers have developed the ability to create and then study materials at an atomic level, using advanced processes to replicate the characteristics of materials and their components with computers. Most materials engineers specialize in a particular material. For example, metallurgical engineers specialize in metals such as steel, and ceramic engineers develop ceramic materials and the processes for making them into useful products such as glassware or fiber optic communication lines.

• Mechanical engineers research, design, develop, manufacture, and test tools, engines, machines, and other mechanical devices. Mechanical engineering is one of the broadest engineering disciplines. Engineers in this discipline work on power-producing machines such as electric generators, internal combustion engines, and steam and gas turbines. They also work on power-using machines such as refrigeration and air-conditioning equipment, machine tools, material handling systems, elevators and escalators, industrial production equipment, and robots used in manufacturing. Mechanical engineers also design tools that other engineers need for their work. In addition, mechanical engineers work in manufacturing or agriculture production, maintenance, or technical sales; many become administrators or managers.

• Mining and geological engineers, including mining safety engineers find, extract, and prepare coal, metals, and minerals for use by manufacturing industries and utilities. They design open-pit and underground mines, supervise the construction of mine shafts and tunnels in underground operations, and devise methods for transporting minerals to processing plants. Mining engineers are responsible for the safe, economical, and environmentally sound operation of mines. Some mining engineers work with geologists and metallurgical engineers to locate and appraise new ore deposits. Others develop new mining equipment or direct mineral-processing operations that separate minerals from the dirt, rock, and other materials with which they are mixed. Mining engineers frequently specialize in the mining of one mineral or metal, such as coal or gold. With increased emphasis on protecting the environment, many mining engineers work to solve problems related to land reclamation and water and air pollution. Mining safety engineers use their knowledge of mine design and practices to ensure the safety of workers and to comply with State and Federal safety regulations. They inspect walls and roof surfaces, monitor air quality, and examine mining equipment for compliance with safety practices.

• Nuclear engineers research and develop the processes, instruments, and systems used to derive benefits from nuclear energy and radiation. They design, develop, monitor, and operate nuclear plants to generate power. They may work on the nuclear fuel cycle—the production, handling, and use of nuclear fuel and the safe disposal of waste produced by the generation of nuclear energy—or on the development of fusion energy. Some specialize in the development of nuclear power sources for naval vessels or spacecraft; others find industrial and medical uses for radioactive materials, as in equipment used to diagnose and treat medical problems.

• Petroleum engineers search the world for reservoirs containing oil or natural gas. Once these resources are discovered,

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petroleum engineers work with geologists and other specialists to understand the geologic formation and properties of the rock containing the reservoir, determine the drilling methods to be used, and monitor drilling and production operations. They design equipment and processes to achieve the maximum profitable recovery of oil and gas. Because only a small proportion of oil and gas in a reservoir flows out under natural forces, petroleum engineers develop and use various enhanced recovery methods. These include injecting water, chemicals, gases, or steam into an oil reservoir to force out more of the oil and doing computer-controlled drilling or fracturing to connect a larger area of a reservoir to a single well. Because even the best techniques in use today recover only a portion of the oil and gas in a reservoir, petroleum engineers research and develop technology and methods to increase recovery and lower the cost of drilling and production operations.

Work environment. Most engineers work in office buildings, laboratories, or industrial plants. Others may spend time outdoors at construction sites and oil and gas exploration and production sites, where they monitor or direct operations or solve onsite problems. Some engineers travel extensively to plants or worksites here and abroad.

Many engineers work a standard 40-hour week. At times, deadlines or design standards may bring extra pressure to a job, requiring engineers to work longer hours.

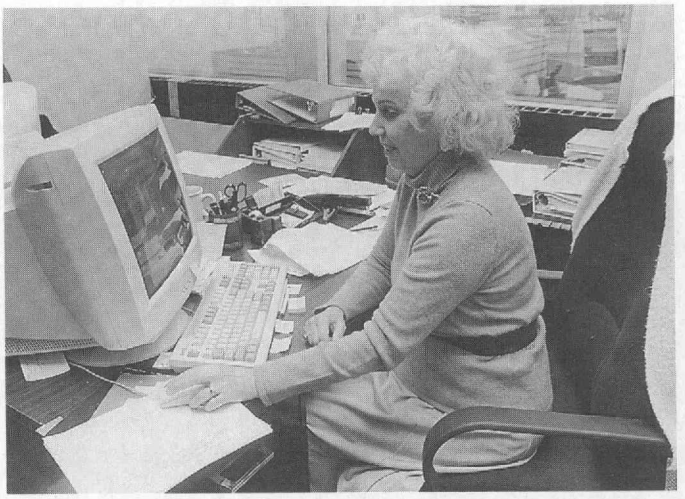
Training, Other Qualifications, and Advancement

Engineers typically enter the occupation with a bachelor's degree in an engineering specialty, but some basic research positions may require a graduate degree. Engineers offering their services directly to the public must be licensed. Continuing education to keep current with rapidly changing technology is important for engineers.

Education and training. A bachelor's degree in engineering is required for almost all entry-level engineering jobs. College graduates with a degree in a natural science or mathematics occasionally may qualify for some engineering jobs, especially in specialties in high demand. Most engineering degrees are granted in electrical, electronics, mechanical, or civil engineering. However, engineers trained in one branch may work in related branches. For example, many aerospace engineers have training in mechanical engineering. This flexibility allows employers to meet staffing needs in new technologies and specialties in which engineers may be in short supply. It also allows engineers to shift to fields with better employment prospects or to those that more closely match their interests.

Most engineering programs involve a concentration of study in an engineering specialty, along with courses in both mathematics and the physical and life sciences. Many programs also include courses in general engineering. A design course, sometimes accompanied by a computer or laboratory class or both, is part of the curriculum of most programs. General courses not directly related to engineering, such as those in the social sciences or humanities, are also often required.

In addition to the standard engineering degree, many colleges offer 2-year or 4-year degree programs in engineering technology. These programs, which usually include various hands-on laboratory classes that focus on current issues in the application of engineering principles, prepare students for practical design and production work, rather than for jobs that require more theoretical and scientific knowledge. Graduates of 4-year technology programs may get jobs similar to those obtained by graduates with a bachelor's degree in engineering. Engineering technology graduates, however, are not qualified to register as professional engineers under the same terms as graduates with degrees in engineering. Some employers regard technology program graduates as having skills between those of a technician and an engineer.



A bachelor's degree in engineering is required for most entry-level jobs.

Graduate training is essential for engineering faculty positions and many research and development programs, but is not required for the majority of entry-level engineering jobs. Many experienced engineers obtain graduate degrees in engineering or business administration to learn new technology and broaden their education. Many high-level executives in government and industry began their careers as engineers.

About 1,830 programs at colleges and universities offer bachelor's degrees in engineering that are accredited by the Accreditation Board for Engineering and Technology (ABET), Inc., and there are another 710 accredited programs in engineering technology. ABET accreditation is based on a program's faculty, curriculum, and facilities; the achievement of a program's students; program improvements; and institutional commitment to specific principles of quality and ethics. Although most institutions offer programs in the major branches of engineering, only a few offer programs in the smaller specialties. Also, programs of the same title may vary in content. For example, some programs emphasize industrial practices, preparing students for a job in industry, whereas others are more theoretical and are designed to prepare students for graduate work. Therefore, students should investigate curriculums and check accreditations carefully before selecting a college.

Admissions requirements for undergraduate engineering schools include a solid background in mathematics (algebra, geometry, trigonometry, and calculus) and science (biology, chemistry, and physics), with courses in English, social studies, and humanities. Bachelor's degree programs in engineering typically are designed to last 4 years, but many students find that it takes between 4 and 5 years to complete their studies. In

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a typical 4-year college curriculum, the first 2 years are spent studying mathematics, basic sciences, introductory engineering, humanities, and social sciences. In the last 2 years, most courses are in engineering, usually with a concentration in one specialty. Some programs offer a general engineering curriculum; students then specialize on the job or in graduate school.

Some engineering schools have agreements with 2-year colleges whereby the college provides the initial engineering education, and the engineering school automatically admits students for their last 2 years. In addition, a few engineering schools have arrangements that allow students who spend 3 years in a liberal arts college studying pre-engineering subjects and 2 years in an engineering school studying core subjects to receive a bachelor's degree from each school. Some colleges and universities offer 5-year master's degree programs. Some 5-year or even 6-year cooperative plans combine classroom study and practical work, permitting students to gain valuable experience and to finance part of their education.

Licensure. All 50 States and the District of Columbia require licensure for engineers who offer their services directly to the public. Engineers who are licensed are called professional engineers (PE). This licensure generally requires a degree from an ABET-accredited engineering program, 4 years of relevant work experience, and successful completion of a State examination. Recent graduates can start the licensing process by taking the examination in two stages. The initial Fundamentals of Engineering (FE) examination can be taken upon graduation. Engineers who pass this examination commonly are called engineers in training (EIT) or engineer interns (EI). After acquiring suitable work experience, EITs can take the second examination, the Principles and Practice of Engineering exam. Several States have imposed mandatory continuing education requirements for relicensure. Most States recognize licensure from other States, provided that the manner in which the initial license was obtained meets or exceeds their own licensure requirements. Many civil, electrical, mechanical, and chemical engineers are licensed PEs. Independent of licensure, various certification programs are offered by professional organizations to demonstrate competency in specific fields of engineering.

Other qualifications. Engineers should be creative, inquisitive, analytical, and detail oriented. They should be able to work as part of a team and to communicate well, both orally and in writing. Communication abilities are becoming increasingly important as engineers frequently interact with specialists in a wide range of fields outside engineering.

Certification and advancement. Beginning engineering graduates usually work under the supervision of experienced engineers and, in large companies, also may receive formal classroom or seminar-type training. As new engineers gain knowledge and experience, they are assigned more difficult projects with greater independence to develop designs, solve problems, and make decisions. Engineers may advance to become technical specialists or to supervise a staff or team of engineers and technicians. Some may eventually become engineering managers or enter other managerial or sales jobs. In sales, an engineering background enables them to discuss a product's technical aspects and assist in product planning, installation, and use. (See the statements under management and business and financial operations occupations, and the statement on sales engineers elsewhere in the *Handbook*.)

Numerous professional certifications for engineers exist and may be beneficial for advancement to senior technical or managerial positions. Many certification programs are offered by the professional societies listed as sources of additional information for engineering specialties at the end of this statement.

Employment

In 2006, engineers held about 1.5 million jobs. The distribution of employment by engineering specialty follows:

Civil engineers	256,000
Mechanical engineers	227,000
Industrial engineers	201,000
Electrical engineers	153,000
Electronics engineers, except computer	138,000
Aerospace engineers	90,000
Computer hardware engineers	79,000
Environmental engineers	54,000
Chemical engineers	30,000
Health and safety engineers, except mining safety engineers and inspectors	25,000
Materials engineers	22,000
Petroleum engineers	17,000
Nuclear engineers	15,000
Biomedical engineers	14,000
Marine engineers and naval architects	9,200
Mining and geological engineers, including mining safety engineers	7,100
Agricultural engineers	3,100
All other engineers	170,000

About 37 percent of engineering jobs were found in manufacturing industries and another 28 percent were in the professional, scientific, and technical services sector, primarily in architectural, engineering, and related services. Many engineers also worked in the construction, telecommunications, and wholesale trade industries.

Federal, State, and local governments employed about 12 percent of engineers in 2006. About half of these were in the Federal Government, mainly in the U.S. Departments of Defense, Transportation, Agriculture, Interior, and Energy, and in the National Aeronautics and Space Administration. Most engineers in State and local government agencies worked in highway and public works departments. In 2006, about 3 percent of engineers were self-employed, many as consultants.

Engineers are employed in every State, in small and large cities and in rural areas. Some branches of engineering are concentrated in particular industries and geographic areas—for example, petroleum engineering jobs tend to be located in areas with sizable petroleum deposits, such as Texas, Louisiana, Oklahoma, Alaska, and California. Others, such as civil engineering, are widely dispersed, and engineers in these fields often move from place to place to work on different projects.

Engineers are employed in every major industry. The industries employing the most engineers in each specialty are given in table 1, along with the percent of occupational employment in the industry.

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Table 1. Percent concentration of engineering specialty employment in key industries, 2006

Specialty	Industry	Percent
Aerospace engineers	Aerospace product and parts manufacturing	49
Agricultural engineers	Food manufacturing	25
	Architectural, engineering, and related services	15
Biomedical engineers	Medical equipment and supplies manufacturing	20
	Scientific research and development services	20
Chemical engineers	Chemical manufacturing	29
	Architectural, engineering, and related services	15
Civil engineers	Architectural, engineering, and related services	49
Computer hardware engineers	Computer and electronic product manufacturing	41
	Computer systems design and related services	19
Electrical engineers	Architectural, engineering, and related services	21
Electronics engineers, except computer	Computer and electronic product manufacturing	26
	Telecommunications	15
Environmental engineers	Architectural, engineering, and related services	29
	State and local government	21
Health and safety engineers, except mining safety engineers and inspectors	State and local government	10
Industrial engineers	Transportation equipment manufacturing	18
	Machinery manufacturing	8
Marine engineers and naval architects	Architectural, engineering, and related services	29
Materials engineers	Primary metal manufacturing	11
	Semiconductor and other electronic component manufacturing	9
Mechanical engineers	Architectural, engineering, and related services	22
	Transportation equipment manufacturing	14
Mining and geological engineers, including mining safety engineers	Mining	58
Nuclear engineers	Research and development in the physical, engineering, and life sciences	30
	Electric power generation, transmission and distribution	27
Petroleum engineers	Oil and gas extraction	43

Job Outlook

Employment of engineers is expected to grow about as fast as the average for all occupations over the next decade, but growth will vary by specialty. Environmental engineers should experience the fastest growth, while civil engineers should see the largest employment increase. Overall job opportunities in engineering are expected to be good.

Overall employment change. Overall engineering employment is expected to grow by 11 percent over the 2006-16 decade, about as fast as the average for all occupations. Engineers have traditionally been concentrated in slower growing or declining manufacturing industries, in which they will continue to be needed to design, build, test, and improve manufactured products. However, increasing employment of engineers in faster growing service industries should generate most of the employment growth. Job outlook varies by engineering specialty, as discussed later.

Competitive pressures and advancing technology will force companies to improve and update product designs and to optimize their manufacturing processes. Employers will rely on engineers to increase productivity and expand output of goods and services. New technologies continue to improve the design process, enabling engineers to produce and analyze various product designs much more rapidly than in the past. Unlike in some other occupations, however, technological advances are not expected to substantially limit employment opportunities in engineering because engineers will continue to develop new products and processes that increase productivity.

Offshoring of engineering work will likely dampen domestic employment growth to some degree. There are many well-trained, often English-speaking engineers available around the world willing to work at much lower salaries than U.S. engineers. The rise of the Internet has made it relatively easy for part of the engineering work previously done by engineers in this country to be done by engineers in other countries, a factor that will tend to hold down employment growth. Even so, there will always be a need for onsite engineers to interact with other employees and clients.

Overall job outlook. Overall job opportunities in engineering are expected to be good because the number of engineering graduates should be in rough balance with the number of job openings between 2006 and 2016. In addition to openings from job growth, many openings will be created by the need to replace current engineers who retire; transfer to management, sales, or other occupations; or leave engineering for other reasons.

Many engineers work on long-term research and development projects or in other activities that continue even during economic slowdowns. In industries such as electronics and aerospace, however, large cutbacks in defense expenditures and in government funding for research and development have resulted in significant layoffs of engineers in the past. The trend toward contracting for engineering work with engineering services firms, both domestic and foreign, has also made engineers more vulnerable to layoffs during periods of lower demand.

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It is important for engineers, as it is for workers in other technical and scientific occupations, to continue their education throughout their careers because much of their value to their employer depends on their knowledge of the latest technology. Engineers in high-technology areas, such as biotechnology or information technology, may find that technical knowledge becomes outdated rapidly. By keeping current in their field, engineers are able to deliver the best solutions and greatest value to their employers. Engineers who have not kept current in their field may find themselves at a disadvantage when seeking promotions or during layoffs.

Employment change and job outlook by engineering specialty.

- Aerospace engineers are expected to have 10 percent growth in employment over the projections decade, about as fast as the average for all occupations. Increases in the number and scope of military aerospace projects likely will generate new jobs. In addition, new technologies expected to be used on commercial aircraft produced during the next decade should spur demand for aerospace engineers. The employment outlook for aerospace engineers appears favorable. The number of degrees granted in aerospace engineering has declined for many years because of a perceived lack of opportunities in this field. Although this trend has reversed, new graduates continue to be needed to replace aerospace engineers who retire or leave the occupation for other reasons.
- Agricultural engineers are expected to have employment growth of 9 percent over the projections decade, about as fast as the average for all occupations. More engineers will be needed to meet the increasing demand for using biosensors to determine the optimal treatment of crops. Employment growth should also result from the need to increase crop yields to feed an expanding population and produce crops used as renewable energy sources. Moreover, engineers will be needed to develop more efficient agricultural production and conserve resources.
- Biomedical engineers are expected to have 21 percent employment growth over the projections decade, much faster than the average for all occupations. The aging of the population and the focus on health issues will drive demand for better medical devices and equipment designed by biomedical engineers. Along with the demand for more sophisticated medical equipment and procedures, an increased concern for cost-effectiveness will boost demand for biomedical engineers, particularly in pharmaceutical manufacturing and related industries. However, because of the growing interest in this field, the number of degrees granted in biomedical engineering has increased greatly. Biomedical engineers, particularly those with only a bachelor's degree, may face competition for jobs. Unlike many other engineering specialties, a graduate degree is recommended or required for many entry-level jobs.
- Chemical engineers are expected to have employment growth of 8 percent over the projections decade, about as fast as the average for all occupations. Although overall employment in the chemical manufacturing industry is expected to decline, chemical companies will continue to research and develop new chemicals and more efficient processes to increase output of existing chemicals. Among manufacturing industries, pharmaceuticals may provide the best opportunities for jobseekers. However, most employment growth for chemical engineers will be in service-providing industries such as professional, scien-

Projections data from the National Employment Matrix

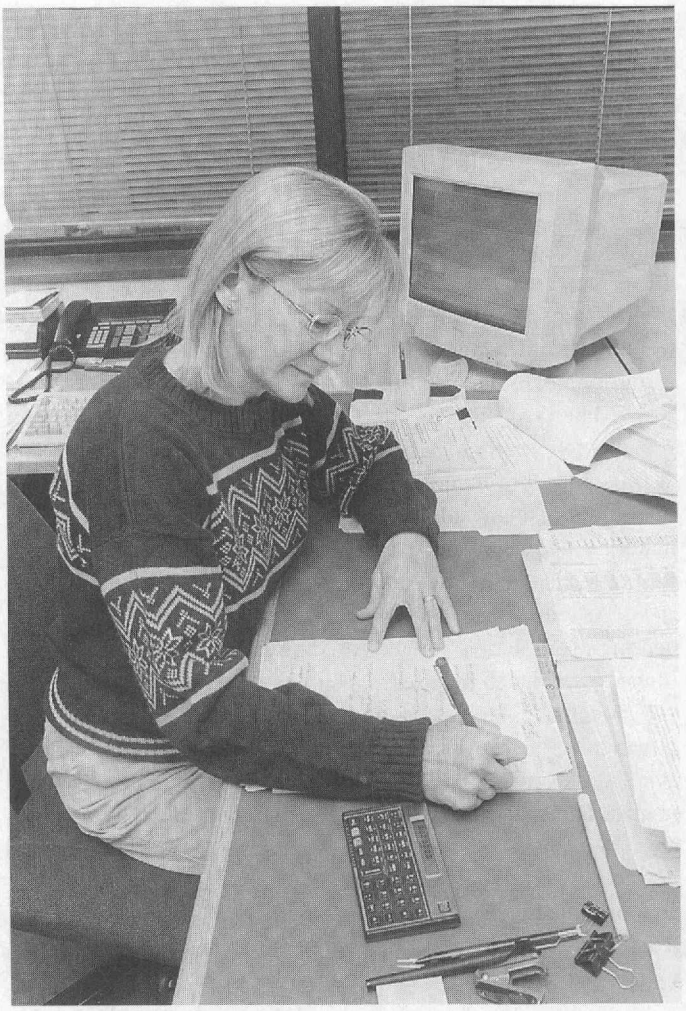
Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Engineers	17-2000	1,512,000	1,671,000	160,000	11
Aerospace engineers	17-2011	90,000	99,000	9,200	10
Agricultural engineers	17-2021	3,100	3,400	300	9
Biomedical engineers	17-2031	14,000	17,000	3,000	21
Chemical engineers	17-2041	30,000	33,000	2,400	8
Civil engineers	17-2051	256,000	302,000	46,000	18
Computer hardware engineers	17-2061	79,000	82,000	3,600	5
Electrical and electronics engineers	17-2070	291,000	306,000	15,000	5
Electrical engineers	17-2071	153,000	163,000	9,600	6
Electronics engineers, except computer	17-2072	138,000	143,000	5,100	4
Environmental engineers	17-2081	54,000	68,000	14,000	25
Industrial engineers, including health and safety	17-2110	227,000	270,000	43,000	19
Health and safety engineers, except mining safety engineers and inspectors	17-2111	25,000	28,000	2,400	10
Industrial engineers	17-2112	201,000	242,000	41,000	20
Marine engineers and naval architects	17-2121	9,200	10,000	1,000	11
Materials engineers	17-2131	22,000	22,000	900	4
Mechanical engineers	17-2141	226,000	235,000	9,400	4
Mining and geological engineers, including mining safety engineers	17-2151	7,100	7,800	700	10
Nuclear engineers	17-2161	15,000	16,000	1,100	7
Petroleum engineers	17-2171	17,000	18,000	900	5
Engineers, all other	17-2199	170,000	180,000	9,400	6

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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tific, and technical services, particularly for research in energy and the developing fields of biotechnology and nanotechnology.

- Civil engineers are expected to experience 18 percent employment growth during the projections decade, faster than the average for all occupations. Spurred by general population growth and the related need to improve the Nation's infrastructure, more civil engineers will be needed to design and construct or expand transportation, water supply, and pollution control systems and buildings and building complexes. They also will be needed to repair or replace existing roads, bridges, and other public structures. Because construction industries and architectural, engineering and related services employ many civil engineers, employment opportunities will vary by geographic area and may decrease during economic slowdowns, when construction is often curtailed.
- Computer hardware engineers are expected to have 5 percent employment growth over the projections decade, slower than the average for all occupations. Although the use of information technology continues to expand rapidly, the manufacture of computer hardware is expected to be adversely affected by intense foreign competition. As computer and semiconductor manufacturers contract out more of their engineering needs to both domestic and foreign design firms, much of the growth in employment of hardware engineers is expected in the computer systems design and related services industry.
- Electrical engineers are expected to have employment growth of 6 percent over the projections decade, slower than the average for all occupations. Although strong demand for electrical devices—including electric power generators, wireless phone transmitters, high-density batteries, and navigation systems—should spur job growth, international competition and the use of engineering services performed in other countries will limit employment growth. Electrical engineers working in firms providing engineering expertise and design services to manufacturers should have better job prospects.
- Electronics engineers, except computer are expected to have employment growth of 4 percent during the projections decade, slower than the average for all occupations. Although rising demand for electronic goods—including communications equipment, defense-related equipment, medical electronics, and consumer products—should continue to increase demand for electronics engineers, foreign competition in electronic products development and the use of engineering services performed in other countries will limit employment growth. Growth is expected to be fastest in service-providing industries—particularly in firms that provide engineering and design services.
- Environmental engineers should have employment growth of 25 percent during the projections decade, much faster than the average for all occupations. More environmental engineers will be needed to comply with environmental regulations and to develop methods of cleaning up existing hazards. A shift in emphasis toward preventing problems rather than controlling those that already exist, as well as increasing public health concerns resulting from population growth, also are expected to spur demand for environmental engineers. Because of this employment growth, job opportunities should be good even as more students earn degrees. Even though employment of environmental engineers should be less affected by economic conditions than most other types of engineers, a significant economic downturn could reduce the emphasis on environmental protection, reducing job opportunities.



Overall job opportunities in engineering are expected to be good.

- Health and safety engineers, except mining safety engineers and inspectors are projected to experience 10 percent employment growth over the projections decade, about as fast as the average for all occupations. Because health and safety engineers make production processes and products as safe as possible, their services should be in demand as concern increases for health and safety within work environments. As new technologies for production or processing are developed, health and safety engineers will be needed to ensure that they are safe.
- Industrial engineers are expected to have employment growth of 20 percent over the projections decade, faster than the average for all occupations. As firms look for new ways to reduce costs and raise productivity, they increasingly will turn to industrial engineers to develop more efficient processes and reduce costs, delays, and waste. This should lead to job growth for these engineers, even in manufacturing industries with slowly growing or declining employment overall. Because their work is similar to that done in management occupations, many industrial engineers leave the occupation to become managers. Many openings will be created by the need to replace

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industrial engineers who transfer to other occupations or leave the labor force.

- Marine engineers and naval architects are expected to experience employment growth of 11 percent over the projections decade, about as fast as the average for all occupations. Strong demand for naval vessels and recreational small craft should more than offset the long-term decline in the domestic design and construction of large oceangoing vessels. Good prospects are expected for marine engineers and naval architects because of growth in employment, the need to replace workers who retire or take other jobs, and the limited number of students pursuing careers in this occupation.

- Materials engineers are expected to have employment growth of 4 percent over the projections decade, slower than the average for all occupations. Although employment is expected to decline in many of the manufacturing industries in which materials engineers are concentrated, growth should be strong for materials engineers working on nanomaterials and biomaterials. As manufacturing firms contract for their materials engineering needs, employment growth is expected in professional, scientific, and technical services industries also.

- Mechanical engineers are projected to have 4 percent employment growth over the projections decade, slower than the average for all occupations. This is because total employment in manufacturing industries—in which employment of mechanical engineers is concentrated—is expected to decline. Some new job opportunities will be created due to emerging technologies in biotechnology, materials science, and nanotechnology. Additional opportunities outside of mechanical engineering will exist because the skills acquired through earning a degree in mechanical engineering often can be applied in other engineering specialties.

- Mining and geological engineers, including mining safety engineers are expected to have 10 percent employment growth over the projections decade, about as fast as the average for all occupations. Following a lengthy period of decline, strong growth in demand for minerals and increased use of mining engineers in the oil and gas extraction industry is expected to create some employment growth over the 2006-16 period. Moreover, many mining engineers currently employed are approaching retirement age, a factor that should create additional job openings. Furthermore, relatively few schools offer mining engineering programs, resulting in good job opportunities for graduates. The best opportunities may require frequent travel or even living overseas for extended periods of time as mining operations around the world recruit graduates of U.S. mining engineering programs.

- Nuclear engineers are expected to have employment growth of 7 percent over the projections decade, about as fast as the average for all occupations. Most job growth will be in research and development and engineering services. Although no commercial nuclear power plants have been built in the United States for many years, nuclear engineers will be needed to operate existing plants and design new ones, including researching future nuclear power sources. They also will be needed to work in defense-related areas, to develop nuclear medical technology, and to improve and enforce waste management and safety standards. Nuclear engineers are expected to have good employment opportunities because the small number of nuclear engineering graduates is likely to be in rough balance with the number of job openings.

- Petroleum engineers are expected to have 5 percent employment growth over the projections decade, more slowly than the average for all occupations. Even though most of the potential petroleum-producing areas in the United States already have been explored, petroleum engineers will increasingly be needed to develop new methods of extracting more resources from existing sources. Favorable opportunities are expected for petroleum engineers because the number of job openings is likely to exceed the relatively small number of graduates. Petroleum engineers work around the world and, in fact, the best employment opportunities may include some work in other countries.

Table 2: Earnings distribution by engineering specialty, May 2006

Specialty	Lowest 10%	Lowest 25%	Median	Highest 25%	Highest 10%
Aerospace engineers	59,610	71,360	87,610	106,450	124,550
Agricultural engineers	42,390	53,040	66,030	80,370	96,270
Biomedical engineers	44,930	56,420	73,930	93,420	116,330
Chemical engineers	50,060	62,410	78,860	98,100	118,670
Civil engineers	44,810	54,520	68,600	86,260	104,420
Computer hardware engineers	53,910	69,500	88,470	111,030	135,260
Electrical engineers	49,120	60,640	75,930	94,050	115,240
Electronics engineers, except computer	52,050	64,440	81,050	99,630	119,900
Environmental engineers	43,180	54,150	69,940	88,480	106,230
Health and safety engineers, except mining safety engineers and inspectors	41,050	51,630	66,290	83,240	100,160
Industrial engineers	44,790	55,060	68,620	84,850	100,980
Marine engineers and naval architects	45,200	56,280	72,990	90,790	113,320
Materials engineers	46,120	57,850	73,990	92,210	112,140
Mechanical engineers	45,170	55,420	69,850	87,550	104,900
Mining and geological engineers, including mining safety engineers	42,040	54,390	72,160	94,110	128,410
Nuclear engineers	65,220	77,920	90,220	105,710	124,510
Petroleum engineers	57,960	75,880	98,380	123,130	145,600+
All other engineers	46,080	62,710	81,660	100,320	120,610

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Table 3: Average starting salary by engineering specialty and degree , 2007

Curriculum	Bachelor's	Master's	Ph.D.
Aerospace/aeronautical/ astronautical	$53,408	$62,459	$73,814
Agricultural	49,764	—	—
Architectual	48,664	—	—
Bioengineering and biomedical	51,356	59,240	—
Chemical	59,361	68,561	73,667
Civil	48,509	48,280	62,275
Computer	56,201	60,000	92,500
Electrical/electronics and communications	55,292	66,309	75,982
Environmental/ environmental health	47,960	—	—
Industrial/manufacturing	55,067	64,759	77,364
Materials	56,233	—	—
Mechanical	54,128	62,798	72,763
Mining and mineral	54,381	—	—
Nuclear	56,587	59,167	—
Petroleum	60,718	57,000	—

Source: National Association of Colleges and Employers

Earnings

Earnings for engineers vary significantly by specialty, industry, and education. Variation in median earnings and in the earnings distributions for engineers in various specialties is especially significant. Table 2 shows wage-and-salary earnings distributions in May 2006 for engineers in specialties covered in this statement.

In the Federal Government, mean annual salaries for engineers ranged from $75,144 in agricultural engineering to $107,546 in ceramic engineering in 2007.

As a group, engineers earn some of the highest average starting salaries among those holding bachelor's degrees. Table 3 shows average starting salary offers for engineers, according to a 2007 survey by the National Association of Colleges and Employers.

Related Occupations

Engineers apply the principles of physical science and mathematics in their work. Other workers who use scientific and mathematical principles include architects, except landscape and naval; engineering and natural sciences managers; computer and information systems managers; computer programmers; computer software engineers; mathematicians; drafters; engineering technicians; sales engineers; science technicians; and physical and life scientists, including agricultural and food scientists, biological scientists, conservation scientists and foresters, atmospheric scientists, chemists and materials scientists, environmental scientists and hydrologists, geoscientists, and physicists and astronomers.

Sources of Additional Information

Information about careers in engineering is available from:

➤ JETS, 1420 King St., Suite 405, Alexandria, VA 22314. Internet: **http://www.jets.org**

Information on ABET-accredited engineering programs is available from:

➤ ABET, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202. Internet: **http://www.abet.org**

Those interested in information on the Professional Engineer licensure should contact:

➤ National Council of Examiners for Engineering and Surveying, P.O. Box 1686, Clemson, SC 29633. Internet: **http://www.ncees.org**

➤ National Society of Professional Engineers, 1420 King St., Alexandria, VA 22314. Internet: **http://www.nspe.org**

Information on general engineering education and career resources is available from:

➤ American Society for Engineering Education, 1818 N St.NW., Suite 600, Washington, DC 20036. Internet: **http://www.asee.org**

Information on obtaining engineering positions with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result. For advice on how to find and apply for Federal jobs, see the Occupational Outlook Quarterly article "How to get a job in the Federal Government," online at: **http://www.bls.gov/opub/ooq/2004/summer/art01.pdf**.

For more detailed information on an engineering specialty, contact societies representing the individual branches of engineering. Each can provide information about careers in the particular branch.

Aerospace engineers

➤ Aerospace Industries Association, 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209. Internet: **http://www.aia-aerospace.org**

➤ American Institute of Aeronautics and Astronautics, Inc., 1801 Alexander Bell Dr., Suite 500, Reston, VA 20191. Internet: **http://www.aiaa.org**

Agricultural engineers

➤ American Society of Agricultural and Biological Engineers, 2950 Niles Rd., St.Joseph, MI 49085. Internet: **http://www.asabe.org**

Biomedical engineers

➤ Biomedical Engineering Society, 8401 Corporate Dr., Suite 140, Landover, MD 20785. Internet: **http://www.bmes.org**

Chemical engineers

➤ American Chemical Society, Department of Career Services, 1155 16th St.NW., Washington, DC 20036. Internet: **http://www.chemistry.org**

➤ American Institute of Chemical Engineers, 3 Park Ave., New York, NY 10016. Internet: **http://www.aiche.org**

Civil engineers

➤ American Society of Civil Engineers, 1801 Alexander Bell Dr., Reston, VA 20191. Internet: **http://www.asce.org**

Computer hardware engineers

➤ IEEE Computer Society, 1730 Massachusetts Ave. NW., Washington, DC 20036. Internet: **http://www.computer.org**

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Electrical and electronics engineers

➤ Institute of Electrical and Electronics Engineers–USA, 1828 L St.NW., Suite 1202, Washington, DC 20036. Internet: **http://www.ieeeusa.org**

Environmental engineers

➤ American Academy of Environmental Engineers, 130 Holiday Court, Suite 100, Annapolis, MD 21401. Internet: **http://www.aaee.net**

Health and safety engineers

➤ American Society of Safety Engineers, 1800 E Oakton St., Des Plaines, IL 60018. Internet: **http://www.asse.org**

➤ Board of Certified Safety Professionals, 208 Burwash Ave., Savoy, IL 61874. Internet: **http://www.bcsp.org**

Industrial engineers

➤ Institute of Industrial Engineers, 3577 Parkway LaNE., Suite 200, Norcross, GA 30092. Internet: **http://www.iienet.org**

Marine engineers and naval architects

➤ Society of Naval Architects and Marine Engineers, 601 Pavonia Ave., Jersey City, NJ 07306. Internet: **http://www.sname.org**

Materials engineers

➤ ASM International, 9639 Kinsman Rd., Materials Park, OH 44073. Internet: **http://www.asminternational.org**

➤ Minerals, Metals, and Materials Society, 184 Thorn Hill Rd., Warrendale, PA 15086. Internet: **http://www.tms.org**

Mechanical engineers

➤ American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., 1791 Tullie Circle NE., Atlanta, GA 30329. Internet: **http://www.ashrae.org**

➤ American Society of Mechanical Engineers, 3 Park Ave., New York, NY 10016. Internet: **http://www.asme.org**

➤ SAE International, 400 Commonwealth Dr., Warrendale, PA 15096. Internet: **http://www.sae.org**

Mining and geological engineers, including mining safety engineers

➤ Society for Mining, Metallurgy, and Exploration, Inc., 8307 Shaffer Parkway, Littleton, CO 80127. Internet: **http://www.smenet.org**

Nuclear engineers

➤ American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60526. Internet: **http://www.ans.org**

Petroleum engineers

➤ Society of Petroleum Engineers, P.O. Box 833836, Richardson, TX 75083. Internet: **http://www.spe.org**

Drafters and Engineering Technicians

Drafters

(O*NET 17-3011.00, 17-3011.01, 17-3011.02, 17-3012.00, 17-3012.01, 17-3012.02, 17-3013.00, 17-3019.99)

Significant Points

- The type and quality of training programs vary considerably so prospective students should be careful in selecting a program.
- Opportunities should be best for individuals with at least 2 years of postsecondary training in drafting and considerable skill and experience using computer-aided design and drafting systems.
- Employment is projected to grow more slowly than average.
- Demand for drafters varies by specialty and depends on the needs of local industry.

Nature of the Work

Drafters prepare technical drawings and plans, which are used to build everything from manufactured products such as toys, toasters, industrial machinery, and spacecraft to structures such as houses, office buildings, and oil and gas pipelines.

In the past, drafters sat at drawing boards and used pencils, pens, compasses, protractors, triangles, and other drafting devices to prepare a drawing by hand. Now, most drafters use Computer Aided Design and Drafting (CADD) systems to prepare drawings. Consequently, some drafters may be referred to as *CADD operators*.

With CADD systems, drafters can create and store drawings electronically so that they can be viewed, printed, or programmed directly into automated manufacturing systems. CADD systems also permit drafters to quickly prepare variations of a design. Although drafters use CADD extensively, it is only a tool. Drafters still need knowledge of traditional drafting techniques, in addition to CADD skills. Despite the nearly universal use of CADD systems, manual drafting and sketching are used in certain applications.

Drafters' drawings provide visual guidelines and show how to construct a product or structure. Drawings include technical details and specify dimensions, materials, and procedures. Drafters fill in technical details using drawings, rough sketches, specifications, and calculations made by engineers, surveyors, architects, or scientists. For example, drafters use their knowledge of standardized building techniques to draw in the details of a structure. Some use their understanding of engineering and manufacturing theory and standards to draw the parts of a machine; they determine design elements, such as the numbers and kinds of fasteners needed to assemble the machine. Drafters use technical handbooks, tables, calculators, and computers to complete their work.

Drafting work has many specialties:

Aeronautical drafters prepare engineering drawings detailing plans and specifications used in the manufacture of aircraft, missiles, and related parts.

Architectural drafters draw architectural and structural features of buildings and other structures. These workers may specialize in a type of structure, such as residential or commercial, or in a kind of material used, such as reinforced concrete, masonry, steel, or timber.

Civil drafters prepare drawings and topographical and relief maps used in major construction or civil engineering projects,

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such as highways, bridges, pipelines, flood control projects, and water and sewage systems.

Electrical drafters prepare wiring and layout diagrams used by workers who erect, install, and repair electrical equipment and wiring in communication centers, power plants, electrical distribution systems, and buildings.

Electronics drafters draw wiring diagrams, circuit board assembly diagrams, schematics, and layout drawings used in the manufacture, installation, and repair of electronic devices and components.

Mechanical drafters prepare drawings showing the detail and assembly of a wide variety of machinery and mechanical devices, indicating dimensions, fastening methods, and other requirements.

Process piping or pipeline drafters prepare drawings used in the layout, construction, and operation of oil and gas fields, refineries, chemical plants, and process piping systems.

Work environment. Drafters usually work in comfortable offices. They may sit at adjustable drawing boards or drafting tables when doing manual drawings, although most drafters work at computer terminals much of the time. Because they spend long periods in front of computers doing detailed work, drafters may be susceptible to eyestrain, back discomfort, and hand and wrist problems. Most drafters work a standard 40-hour week; only a small number work part time.



Drafters pay careful attention to detail in their technical drawings.

Training, Other Qualifications, and Advancement

Employers prefer applicants who have completed postsecondary school training in drafting, which is offered by technical institutes, community colleges, and some 4-year colleges and universities. Employers are most interested in applicants with well-developed drafting and mechanical drawing skills; knowledge of drafting standards, mathematics, science, and engineering technology; and a solid background in CADD techniques.

Education and training. High school courses in mathematics, science, computer technology, design, computer graphics, and, where available, drafting are useful for people considering a drafting career. Employers prefer applicants who have also completed training after high school at a technical institute, community college, or 4-year college or university.

The kind and quality of drafting training programs vary considerably so prospective students should be careful in selecting a program. They should contact prospective employers to ask which schools they prefer and contact schools to ask for information about the kinds of jobs their graduates have, the type and condition of instructional facilities and equipment, and teacher qualifications.

Technical institutes offer intensive technical training, but they provide a less general education than do community colleges. Either certificates or diplomas may be awarded. Many technical institutes offer 2-year associate degree programs, which are similar to, or part of, the programs offered by community colleges or State university systems. Their programs vary considerably in length and in the type of courses offered. Some public vocational-technical schools serve local students and emphasize the type of training preferred by local employers. Most require a high school diploma or its equivalent for admission. Other technical institutes are run by private, often for-profit, organizations sometimes called proprietary schools.

Community colleges offer courses similar to those in technical institutes but include more classes in theory and liberal arts. Often, there is little or no difference between technical institute and community college programs. However, courses taken at community colleges are more likely to be accepted for credit at 4-year colleges. After completing a 2-year associate degree program, graduates may obtain jobs as drafters or continue their education in a related field at a 4-year college. Most 4-year colleges do not offer training in drafting, but they do offer classes in engineering, architecture, and mathematics that are useful for obtaining a job as a drafter.

Technical training obtained in the Armed Forces also can be applied in civilian drafting jobs. Some additional training may be necessary, depending on the technical area or military specialty.

Training differs somewhat within the drafting specialties, although the basics, such as mathematics, are similar. In an electronics drafting program, for example, students learn how to depict electronic components and circuits in drawings. In architectural drafting, they learn the technical specifications of buildings.

Certification and other qualifications. Mechanical ability and visual aptitude are important for drafters. Prospective drafters should be able to draw well and perform detailed work accurately and neatly. Artistic ability is helpful in some specialized fields, as is knowledge of manufacturing and construction methods. In addition, prospective drafters should have good

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interpersonal skills because they work closely with engineers, surveyors, architects, and other professionals and, sometimes, with customers.

The American Design Drafting Association (ADDA) has established a certification program for drafters. Although employers usually do not require drafters to be certified, certification demonstrates knowledge and an understanding of nationally recognized practices. Individuals who wish to become certified must pass the Drafter Certification Test, administered periodically at ADDA-authorized sites. Applicants are tested on basic drafting concepts, such as geometric construction, working drawings, and architectural terms and standards.

Advancement. Entry-level or junior drafters usually do routine work under close supervision. After gaining experience, they may become intermediate drafters and progress to more difficult work with less supervision. At the intermediate level, they may need to exercise more judgment and perform calculations when preparing and modifying drawings. Drafters may eventually advance to senior drafter, designer, or supervisor. Many employers pay for continuing education, and, with appropriate college degrees, drafters may go on to become engineering technicians, engineers, or architects.

Employment

Drafters held about 253,000 jobs in 2006. Architectural and civil drafters held 46 percent of all jobs for drafters, mechanical drafters held about 31 percent, and electrical and electronics drafters held about 14 percent.

About 49 percent of all jobs for drafters were in architectural, engineering, and related services firms that design construction projects or do other engineering work on a contract basis for other industries. Another 25 percent of jobs were in manufacturing industries such as machinery manufacturing, including metalworking and other general machinery; fabricated metal products manufacturing, including architectural and structural metals; computer and electronic products manufacturing, including navigational, measuring, electromedical, and control instruments; and transportation equipment manufacturing, including aerospace products and parts manufacturing, as well as ship and boat building. Most of the rest were employed in construction, government, wholesale trade, utilities, and employment services. Approximately 5 percent were self-employed in 2006.

Job Outlook

Drafters can expect slower than average employment growth through 2016, with the best opportunities expected for those with 2 years of professional training.

Employment change. Employment of drafters is expected to grow by 6 percent between 2006 and 2016, which is slower than the average for all occupations. Industrial growth and increasingly complex design problems associated with new products and manufacturing processes will increase the demand for drafting services. Furthermore, drafters are beginning to break out of the traditional drafting role and do work traditionally performed by engineers and architects, also increasing demand. However, drafters tend to be concentrated in slow-growing or declining manufacturing industries. In addition, CADD systems that are more powerful and easier to use are also expected to limit demand for lesser skilled drafters because simple tasks will be made easier or able to be done by other technical professionals. Employment growth also should be slowed by the offshore outsourcing to other countries of some drafting work because some drafting can be done by sending CADD files over the Internet.

Although growth is expected to be greatest for mechanical, architectural, and civil drafters, demand for particular drafting specialties varies throughout the country because employment usually is contingent on the needs of local industry.

Job prospects. Most job openings are expected to arise from the need to replace drafters who transfer to other occupations, leave the labor force, or retire.

Opportunities should be best for individuals with at least 2 years of postsecondary training in a drafting program that provides strong technical skills and considerable experience with CADD systems. CADD has increased the complexity of drafting applications while enhancing the productivity of drafters. It also has enhanced the nature of drafting by creating more possibilities for design and drafting. As technology continues to advance, employers will look for drafters with a strong background in fundamental drafting principles, a high level of technical sophistication, and the ability to apply their knowledge to a broader range of responsibilities.

Employment of drafters remains highly concentrated in industries that are sensitive to cyclical changes in the economy, primarily manufacturing industries. During recessions, drafters may be laid off. However, a growing number of drafters should continue to find employment on a temporary or contract basis as more companies turn to the employment services industry to meet their changing needs.

Earnings

Drafters' earnings vary by specialty, location, and level of responsibility. Median annual earnings of architectural and civil drafters were $41,960 in May 2006. The middle 50 percent earned between $33,550 and $52,220. The lowest 10 percent

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Drafters	17-3010	253,000	268,000	15,000	6
Architectural and civil drafters	17-3011	116,000	123,000	7,000	6
Electrical and electronics drafters	17-3012	35,000	36,000	1,400	4
Mechanical drafters	17-3013	78,000	82,000	4,100	5
Drafters, all other	17-3019	25,000	27,000	2,700	11

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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earned less than $27,010, and the highest 10 percent earned more than $63,310.

Median annual earnings of mechanical drafters were $43,700 in May 2006. The middle 50 percent earned between $34,680 and $55,130. The lowest 10 percent earned less than $28,230, and the highest 10 percent earned more than $67,860. Median annual earnings for mechanical drafters in architectural, engineering, and related services were $44,120.

Median annual earnings of electrical and electronics drafters were $46,830 in May 2006. The middle 50 percent earned between $36,660 and $60,160. The lowest 10 percent earned less than $29,290, and the highest 10 percent earned more than $74,490. In architectural, engineering, and related services, median annual earnings for electrical and electronics drafters were $44,140.

Related Occupations

Other workers who prepare or analyze detailed drawings and make precise calculations and measurements include architects, except landscape and naval; landscape architects; commercial and industrial designers; engineers; engineering technicians; science technicians; and surveyors, cartographers, photogrammetrists, and surveying technicians.

Sources of Additional Information

Information on schools offering programs in drafting and related fields is available from:

➤ Accrediting Commission of Career Schools and Colleges of Technology, 2101 Wilson Blvd., Suite 302, Arlington, VA 22201. Internet: **http://www.accsct.org**

Information about certification is available from:

➤ American Design Drafting Association, 105 E. Main St., Newbern, TN 38059. Internet: **http://www.adda.org**

Engineering Technicians

(O*NET 17-3021.00, 17-3022.00, 17-3023.00, 17-3023.01, 17-3023.03, 17-3024.00, 17-3025.00, 17-3026.00, 17-3027.00, 17-3029.99)

Significant Points

- Because the type and quality of training programs vary considerably, prospective students should carefully investigate training programs before enrolling.
- Electrical and electronic engineering technicians make up 33 percent of all engineering technicians.
- Employment of engineering technicians often is influenced by the same economic conditions that affect engineers; as a result, job outlook varies by specialty.
- 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 narrowly focused and application-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. Although many workers who repair or maintain various types of electrical, electronic, or mechanical equipment are called technicians, these workers are covered in the *Handbook* section on installation, maintenance, and repair occupations.

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 and drafting (CADD) equipment.

Most engineering technicians specialize, learning skills and working in the same disciplines as engineers. Occupational titles, therefore, tend to reflect this similarity. The *Handbook* does not cover in detail some branches of engineering technology, such as chemical engineering technology (the development of new chemical products and processes) and bioengineering technology (the development and implementation of biomedical equipment), for which there are accredited programs of study.

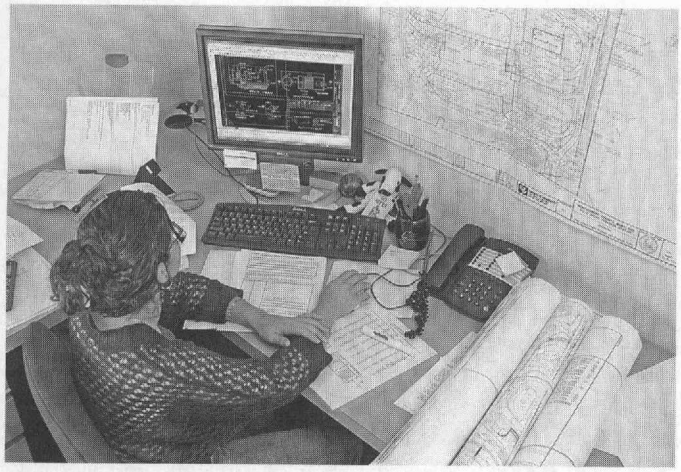
Aerospace engineering and operations technicians construct, test, and maintain aircraft and space vehicles. They may calibrate test equipment and determine causes of equipment malfunctions. Using computer and communications systems, aerospace engineering and operations technicians often record and interpret test data.

Civil engineering technicians help civil engineers plan and oversee the building of highways, buildings, bridges, dams, wastewater treatment systems, and other structures and 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. (Cost estimators; construction and building inspectors; drafters; and surveyors, cartographers, photogrammetrists, and surveying technicians are covered elsewhere in the *Handbook*.)

Electrical and electronics engineering technicians help design, develop, test, and manufacture electrical and electronic equipment such as communication equipment; radar, industrial, and medical monitoring 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. (Workers whose jobs primarily involve repairing electrical and electronic equipment are often are referred to as electronics technicians, but they are included with electrical and electronics installers and repairers discussed elsewhere in the *Handbook*.)

Electromechanical engineering technicians combine knowledge of mechanical engineering technology with knowledge of electrical and electronic circuits to design, develop, test, and manufacture electronic and computer-controlled mechanical systems. Their work often overlaps that of both electrical and

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Some engineering technicians assist engineers and scientists in data analysis.

electronics engineering technicians and mechanical engineering technicians.

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 related to 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, conduct statistical studies of production time or quality, and analyze production costs.

Mechanical engineering technicians help engineers design, develop, test, and manufacture industrial machinery, consumer products, and other equipment. They may assist in product tests by, for example, setting up instrumentation for auto crash tests. They may make sketches and rough layouts, record and analyze data, make calculations and estimates, and report on their findings. 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.

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

Training, Other Qualifications, and Advancement

Most engineering technicians enter the occupation with an associate degree in engineering technology. Training is available at technical institutes, community colleges, extension divisions of colleges and universities, public and private vocational-technical schools, and in the Armed Forces. Because the type and quality of training programs vary considerably, prospective students should carefully investigate training programs before enrolling.

Education and training. 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. People with college courses in science, engineering, and mathematics may qualify for some positions but may need additional specialized training and experience. Prospective engineering technicians should take as many high school science and math courses as possible to prepare for programs in engineering technology after high school.

Most 2-year associate degree programs accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) include at least college algebra and trigonometry and one or two basic science courses. Depending on the specialty, more math or science may be required. About 710 ABET-accredited programs are offered in engineering technology specialties.

The type of technical courses required 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 electrical 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.

Many publicly and privately operated schools provide technical training, but the type and quality of training vary considerably. Therefore, prospective students should carefully select a program in line with their goals. They should ascertain prospective employers' preferences and ask schools to provide information about the kinds of jobs obtained by program graduates, about instructional facilities and equipment, and about faculty qualifications. Graduates of ABET-accredited programs usually are recognized as having 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 they provide less theory and general education than do community colleges. Many technical institutes 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 organizations, with programs that vary considerably in length and types of courses offered.

Community colleges offer curriculums that are similar to those in technical institutes but 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, whereas others continue their education at 4-year colleges. However, an associate degree in pre-engineering is different from 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 if 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

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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 having 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 and may be of limited applicability 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.

Other qualifications. Because many engineering technicians assist in design work, creativity is desirable. Good communication skills and the ability to work well with others also are important as engineering technicians are typically part of a team of engineers and other technicians.

Certification and advancement. Although employers usually do not require engineering technicians to be certified, such certification may provide jobseekers a competitive advantage. The National Institute for Certification in Engineering Technologies has established voluntary certification programs for several engineering technology specialties. Certification is available at various levels, each level combining a written examination in a specialty with a certain amount of job-related experience, a supervisory evaluation, and a recommendation.

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.

Employment

Engineering technicians held 511,000 jobs in 2006. Approximately 33 percent were electrical and electronics engineering technicians, as indicated by the following tabulation.

Electrical and electronic engineering technicians	170,000
Civil engineering technicians	91,000
Industrial engineering technicians	75,000
Mechanical engineering technicians	48,000
Environmental engineering technicians	21,000
Electro-mechanical technicians	16,000
Aerospace engineering and operations technicians	8,500
Engineering technicians, except drafters, all other	82,000

About 35 percent of all engineering technicians worked in manufacturing, mainly in the computer and electronic equipment, transportation equipment, and machinery manufacturing industries. Another 25 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 2006, the Federal Government employed 37,000 engineering technicians. State governments employed 29,000, and local governments employed 25,000.

Job Outlook

Overall employment of engineering technicians is expected to grow about as fast as the average for all occupations, but projected growth and job prospects vary by specialty. Opportunities will be best for individuals with an associate degree or extensive job training in engineering technology.

Employment change. Overall employment of engineering technicians is expected to grow 7 percent between 2006 and 2016, about as fast as the average for all occupations. Competitive pressures will force companies to improve and update manufacturing facilities and product designs, resulting in more jobs for engineering technicians.

Growth of engineering technician employment in some design functions may be dampened by increasing globalization of the development process. To reduce costs and speed project completion, some companies may relocate part of their development operations to facilities overseas, impacting both engi-

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Engineering technicians, except drafters	17-3020	511,000	545,000	34,000	7
Aerospace engineering and operations technicians	17-3021	8,500	9,400	900	10
Civil engineering technicians	17-3022	91,000	100,000	9,200	10
Electrical and electronic engineering technicians	17-3023	170,000	177,000	6,100	4
Electro-mechanical technicians	17-3024	16,000	16,000	400	3
Environmental engineering technicians	17-3025	21,000	26,000	5,200	25
Industrial engineering technicians	17-3026	75,000	82,000	7,500	10
Mechanical engineering technicians	17-3027	48,000	51,000	3,100	6
Engineering technicians, except drafters, all other	17-3029	82,000	83,000	1,600	2

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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neers and engineering technicians—particularly in electronics and computer-related specialties. However, much of the work of engineering technicians requires on-site presence, so demand for engineering technicians within the U.S. should continue to grow—particularly in the environmental, civil, and industrial specialties.

Because engineering technicians work closely with engineers, employment of engineering technicians is often influenced by the same local and national economic conditions that affect engineers. As a result, the employment outlook varies with industry and specialization.

Aerospace engineering and operations technicians are expected to have 10 percent employment growth between 2006 and 2016, about as fast as the average for all occupations. Increases in the number and scope of military aerospace projects likely will generate new jobs. New technologies to be used on commercial aircraft produced during the next decade should also spur demand for these workers.

Civil engineering technicians are expected to have 10 percent employment growth between 2006 and 2016, about as fast as the average for all occupations. Spurred by population growth and the related need to improve the Nation's infrastructure, more civil engineering technicians will be needed to expand transportation, water supply, and pollution control systems, as well as large buildings and building complexes. They also will be needed to repair or replace existing roads, bridges, and other public structures.

Electrical and electronic engineering technicians are expected to have 4 percent employment growth between 2006 and 2016, more slowly than the average for all occupations. Although rising demand for electronic goods—including communications equipment, defense-related equipment, medical electronics, and consumer products—should continue to drive demand, foreign competition in design and manufacturing will limit employment growth.

Electro-mechanical technicians are expected to have 3 percent employment growth between 2006 and 2016, more slowly than the average for all occupations. As with the closely-related electrical and electronic engineering technicians and mechanical engineering technicians, job growth should be driven by increasing demand for electro-mechanical products such as unmanned aircraft and robotic equipment. However, growth will be tempered by advances in productivity and strong foreign competition.

Environmental engineering technicians are expected to have 25 percent employment growth between 2006 and 2016, much faster than the average for all occupations. More environmental engineering technicians will be needed to comply with environmental regulations and to develop methods of cleaning up existing hazards. A shift in emphasis toward preventing problems rather than controlling those that already exist, as well as increasing public health concerns resulting from population growth, also will spur demand.

Industrial engineering technicians are expected to have 10 percent employment growth between 2006 and 2016, about as fast as the average for all occupations. As firms continue to seek new means of reducing costs and increasing productivity, demand for industrial engineering technicians to analyze and improve production processes should increase. This should lead to some job growth even in manufacturing industries with slowly growing or declining employment.

Mechanical engineering technicians are expected to have 6 percent employment growth between 2006 and 2016, more slowly than the average for all occupations. As mechanical products and components become increasingly complex, demand for improvements in these products should drive employment growth of mechanical engineering technicians. However, growth is expected to be limited by foreign competition in both design services and manufacturing.

Job prospects. Job prospects will vary by specialty and location, depending on the health and composition of local industry. In general, 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 little additional training. An increase in the number of jobs related to public health and safety should create job opportunities for engineering technicians with the appropriate training and certification. In addition to openings from job growth, many job openings will stem from the need to replace technicians who retire or leave the labor force.

Earnings

Median annual earnings in May 2006 of engineering technicians by specialty are shown in the following tabulation.

Aerospace engineering and operations technicians	$53,300
Electrical and electronic engineering technicians	50,660
Industrial engineering technicians	46,810
Mechanical engineering technicians	45,850
Electro-mechanical technicians	44,720
Civil engineering technicians	40,560
Environmental engineering technicians	40,560

Median annual earnings of wage-and-salary electrical and electronics engineering technicians were $50,660 in May 2006. The middle 50 percent earned between $39,270 and $60,470. The lowest 10 percent earned less than $30,120, and the highest 10 percent earned more than $73,200. Median annual earnings in the industries employing the largest numbers of electrical and electronics engineering technicians are:

Wired telecommunications carriers	$54,780
Engineering services	48,330
Semiconductor and other electronic component manufacturing	45,720
Navigational, measuring, electromedical, and control instruments manufacturing	45,140
Employment services	38,910

Median annual earnings of wage-and-salary civil engineering technicians were $40,560 in May 2006. The middle 50 percent earned between $31,310 and $51,230. The lowest 10 percent earned less than $25,250, and the highest 10 percent earned more than $62,920. Median annual earnings in the in-

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dustries employing the largest numbers of civil engineering technicians are:

Local government	$45,800
Architectural services	42,310
Engineering services	41,180
State government	35,870
Testing laboratories	31,800

In May 2006, the median annual salary for aerospace engineering and operations technicians in the aerospace products and parts manufacturing industry was $52,060, and the median annual salary for environmental engineering technicians in the architectural, engineering, and related services industry was $38,060. The median annual salary for industrial engineering technicians in the aerospace product and parts manufacturing industry was $57,330. In the architectural, engineering, and related services industry, the median annual salary for mechanical engineering technicians was $43,920. Electro-mechanical technicians earned a median salary of $41,550 in the navigational, measuring, electromedical, and control instruments manufacturing industry.

Related Occupations

Engineering technicians apply scientific and engineering skills usually gained in postsecondary programs below the bachelor's degree level. Similar occupations include science technicians; drafters; surveyors, cartographers, photogrammetrists, and surveying technicians; and broadcast and sound engineering technicians and radio operators.

Sources of Additional Information

For information about careers in engineering technology, contact:

➤ JETS (Junior Engineering Technical Society) Guidance, 1420 King St., Suite 405, Alexandria, VA 22314. Internet: **http://www.jets.org**

Information on engineering technology programs accredited by the Accreditation Board for Engineering and Technology is available from:

➤ ABET, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202. Internet: **http://www.abet.org**

Information on certification, as well as job and career information, is available from:

➤ National Institute for Certification in Engineering Technologies, 1420 King St., Alexandria, VA 22314. Internet: **http://www.nicet.org**

Life Scientists

Agricultural and Food Scientists

(O*NET 19–1011.00, 19–1012.00, 19–1013.00)

Significant Points

- About 14 percent of agricultural and food scientists work for Federal, State, or local governments.
- A bachelor's degree in agricultural science is sufficient for some jobs in product development; a master's or Ph.D. degree is required for research or teaching.
- Opportunities for agricultural and food scientists are expected to be good over the next decade, particularly for those holding a master's or Ph.D. degree.

Nature of the Work

The work of agricultural and food scientists plays an important part in maintaining the Nation's food supply by ensuring agricultural productivity and food safety. Agricultural scientists study farm crops and animals and develop ways of improving their quantity and quality. They look for ways to improve crop yield with less labor, control pests and weeds more safely and effectively, and conserve soil and water. They research methods of converting raw agricultural commodities into attractive and healthy food products for consumers. Some agricultural scientists look for ways to use agricultural products for fuels.

In the past two decades, rapid advances in the study of genetics have spurred the growth of biotechnology. Some agricultural and food scientists use biotechnology to manipulate the genetic material of plants and crops, attempting to make these organisms more productive or resistant to disease. Advances in biotechnology have opened up research opportunities in many areas of agricultural and food science, including commercial applications in agriculture, environmental remediation, and the food industry. Interest in the production of biofuels, or fuels manufactured from agricultural derivatives, has also increased. Some agricultural scientists work with biologists and chemists to develop processes for turning crops into energy sources, such as ethanol produced from corn.

Another emerging technology expected to affect agriculture is nanotechnology—a molecular manufacturing technology which promises to revolutionize methods of testing agricultural and food products for contamination or spoilage. Some food scientists are using nanotechnology to develop sensors that can quickly and accurately detect contaminant molecules in food.

Many agricultural scientists work in basic or applied research and development. Basic research seeks to understand the biological and chemical processes by which crops and livestock grow, such as determining the role of a particular gene in plant growth. Applied research uses this knowledge to discover mechanisms to improve the quality, quantity, or safety of agricultural products. Other agricultural scientists manage or administer research and development programs, or manage marketing or production operations in companies that produce food products or agricultural chemicals, supplies, and machin-

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ery. Some agricultural scientists are consultants to business firms, private clients, or government.

Depending on the agricultural or food scientist's area of specialization, the nature of the work performed varies.

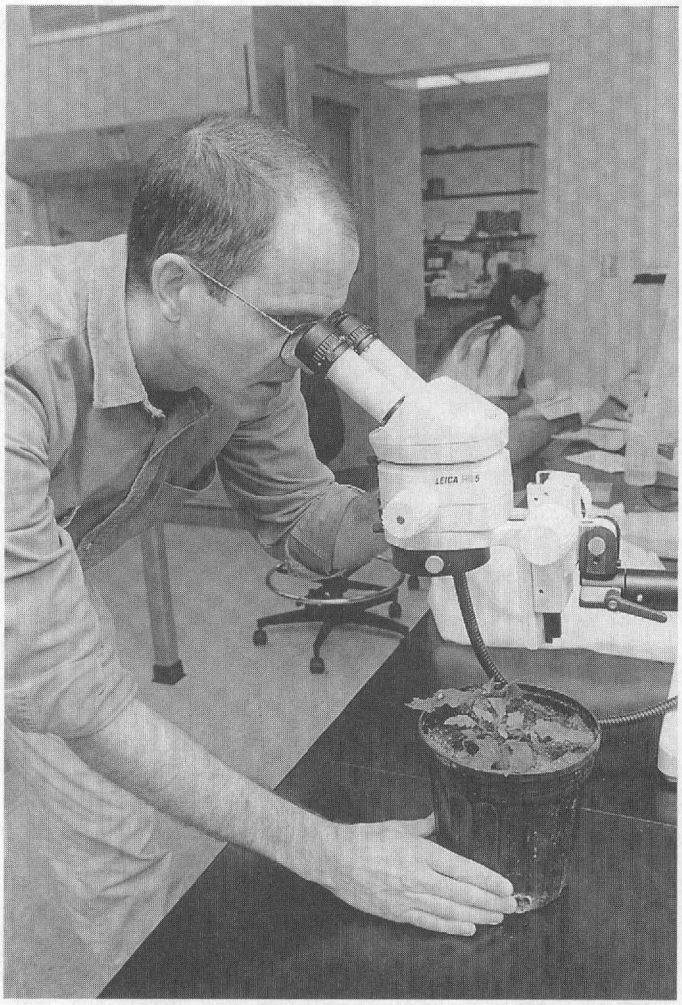
Food scientists and technologists usually work in the food processing industry, universities, or the Federal Government to create and improve food products. They use their knowledge of chemistry, physics, engineering, microbiology, biotechnology, and other sciences to develop new or better ways of preserving, processing, packaging, storing, and delivering foods. Some food scientists engage in basic research, discovering new food sources; analyzing food content to determine levels of vitamins, fat, sugar, or protein; or searching for substitutes for harmful or undesirable additives, such as nitrites. Others engage in applied research, finding ways to improve the content of food or to remove harmful additives. They also develop ways to process, preserve, package, or store food according to industry and government regulations. Traditional food processing research into baking, blanching, canning, drying, evaporation, and pasteurization also continues. Other food scientists enforce government regulations, inspecting food processing areas and ensuring that sanitation, safety, quality, and waste management standards are met.

Food technologists generally work in product development, applying the findings from food science research to improve the selection, preservation, processing, packaging, and distribution of food.

Plant scientists study plants, helping producers of food, feed, and fiber crops to feed a growing population and conserve natural resources. *Agronomists* and *crop scientists* not only help increase productivity, but also study ways to improve the nutritional value of crops and the quality of seed, often through biotechnology. Some crop scientists study the breeding, physiology, and management of crops and use genetic engineering to develop crops resistant to pests and drought. Some plant scientists develop new technologies to control or eliminate pests and prevent their spread in ways appropriate to the specific environment. They also conduct research or oversee activities to halt the spread of insect-borne disease.

Soil scientists study the chemical, physical, biological, and mineralogical composition of soils as it relates to plant growth. They also study the responses of various soil types to fertilizers, tillage practices, and crop rotation. Many soil scientists who work for the Federal Government conduct soil surveys, classifying and mapping soils. They provide information and recommendations to farmers and other landowners regarding the best use of land and plants to avoid or correct problems, such as erosion. They may also consult with engineers and other technical personnel working on construction projects about the effects of, and solutions to, soil problems. Because soil science is closely related to environmental science, persons trained in soil science also work to ensure environmental quality and effective land use.

Animal scientists work to develop better, more efficient ways of producing and processing meat, poultry, eggs, and milk. Dairy scientists, poultry scientists, animal breeders, and other scientists in related fields study the genetics, nutrition, reproduction, and growth of domestic farm animals. Some animal scientists inspect and grade livestock food products, purchase livestock, or work in technical sales or marketing. As extension agents or consultants, animal scientists advise agricultural producers on how to upgrade animal housing facilities properly, lower mortality rates, handle waste matter, or increase production of animal products, such as milk or eggs.



Agicultural and food scientists often work in offices or labratories.

Work environment. Agricultural scientists involved in management or basic research tend to work regular hours in offices and laboratories. The work environment for those engaged in applied research or product development varies, depending on specialty and on type of employer. For example, food scientists in private industry may work in test kitchens while investigating new processing techniques. Animal scientists working for Federal, State, or university research stations may spend part of their time at dairies, farrowing houses, feedlots, farm animal facilities, or outdoors conducting research. Soil and crop scientists also spend time outdoors conducting research on farms and agricultural research stations.

Training, Other Qualifications, and Advancement

Most agricultural and food scientists need at least a master's degree to work in basic or applied research, whereas a bachelor's degree is sufficient for some jobs in applied research or product

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development, or jobs in other occupations related to agricultural science.

Education and training. Training requirements for agricultural scientists depend on the type of work they perform. A bachelor's degree in agricultural science is sufficient for some jobs in product development or assisting in applied research, but a master's or doctoral degree is generally required for basic research or for jobs directing applied research. A Ph.D. in agricultural science usually is needed for college teaching and for advancement to senior research positions. Degrees in related sciences such as biology, chemistry, or physics or in related engineering specialties also may qualify people for many agricultural science jobs.

All States have a land-grant college that offers agricultural science degrees. Many other colleges and universities also offer agricultural science degrees or agricultural science courses. However, not every school offers all specialties. A typical undergraduate agricultural science curriculum includes communications, mathematics, economics, business, and physical and life sciences courses, in addition to a wide variety of technical agricultural science courses. For prospective animal scientists, these technical agricultural science courses might include animal breeding, reproductive physiology, nutrition, and meats and muscle biology. Graduate students usually specialize in a subfield of agricultural science, such as animal breeding and genetics, crop science, or horticulture science, depending on their interests. For example, those interested in doing genetic and biotechnological research in the food industry need a strong background in life and physical sciences, such as cell and molecular biology, microbiology, and inorganic and organic chemistry. Undergraduate students, however, need not specialize. In fact, undergraduates who are broadly trained often have greater career flexibility.

Students preparing to be food scientists take courses such as food chemistry, food analysis, food microbiology, food engineering, and food processing operations. Those preparing as soil and plant scientists take courses in plant pathology, soil chemistry, entomology, plant physiology, and biochemistry, among others. Advanced degree programs include classroom and fieldwork, laboratory research, and a thesis or dissertation based on independent research.

Other qualifications. Agricultural and food scientists should be able to work independently or as part of a team and be able to communicate clearly and concisely, both orally and in writing. Most of these scientists also need an understanding of basic business principles, the ability to apply statistical techniques, and the ability to use computers to analyze data and to control biological and chemical processing.

Certification and advancement. Agricultural scientists who have advanced degrees usually begin in research or teaching. With experience, they may advance to jobs as supervisors of research programs or managers of other agriculture-related activities.

The American Society of Agronomy certifies agronomists and crop advisors, and the Soil Science Society of America certifies soil scientists and soil classifiers. To become certified in soil science or soil classification, applicants must have a bachelor's degree in soil science and 5 years of experience or a graduate degree and 3 years experience. Certification in agronomy requires a bachelor's degree in agronomy or a related field and 5 years experience or a graduate degree and 3 years. Crop advising certification requires either 4 years of experience or a bachelor's degree in agriculture and 2 years of experience. To receive any of these certifications, applicants must also pass designated examinations and agree to adhere to a code of ethics. Each certification is maintained through continuing education.

Employment

Agricultural and food scientists held about 33,000 jobs in 2006. In addition, many people trained in these sciences held faculty positions in colleges and universities. (See the statement on postsecondary teachers elsewhere in the *Handbook*.)

About 14 percent of agricultural and food scientists work for Federal, State, or local governments. State and local governments employed about 5 percent, while the Federal Government employed another 9 percent in 2006, mostly in the U.S. Department of Agriculture. Educational services accounted for another 18 percent of jobs. Other agricultural and food scientists worked for agricultural service companies, commercial research and development laboratories, seed companies, wholesale distributors, and food products companies. About 5,500 agricultural scientists were self-employed in 2006, mainly as consultants.

Job Outlook

Job growth among agricultural and food scientists should be about as fast as the average for all occupations. Opportunities are expected to be good over the next decade, particularly for those holding a master's or Ph.D. degree.

Employment change. Employment of agricultural and food scientists is expected to grow 9 percent between 2006 and 2016, about as fast as the average for all occupations. Past agricultural research has created higher yielding crops, crops with bet-

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Agricultural and food scientists	19-1010	33,000	36,000	3,100	9
Animal scientists	19-1011	5,400	5,900	500	10
Food scientists and technologists	19-1012	12,000	13,000	1,200	10
Soil and plant Scientists	19-1013	16,000	17,000	1,300	8

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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ter resistance to pests and plant pathogens, and more effective fertilizers and pesticides. Research is still necessary, however, particularly as insects and diseases continue to adapt to pesticides and as soil fertility and water quality continue to need improvement. This creates more jobs for agricultural scientists.

Emerging biotechnologies will play an ever larger role in agricultural research. Scientists will be needed to apply these technologies to the creation of new food products and other advances. Moreover, increasing demand is expected for biofuels and other agricultural products used in industrial processes. Agricultural scientists will be needed to find ways to increase the output of crops used in these products.

Agricultural scientists will also be needed to balance increased agricultural output with protection and preservation of soil, water, and ecosystems. They increasingly encourage the practice of sustainable agriculture by developing and implementing plans to manage pests, crops, soil fertility and erosion, and animal waste in ways that reduce the use of harmful chemicals and do little damage to farms and the natural environment.

Job growth for food scientists and technologists will be driven by the demand for new food products and food safety measures. Food research is expected to increase because of heightened public awareness of diet, health, food safety, and biosecurity—preventing the introduction of infectious agents into herds of animals. Advances in biotechnology and nanotechnology should also spur demand, as food scientists and technologists apply these technologies to testing and monitoring food safety.

Fewer new jobs for agricultural and food scientists are expected in the Federal Government, mostly because of budgetary constraints at the U.S. Department of Agriculture.

Job prospects. Opportunities should be good for agricultural and food scientists with a master's degree, particularly those seeking applied research positions in a laboratory. Master's degree candidates also can seek to become certified crop advisors, helping farmers better manage their crops. Those with a Ph.D. in agricultural and food science will experience the best opportunities, especially in basic research and teaching positions at colleges and universities.

Graduates with a bachelor's degree in agricultural or food science can sometimes work in applied research and product development positions under the guidance of a Ph.D. scientist, but usually only in certain subfields, such as food science and technology. The Federal Government also hires bachelor's degree holders to work as soil scientists.

Most people with bachelor's degrees find work in positions related to agricultural or food science rather than in jobs as agricultural or food scientists. A bachelor's degree in agricultural science is useful for managerial jobs in farm-related or ranch-related businesses, such as farm credit institutions or companies that manufacture or sell feed, fertilizer, seed, and farm equipment. In some cases, people with a bachelor's degree can provide consulting services or work in sales and marketing—promoting high-demand products such as organic foods. Bachelor's degrees also may help people become farmers, ranchers, and agricultural managers; agricultural inspectors; or purchasing agents for agricultural commodity or farm supply companies.

Employment of agricultural and food scientists is relatively stable during periods of economic recession. Layoffs are less likely among agricultural and food scientists than in some other occupations because food is a staple item and its demand fluctuates very little with economic activity.

Earnings

Median annual earnings of food scientists and technologists were $53,810 in May 2006. The middle 50 percent earned between $37,740 and $76,960. The lowest 10 percent earned less than $29,620, and the highest 10 percent earned more than $97,350. Median annual earnings of soil and plant scientists were $56,080 in May 2006. The middle 50 percent earned between $42,410 and $72,020. The lowest 10 percent earned less than $33,650, and the highest 10 percent earned more than $93,460. In May 2006, median annual earnings of animal scientists were $47,800.

The average Federal salary in 2007 was $91,491 in animal science and $79,051 in agronomy.

According to the National Association of Colleges and Employers, beginning salary offers in 2007 for graduates with a bachelor's degree in animal sciences averaged $35,035 a year; plant sciences, $31,291 a year; and in other agricultural sciences, $37,908 a year.

Related Occupations

The work of agricultural scientists is closely related to that of other scientists, including biological scientists, chemists, and conservation scientists and foresters. It also is related to the work of managers of agricultural production, such as farmers, ranchers, and agricultural managers. Certain specialties of agricultural science also are related to other occupations. For example, the work of animal scientists is related to the work of veterinarians.

Sources of Additional Information

Information on careers in agricultural science is available from:

➤ American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, 677 S. Segoe Rd., Madison, WI 53711-1086.
Internet: **http://www.agronomy.org**

➤ Living Science, Purdue University, 1140 Agricultural Administration Bldg., West Lafayette, IN 47907-1140.
Internet: **http://www.agriculture.purdue.edu/USDA/careers**

Information on careers in food science and technology is available from:

➤ Institute of Food Technologists, 525 W. Van Buren, Suite 1000, Chicago, IL 60607. Internet: **http://www.ift.org**

Information on getting a job as an agricultural scientist with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not tollfree, and charges may result.

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Biological Scientists

(O*NET 19-1021.00, 19-1022.00, 19-1023.00, 19-1029.99)

Significant Points

- Biotechnological research and development should continue to drive employment growth.
- A Ph.D. degree usually is required for independent research, but a master's degree is sufficient for some jobs in applied research or product development; temporary postdoctoral research positions are common.
- Competition for jobs is expected.

Nature of the Work

Biological scientists study living organisms and their relationship to the environment. They perform research to gain a better understanding of fundamental life processes or apply that understanding to developing new products or processes. Most specialize in one area of biology, such as zoology (the study of animals) or microbiology (the study of microscopic organisms). (Medical scientists, whose work is closely related to that of biological scientists, are discussed elsewhere in the *Handbook*.)

Many biological scientists work in research and development. Some conduct basic research to advance our knowledge of living organisms, including bacteria and other infectious agents. Basic biological research enhances our understanding so that we can develop solutions to human health problems and improve the natural environment. These biological scientists mostly work in government, university, or private industry laboratories, often exploring new areas of research. Many expand on specialized research they started in graduate school.

Many research scientists must submit grant proposals to obtain funding for their projects. Colleges and universities, private industry, and Federal Government agencies such as the National Institutes of Health and the National Science Foundation contribute to the support of scientists whose research proposals are determined to be financially feasible and to have the potential to advance new ideas or processes.

Biological scientists who work in applied research or product development use knowledge gained by basic research to develop new drugs, treatments, and medical diagnostic tests; increase crop yields; and develop new biofuels. They usually have less freedom than basic researchers do to choose the emphasis of their research, and they spend more time working on marketable treatments to meet the business goals of their employers. Biological scientists doing applied research and product development in private industry may be required to describe their research plans or results to nonscientists who are in a position to veto or approve their ideas. These scientists must consider the business effects of their work. Scientists often work in teams, interacting with engineers, scientists of other disciplines, business managers, and technicians. Some biological scientists also work with customers or suppliers and manage budgets.

Scientists usually conduct research in laboratories using a wide variety of other equipment. Some conduct experiments involving animals or plants. This is particularly true of botanists, physiologists, and zoologists. Some biological research also takes place outside the laboratory. For example, a botanist might do field research in tropical rain forests to see which plants grow there, or an ecologist might study how a forest area recovers after a fire. Some marine biologists also work outdoors, often on research vessels from which they study fish, plankton, or other marine organisms.

Swift advances in knowledge of genetics and organic molecules spurred growth in the field of biotechnology, transforming the industries in which biological scientists work. Biological scientists can now manipulate the genetic material of animals and plants, attempting to make organisms more productive or resistant to disease. Basic and applied research on biotechnological processes, such as recombining DNA, has led to the production of important substances, including human insulin and growth hormone. Many other substances not previously available in large quantities are now produced by biotechnological means. Some of these substances are useful in treating diseases.

Today, many biological scientists are involved in biotechnology. Those working on various genome (chromosomes with their associated genes) projects isolate genes and determine their function. This work continues to lead to the discovery of genes associated with specific diseases and inherited health risks, such as sickle cell anemia. Advances in biotechnology have created research opportunities in almost all areas of biology, with commercial applications in areas such as medicine, agriculture, and environmental remediation.

Most biological scientists specialize in the study of a certain type of organism or in a specific activity, although recent advances have blurred some traditional classifications.

Aquatic biologists study micro-organisms, plants, and animals living in water. *Marine biologists* study salt water organisms, and *limnologists* study fresh water organisms. Much of the work of marine biology centers on molecular biology, the study of the biochemical processes that take place inside living cells. Marine biologists sometimes are mistakenly called oceanographers, but oceanography is the study of the physical characteristics of oceans and the ocean floor. (See the *Handbook* statements on environmental scientists and hydrologists and on geoscientists.)

Biochemists study the chemical composition of living things. They analyze the complex chemical combinations and reactions involved in metabolism, reproduction, and growth. Biochemists do most of their work in biotechnology, which involves understanding the complex chemistry of life.

Botanists study plants and their environments. Some study all aspects of plant life, including algae, fungi, lichens, mosses, ferns, conifers, and flowering plants; others specialize in areas such as identification and classification of plants, the structure and function of plant parts, the biochemistry of plant processes, the causes and cures of plant diseases, the interaction of plants with other organisms and the environment, and the geological record of plants.

Microbiologists investigate the growth and characteristics of microscopic organisms such as bacteria, algae, or fungi. Most microbiologists specialize in environmental, food, agricultural,

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or industrial microbiology; virology (the study of viruses); immunology (the study of mechanisms that fight infections); or bioinformatics (the use of computers to handle or characterize biological information, usually at the molecular level). Many microbiologists use biotechnology to advance knowledge of cell reproduction and human disease.

Physiologists study life functions of plants and animals, both in the whole organism and at the cellular or molecular level, under normal and abnormal conditions. Physiologists often specialize in functions such as growth, reproduction, photosynthesis, respiration, or movement, or in the physiology of a certain area or system of the organism.

Biophysicists study how physics, such as electrical and mechanical energy and related phenomena, relates to living cells and organisms. They perform research in fields such as neuroscience or bioinformatics.

Zoologists and wildlife biologists study animals and wildlife—their origin, behavior, diseases, and life processes. Some experiment with live animals in controlled or natural surroundings, while others dissect dead animals to study their structure. Zoologists and wildlife biologists also may collect and analyze biological data to determine the environmental effects of current and potential uses of land and water areas. Zoologists usually are identified by the animal group they study—ornithologists study birds, for example, mammalogists study mammals, herpetologists study reptiles, and ichthyologists study fish.

Ecologists investigate the relationships among organisms and between organisms and their environments, examining the effects of population size, pollutants, rainfall, temperature, and altitude. Using knowledge of various scientific disciplines, ecologists may collect, study, and report data on the quality of air, food, soil, and water.

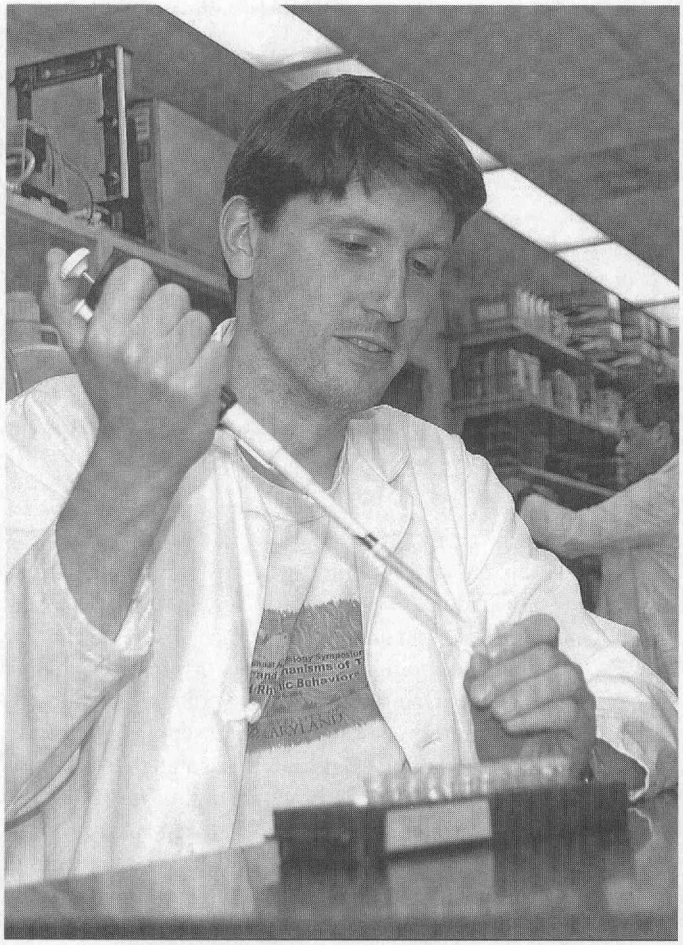
(Agricultural and food scientists, sometimes referred to as biological scientists, are discussed elsewhere in the *Handbook*, as are medical scientists, whose work is closely related to that of biological scientists.)

Work environment. Biological scientists usually are not exposed to unsafe or unhealthy conditions. Those who work with dangerous organisms or toxic substances in the laboratory must follow strict safety procedures to avoid contamination. Many biological scientists, such as botanists, ecologists, and zoologists, do field studies that involve strenuous physical activity and primitive living conditions. Biological scientists in the field may work in warm or cold climates, in all kinds of weather.

Marine biologists encounter a variety of working conditions. Some work in laboratories; others work on research ships, and those who work underwater must practice safe diving while working around sharp coral reefs and hazardous marine life. Although some marine biologists obtain their specimens from the sea, many still spend a good deal of their time in laboratories and offices, conducting tests, running experiments, recording results, and compiling data.

Many biological scientists depend on grant money to support their research. They may be under pressure to meet deadlines and to conform to rigid grant-writing specifications when preparing proposals to seek new or extended funding.

Biological scientists typically work regular hours. While the 40-hour workweek is common, longer hours are not uncommon.



A Ph.D. usually is required for independent research.

Researchers may be required to work odd hours in laboratories or other locations (especially while in the field), depending on the nature of their research.

Training, Other Qualifications, and Advancement

Most biological scientists need a Ph.D. degree in biology or one of its subfields to work in research or development positions. A period of postdoctoral work in the laboratory of a senior researcher has become common for biological scientists who intend to conduct research or teach at the university level.

Education and training. A Ph.D. degree usually is necessary for independent research, industrial research, and college teaching, as well as for advancement to administrative positions. A master's degree is sufficient for some jobs in applied research, product development, management, or inspection; it also may qualify one to work as a research technician or a teacher. The bachelor's degree is adequate for some nonresearch jobs. For example, graduates with a bachelor's degree may start as biological scientists in testing and inspection or may work in jobs related to biological science, such as technical sales or service representatives. Some work as research assistants, laboratory technicians, or high school biology teachers. (See the statements elsewhere in the *Handbook* on clinical laboratory technologists and technicians; science technicians; and teachers—preschool, kindergarten, elementary, middle, and secondary.) Many with a bachelor's degree in biology enter medical, dental, veterinary, or other health profession schools.

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In addition to required courses in chemistry and biology, undergraduate biological science majors usually study allied disciplines such as mathematics, physics, engineering, and computer science. Computer courses are beneficial for modeling and simulating biological processes, operating some laboratory equipment, and performing research in the emerging field of bioinformatics. Those interested in studying the environment also should take courses in environmental studies and become familiar with applicable legislation and regulations. Prospective biological scientists who hope to work as marine biologists should have at least a bachelor's degree in a biological or marine science. However, students should not overspecialize in undergraduate study, as knowledge of marine biology often is acquired in graduate study.

Most colleges and universities offer bachelor's degrees in biological science, and many offer advanced degrees. Advanced degree programs often emphasize a subfield such as microbiology or botany, but not all universities offer curricula in all subfields. Larger universities frequently have separate departments specializing in different areas of biological science. For example, a program in botany might cover agronomy, horticulture, or plant pathology. Advanced degree programs typically include classroom and fieldwork, laboratory research, and a thesis or dissertation.

Biological scientists with a Ph.D. often take temporary postdoctoral research positions that provide specialized research experience. Postdoctoral positions may offer the opportunity to publish research findings. A solid record of published research is essential in obtaining a permanent position involving basic research, especially for those seeking a permanent college or university faculty position.

Other qualifications. Biological scientists should be able to work independently or as part of a team and be able to communicate clearly and concisely, both orally and in writing. Those in private industry, especially those who aspire to management or administrative positions, should possess strong business and communication skills and be familiar with regulatory issues and marketing and management techniques. Those doing field research in remote areas must have physical stamina. Biological scientists also must have patience and self-discipline to conduct long and detailed research projects.

Advancement. As they gain experience, biological scientists typically gain greater control over their research and may advance to become lead researchers directing a team of scientists and technicians. Some work as consultants to businesses or to government agencies. However, those dependent on research grants are still constrained by funding agencies, and they may spend much of their time writing grant proposals. Others choose to move into managerial positions and become natural science managers (see engineering and natural science managers elsewhere in the *Handbook*). They may plan and administer programs for testing foods and drugs, for example, or direct activities at zoos or botanical gardens. Those who pursue management careers spend much of their time preparing budgets and schedules. Some leave biology for nontechnical managerial, administrative, or sales jobs.

Employment

Biological scientists held about 87,000 jobs in 2006. In addition, many biological scientists held biology faculty positions in colleges and universities but are not included in these numbers. Those whose primary work involves teaching and research are considered postsecondary teachers. (See the statement on teachers—postsecondary elsewhere in the *Handbook*.)

About 39 percent of all biological scientists were employed by Federal, State, and local governments. Federal biological scientists worked mainly for the U.S. Departments of Agriculture, Interior, and Defense and for the National Institutes of Health. Most of the rest worked in scientific research and testing laboratories, the pharmaceutical and medicine manufacturing industry, or colleges and universities.

Job Outlook

Biological scientists can expect to face competition for jobs. After a recent period of rapid expansion in research funding, moderate growth in research grants should drive average employment growth over the next decade.

Employment change. Employment of biological scientists is projected to grow 9 percent over the 2006-16 decade, about as fast as the average for all occupations, as biotechnological research and development continues to drive job growth. The Federal Government funds much basic research and development, including many areas of medical research that relate to biological science. Recent budget increases at the National Institutes of Health have led to large increases in Federal basic research and development expenditures, with research grants growing both in number and dollar amount. Nevertheless, the increase in expenditures has slowed substantially and is not expected to match its past growth over the 2006-16 projection period. This may result in a highly competitive environment for winning and renewing research grants.

Biological scientists enjoyed very rapid employment gains since the 1980s—reflecting, in part, the growth of biotechnology companies. Employment growth should slow somewhat,

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Biological scientists	19-1020	87,000	95,000	8,000	9
Biochemists and biophysicists	19-1021	20,000	23,000	3,200	16
Microbiologists	19-1022	17,000	19,000	1,900	11
Zoologists and wildlife biologists	19-1023	20,000	22,000	1,700	9
Biological scientists, all other	19-1029	29,000	30,000	1,100	4

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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as fewer new biotechnology firms are founded and existing firms merge or are absorbed by larger biotechnology or pharmaceutical firms. Some companies may conduct a portion of their research and development in other lower-wage countries, further limiting employment growth. However, much of the basic biological research done in recent years has resulted in new knowledge, including the isolation and identification of genes. Biological scientists will be needed to take this knowledge to the next stage, which is the understanding how certain genes function within an entire organism, so that medical treatments can be developed to treat various diseases. Even pharmaceutical and other firms not solely engaged in biotechnology use biotechnology techniques extensively, spurring employment increases for biological scientists. For example, biological scientists are continuing to help farmers increase crop yields by pinpointing genes that can help crops such as wheat grow worldwide in areas that currently are hostile to the crop. Continued work on chronic diseases should also lead to growing demand for biological scientists.

In addition, efforts to discover new and improved ways to clean up and preserve the environment will continue to add to job growth. More biological scientists will be needed to determine the environmental impact of industry and government actions and to prevent or correct environmental problems such as the negative effects of pesticide use. Some biological scientists will find opportunities in environmental regulatory agencies, while others will use their expertise to advise lawmakers on legislation to save environmentally sensitive areas. New industrial applications of biotechnology, such as new methods for making ethanol for transportation fuel, also will spur demand for biological scientists.

There will continue to be demand for biological scientists specializing in botany, zoology, and marine biology, but opportunities will be limited because of the small size of these fields. Marine biology, despite its attractiveness as a career, is a very small specialty within biological science.

Job prospects. Doctoral degree holders are expected to face competition for basic research positions. Furthermore, should the number of advanced degrees awarded continue to grow, applicants for research grants are likely to face even more competition. Currently, about 1 in 4 grant proposals are approved for long-term research projects. In addition, applied research positions in private industry may become more difficult to obtain if increasing numbers of scientists seek jobs in private industry because of the competitive job market for independent research positions in universities and for college and university faculty.

Prospective marine biology students should be aware that those who would like to enter this specialty far outnumber the very few openings that occur each year for the type of glamorous research jobs that many would like to obtain. Almost all marine biologists who do basic research have a Ph.D.

People with bachelor's and master's degrees are expected to have more opportunities in nonscientist jobs related to biology. The number of science-related jobs in sales, marketing, and research management is expected to exceed the number of independent research positions. Non-Ph.D.s also may fill positions as science or engineering technicians or as medical health technologists and technicians. Some become high school biology teachers.

Biological scientists are less likely to lose their jobs during recessions than are those in many other occupations because many are employed on long-term research projects. However, an economic downturn could influence the amount of money allocated to new research and development efforts, particularly in areas of risky or innovative research. An economic downturn also could limit the possibility of extension or renewal of existing projects.

Earnings

Median annual earnings of biochemists and biophysicists were $76,320 in 2006. The middle 50 percent earned between $53,390 and $100,060. The lowest 10 percent earned less than $40,820, and the highest 10 percent earned more than $129,510. Median annual earnings of biochemists and biophysicists employed in scientific research and development services were $79,990 in 2006.

Median annual earnings of microbiologists were 57,980 in 2006. The middle 50 percent earned between $43,850 and $80,550. The lowest 10 percent earned less than $35,460, and the highest 10 percent earned more than $108,270.

Median annual earnings of zoologists and wildlife biologists were $53,300 in 2006. The middle 50 percent earned between $41,400 and $67,200. The lowest 10 percent earned less than $32,800, and the highest 10 percent earned more than $84,580.

According to the National Association of Colleges and Employers, beginning salary offers in 2007 averaged $34,953 a year for bachelor's degree recipients in biological and life sciences.

In the Federal Government in 2007, general biological scientists earned an average salary of $72,146; microbiologists, $87,206; ecologists, $76,511; physiologists, $100,745; geneticists, $91,470; zoologists, $110,456; and botanists, $67,218.

Related Occupations

Many other occupations deal with living organisms and require a level of training similar to that of biological scientists. These include medical scientists, agricultural and food scientists, conservation scientists and foresters, and engineering and natural sciences managers, as well as health occupations such as physicians and surgeons, dentists, and veterinarians.

Sources of Additional Information

For information on careers in the biological sciences, contact:

➤ American Institute of Biological Sciences, 1444 I St.NW., Suite 200, Washington, DC 20005.
Internet: **http://www.aibs.org**

For information on careers in biochemistry or biological sciences, contact:

➤ Federation of American Societies for Experimental Biology, 9650 Rockville Pike, Bethesda, MD 20814.
Internet: **http://www.faseb.org**

For information on careers in botany, contact:

➤ The Botanical Society of America, 4475 Castleman Ave., P.O. Box 299, St.Louis, MO 63166.
Internet: **http://www.botany.org**

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For information on careers in physiology, contact:

➤ American Physiology Society, 9650 Rockville Pike, Bethesda, MD 20814. Internet: **http://www.the-aps.org**

Information on obtaining a biological scientist position with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not tollfree, and charges may result.

Conservation Scientists and Foresters

(O*NET 19-1031.00, 19-1031.01, 19-1031.02, 19-1031.03, 19-1032.00)

Significant Points

- About 2 of 3 conservation scientists and foresters work for Federal, State, or local governments.
- Workers in this occupation need, at a minimum, a bachelor's degree in forestry, environmental science, range management, or a related discipline.
- Slower than average job growth is projected; most new jobs will be in governments and in private sector forestry and conservation consulting.

Nature of the Work

Forests and rangelands supply wood products, livestock forage, minerals, and water. They serve as sites for recreational activities and provide habitats for wildlife. Conservation scientists and foresters manage the use and development of these lands and help to protect them. Some advise landowners on the use and management of their land. Conservation scientists and foresters often specialize in one area, such as wildlife management, soil conservation, urban forestry, pest management, native species, or forest economics. But most work falls into one of three categories: forestry, conservation science focusing on range lands, and conservation science focusing on farming and soil.

Foresters oversee our Nation's forests and direct activities on them for economic, recreational, conservational, and environmental purposes. Individual landowners, the public, and industry own most of the forested land in this country, and they require the expertise of foresters to keep the forests healthy and sustainable. Often this means coming up with a plan to keep the forests free from disease, harmful insects, and damaging wildfires, for example, planning when and where to plant trees and vegetation and when to cut timber. It may also mean coming up with ways to make the land profitable but still protected for future generations.

Foresters have a wide range of duties, often depending on who they are working for. Some primary duties of foresters include drawing up plans to regenerate forested lands, monitoring their progress, and supervising harvests. Land management foresters choose and direct the preparation of sites on which trees will be planted. They oversee controlled burning and the use of bulldozers or herbicides to clear weeds, brush, and logging debris. They advise on the type, number, and placement of trees to be planted. Foresters then monitor the seedlings to ensure healthy growth and to determine the best time for harvesting. If they detect signs of disease or harmful insects, they consult with specialists in forest pest management to decide on the best course of treatment. When the trees reach a certain size, foresters decide which trees and how many should be harvested and sold to sawmills.

Procurement foresters make up a large share of foresters. Their job is to buy timber, typically for a sawmill or wood products manufacturer, by contacting local forest owners and negotiating a sale contract. This typically involves taking inventory of the type, amount, and location of all standing timber on the property, a process known as timber cruising. They then appraise the timber's worth, negotiate its purchase, and draw up a contract for purchase. The forester next subcontracts with loggers or pulpwood cutters for tree removal and to aid in laying out roads to access the timber. Throughout the process, foresters maintain close contact with the subcontractor and the landowner to ensure that the work meets the landowner's requirements and Federal, State, and local environmental regulations.

Throughout the forest management and procurement processes, foresters are often responsible for conserving wildlife habitats and creek beds within forests, maintaining water quality and soil stability, and complying with environmental regulations. Foresters must balance the desire to conserve forested ecosystems with the need to use forest resources for recreational or economic purposes. For example, foresters are increasingly working with landowners to find ways to generate money from forested lands, such as for hunting or other recreational activity, without cutting down trees. An increasing concern of foresters is the prevention of devastating wildfires. Using a variety of techniques, including the thinning of forests or using controlled burns to clear brush, foresters work with governments and private landowners to minimize the impact of fire on the forest. During fires, they work with or supervise fire fighters and plan ways to attack the fire.

Some foresters, mostly in the Federal Government, perform research on issues facing forests and related natural resources. They may study tree improvement and harvesting techniques; global change; protection of forests from pests, diseases, and fire; improving wildlife habitats; forest recreation; and other topics. State foresters may perform some research but more often work with private landowners in developing forest management plans. Both Federal and State foresters enforce relevant environmental laws, including laws on water quality and fire suppression.

Relatively new fields in forestry are urban forestry and conservation education. Urban foresters live and work in larger cities and manage urban forests. They are concerned with quality of life issues, such as air quality, shade, beautification, storm water runoff, and property values. Conservation education foresters train teachers and students about sound forest stewardship.

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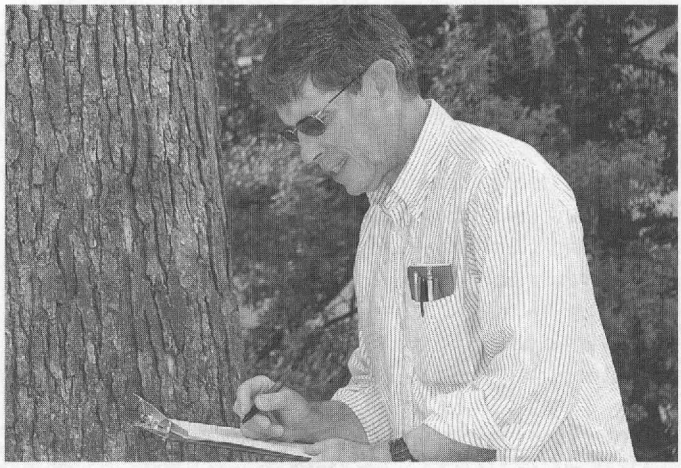
Foresters use a number of tools to perform their jobs. Clinometers measure the height of trees; diameter tapes measure tree diameter; and increment borers and bark gauges measure the growth of trees so that timber volumes can be computed and growth rates estimated. Remote sensing (aerial photographs and other imagery taken from airplanes and satellites) and Geographic Information Systems (GIS) data often are used for mapping large forest areas and for detecting widespread trends of forest and land use. Once a map is generated, data are digitized to create a computerized inventory of information required to manage the forest land and its resources. Moreover, hand-held computers, Global Positioning Systems (GPS), and Internet-based applications are used extensively.

Conservation scientists manage, improve, and protect the country's natural resources. They work with landowners and Federal, State, and local governments to devise ways to use and improve the land while safeguarding the environment. Conservation scientists mainly advise farmers, farm managers, and ranchers on how they can improve their land for agricultural purposes and to control erosion. A growing number of conservation scientists are also advising landowners and governments on recreational uses for the land.

Two of the more common conservation scientists are range managers and soil conservationists. Range managers, also called range conservationists, range ecologists, or range scientists, study, manage, improve, and protect rangelands to maximize their use without damaging the environment. Rangelands cover hundreds of millions of acres of the United States, mostly in Western States and Alaska. They contain many natural resources, including grass and shrubs for animal grazing, wildlife habitats, water from vast watersheds, recreation facilities, and valuable mineral and energy resources. Range managers may inventory soils, plants, and animals; develop resource management plans; help to restore degraded ecosystems; or assist in managing a ranch. For example, they may help ranchers attain optimum livestock production by determining the number and kind of animals to graze, the grazing system to use, and the best season for grazing. At the same time, however, range managers maintain soil stability and vegetation for other uses such as wildlife habitats and outdoor recreation. They also plan and implement revegetation of disturbed sites.

Soil and water conservationists provide technical assistance to farmers, ranchers, forest managers, State and local agencies, and others concerned with the conservation of soil, water, and related natural resources. They develop programs for private landowners designed to make the most productive use of land without damaging it. Soil conservationists also assist landowners by visiting areas with erosion problems, finding the source of the problem, and helping landowners and managers develop management practices to combat it. Water conservationists also assist private landowners and Federal, State, and local governments by advising on water quality, preserving water supplies, groundwater contamination, and management and conservation of water resources.

Work environment. Working conditions vary considerably. Some foresters and conservation scientists work regular hours in offices or labs, but others may split their time between fieldwork and office work. Independent consultants and new, less experienced workers spend the majority of their time outdoors overseeing or participating in hands-on work. Fieldwork can involve long hours alone.



Conservation scientsts and foresters keep careful data on plant growth to protect natural resources.

The work can be physically demanding. Some conservation scientists and foresters work outdoors in all types of weather, sometimes in isolated areas, and consequently may need to walk long distances through densely wooded land to carry out their work. Natural disasters may also cause foresters and conservation scientists to work long hours during emergencies. For example, foresters often have to work long hours during fire season, and conservation scientists often are called to prevent erosion after a forest fire and to provide emergency help after floods, mudslides, and tropical storms.

Foresters employed by the Federal Government and the States usually work 40 hours a week, but not always on a standard schedule. In field positions, foresters often work for long blocks of time, working 10 days straight, followed by 4 days off, for example. Overtime may be necessary when working in fire fighting, law enforcement, or natural disaster response.

Training, Other Qualifications, and Advancement

Most forester and conservation scientist jobs require a bachelor's degree. Research and teaching positions usually need a graduate degree.

Education and training. A bachelor's degree in forestry, biology, natural resource management, environmental sciences, or a related discipline is the minimum educational requirement for careers in forestry. In the Federal Government, a combination of experience and appropriate education occasionally may substitute for a bachelor's degree, but competition for jobs makes this difficult. Foresters who wish to do research or to teach usually need an advanced degree, preferably a Ph.D.

Conservation scientists generally have at least a bachelor's degree in fields such as ecology, natural resource management, agriculture, biology, or environmental science. A master's degree or Ph.D. is usually required for teaching and research positions.

Most land-grant colleges and universities offer degrees in forestry. The Society of American Foresters accredits about 50 degree programs throughout the country. Curricula focus on four areas: forest ecology and biology, measurement of forest

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resources, management of forest resources, and public policy. Students should balance general science courses such as ecology, biology, tree physiology, taxonomy, and soil formation with technical forestry courses, such as forest inventory, wildlife habitat assessment, remote sensing, land surveying, GPS technology, integrated forest resource management, forest protection, and silviculture, which is the care and cultivation of forest trees. In addition, mathematics, statistics, and computer science courses are recommended. Courses in resource policy and administration, specifically forest economics and business administration, are also helpful. Forestry curricula increasingly include courses on wetlands analysis and sustainability and regulatory issues because prospective foresters need a strong grasp of Federal, State, and local policy issues and an understanding of complex environmental regulations.

Many colleges require students to complete a field session either in a camp operated by the college or in a cooperative work-study program with a Federal or State agency or with private industry. All schools encourage students to take summer jobs that provide experience in forestry or conservation work.

Range managers usually have a degree in range management or range science. Nine colleges and universities offer degrees in range management that are accredited by the Society of Range Management. More than 40 other schools offer coursework in range science or in a closely related discipline. Range management courses combine plant, animal, and soil sciences with principles of ecology and resource management. Desirable electives include statistics, forestry, hydrology, agronomy, wildlife, animal husbandry, computer science, and recreation. Selection of a minor in range management, such as wildlife ecology, watershed management, animal science, or agricultural economics, can often enhance qualifications for certain types of employment.

Very few colleges and universities offer degrees in soil conservation. Most soil conservationists have degrees in environmental studies, agronomy, general agriculture, hydrology, or crop or soil science; a few have degrees in related fields such as wildlife biology, forestry, and range management. Programs of study usually include 30 semester hours in natural resources or agriculture, including at least 3 hours in soil science.

Licensure. Sixteen States sponsor some type of credentialing process for foresters. Alabama, California, Connecticut, Maine, Maryland, Massachusetts, and New Hampshire have licensing statutes. Arkansas, Georgia, Mississippi, North Carolina, and South Carolina have mandatory registration statutes, and Michigan, New Jersey, Oklahoma, and West Virginia have voluntary registration statutes. Both licensing and registration requirements usually entail completing a 4-year degree in forestry and several years of forestry work experience. Candidates pursuing licensing also may be required to pass a comprehensive written exam.

Other qualifications. Foresters and conservation scientists usually enjoy working outdoors, are able to tolerate extensive walking and other types of physical exertion, and are willing to relocate to find work. They also must work well with people and have good communication skills.

Certification and advancement. One option to advance in these occupations is to become certified. The Society of American Foresters certifies foresters who have at least a bachelor's degree from one of the 50 forestry programs accredited by the Society or from a forestry program that, though not accredited by the Society, is substantially equivalent. In addition, the candidate must have 5 years of qualifying professional experience and pass an examination.

The Society for Range Management offers two types of certification: one as a certified professional in rangeland management and another as a certified range management consultant. Candidates seeking certification must have at least a bachelor's degree in range science or a closely related field, a minimum of 6 years of full-time work experience, and a passing score on an exam.

Additionally, a graduate with the proper coursework in college can seek certification as a wetland scientist through the Society of Wetland Scientists.

Recent forestry and conservation scientist graduates usually work under the supervision of experienced foresters or scientists. After gaining experience, they may advance to more responsible positions. In the Federal Government, most entry-level foresters work in forest resource management. An experienced Federal forester may supervise a ranger district and may advance to forest supervisor, regional forester, or a top administrative position in the national headquarters.

In private industry, foresters start by learning the practical and administrative aspects of the business and by acquiring comprehensive technical training. They are then introduced to contract writing, timber harvesting, and decision making. Some foresters work their way up to top managerial positions. Foresters in management usually leave fieldwork behind, spending more of their time in an office, working with teams to develop management plans and supervising others. After gaining several years of experience, some foresters may become consultants, working alone or with one or several partners. They contract with State or local governments, private landowners, private industry, or other forestry consulting groups.

Soil conservationists usually begin working within one county or conservation district and, with experience, may advance to the area, State, regional, or national level. Also, soil conservationists can transfer to related occupations, such as farm or ranch management advisor or land appraiser.

Employment

Conservation scientists and foresters held about 33,000 jobs in 2006. Conservation scientist jobs are heavily concentrated in government where nearly 3 in 4 are employed. Soil conservationists are employed primarily in the U.S. Department of Agriculture's (USDA) Natural Resource Conservation Service. Most range managers work in the USDA's Forest Service, the U.S. Department of the Interior's Bureau of Land Management, and the Natural Resource Conservation Service. A small number are self-employed and others work for nonprofit organizations or in consulting firms.

More than half of all foresters work for Federal, State and local governments. Federal Government foresters are concentrated in the USDA's Forest Service. A few foresters are self-employed, generally working as consultants or procurement

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foresters. Others work for sawmills, wood products manufacturers, logging companies, and the forestry industry.

Although conservation scientists and foresters work in every State, employment of foresters is concentrated in the Western and Southeastern States, where many national and private forests and parks—and most of the lumber and pulpwood-producing forests—are located. Range managers work almost entirely in the Western States, where most of the rangeland is located. Soil conservationists, on the other hand, are employed in almost every county in the country. Besides the jobs described above, some foresters and conservation scientists held faculty positions in colleges and universities. (See the section on teachers—postsecondary elsewhere in the *Handbook*.)

Job Outlook

Employment of conservation scientists and foresters is expected to grow more slowly than the average for all occupations through 2016. In addition to job openings from growth, many openings are expected as today's scientists and foresters retire.

Employment change. Employment of conservation scientists and foresters is expected to grow by 5 percent during the 2006-16 decade, more slowly than the average for all occupations. Recent large-scale sales of forestlands by industry has resulted in a loss of jobs within the traditional forest industry while creating limited opportunities with Timber Investment Management Organizations and Real Estate Investment Trusts.

Fire prevention and suppression will become a main activity for some conservation scientists and foresters, especially within the Federal Government, as the human population spreads into previously uninhabited lands. The Federal Government employs more conservation scientists and foresters than any other industry. Overall employment of conservation scientists and foresters in the Federal government is expected to grow more slowly than the average for all occupations, mostly because of budgetary constraints and the trend toward contracting these functions out to private consulting firms. Also, Federal land management agencies, such as the United States Forest Service, have de-emphasized their timber programs and increasingly focused on wildfire suppression and law enforcement, which may require hiring people with other skills.

State governments are the second largest employer of conservation and forest workers, and they are expected to have little or no growth in their employment of conservation scientists and foresters due to budgetary restrictions. A few States are now working to provide market-based incentives to private landowners to encourage them to use forest land for the public benefit by cleaning watersheds, keeping trees, or doing other environmentally focused activities. More State foresters are being asked to design and help implement such eco-management plans.

The management of storm water and coastlines has created demand for people knowledgeable about runoff and erosion on farms and in cities and suburbs. The opening of Federal lands to leasing by oil and gas companies is creating healthy demand for range scientists and range managers, who are finding work with consulting companies to help write environmental impact statements. Additionally, soil and water quality experts will still be needed as States design initiatives to improve water resources by preventing pollution by agricultural producers and industrial plants. A small number of new jobs will result from the need for range and soil conservationists to provide technical assistance to owners of grazing land through the Natural Resource Conservation Service. Salaried foresters working for private industry—such as paper companies, sawmills, and pulpwood mills—will be needed, though in smaller numbers than in the past, to provide technical assistance and management plans to landowners.

Establishments in management, scientific, and technical consulting services have increased their hiring of conservation scientists and foresters in recent years in response to demand for professionals to prepare environmental impact statements and erosion and sediment control plans, monitor water quality near logging sites, and advise on tree harvesting practices required by Federal, State, or local regulations. Hiring by these firms should continue during the 2006-16 decade.

Job prospects. The Federal Government and some State governments expect a large number of workers to retire over the next decade. This is likely to create a large number of job openings for foresters and conservation scientists in government despite the projection for slower than average growth of this occupation in all State, local, and Federal governments combined. However, the best opportunities for foresters and conservation scientists will be in consulting. Government and businesses are increasingly contracting out forestry and conservation services to companies that specialize in providing them.

Foresters involved with timber harvesting will find better opportunities in the Southeast, where much forested land is privately owned. However, the recent opening of public lands, especially in the West, to commercial activity will also help the outlook for foresters.

Earnings

Median annual earnings of conservation scientists in May 2006 were $54,970. The middle 50 percent earned between $40,950 and $68,460. The lowest 10 percent earned less than $29,860, and the highest 10 percent earned more than $80,260.

Median annual earnings of foresters in 2006 were $51,190. The middle 50 percent earned between $40,870 and $62,290.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Conservation scientists and foresters	19-1030	33,000	35,000	1,700	5
Conservation scientists	19-1031	20,000	21,000	1,100	5
Foresters	19-1032	13,000	14,000	700	5

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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The lowest 10 percent earned less than $33,490, and the highest 10 percent earned more than $74,570.

In 2006, most bachelor's degree graduates entering the Federal Government as foresters, range managers, or soil conservationists started at $28,862 or $35,752, depending on academic achievement. Those with a master's degree could start at $43,731 or $52,912. Holders of doctorates could start at $63,417. Beginning salaries were slightly higher in selected areas where the prevailing local pay level was higher. In 2007, the average Federal salary for foresters was $65,964; for soil conservationists, $64,284; and for rangeland managers, $60,828.

According to the National Association of Colleges and Employers, graduates with a bachelor's degree in conservation and renewable natural resources received an average starting salary offer of $34,678 in July 2007.

In private industry, starting salaries for students with a bachelor's degree were comparable with starting salaries in the Federal Government, but starting salaries in State and local governments were usually lower.

Conservation scientists and foresters who work for Federal, State, and local governments and large private firms generally receive more generous benefits than do those working for smaller firms. Governments usually have good pension, health, and leave plans.

Related Occupations

Conservation scientists and foresters manage, develop, and protect natural resources. Other workers with similar responsibilities include environmental engineers, agricultural and food scientists, biological scientists, environmental scientists and hydrologists, geoscientists, and farmers, ranchers, and agricultural managers.

Sources of Additional Information

For information about forestry careers and schools offering education in forestry, send a self-addressed, stamped business envelope to:

➤ Society of American Foresters, 5400 Grosvenor Ln., Bethesda, MD 20814-2198. Internet: **http://www.safnet.org**

Information about a career as a range manager, and a list of schools offering training, is available from:

➤ Society for Range Management, 10030 West 27th Ave., Wheat Ridge, CO 80215-6601.
Internet: **http://www.rangelands.org/srm.shtml**

Information on getting a job as a conservation scientist or forester with the Federal Government is available from the Office of Personnel Management (OPM) through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result. For advice on how to find and apply for jobs, see the Occupational Outlook Quarterly article "How to get a job in the Federal Government," online at: **http://www.bls.gov/opub/ooq/2004/summer/art01.pdf**.

Medical Scientists

(O*NET 19-1041.00, 19-1042.00)

Significant Points

- Most medical scientists need a Ph.D. in a biological science; some hold a medical degree.
- Epidemiologists typically need a master's degree in public health or, in some cases, a Ph.D. or medical degree.
- Competition is expected for most positions; however, those with both a Ph.D. and M.D. are likely to have very good opportunities.

Nature of the Work

Medical scientists research human diseases to improve human health. Most medical scientists conduct biomedical research and development to advance knowledge of life processes and living organisms, including viruses, bacteria, and other infectious agents. Past research has resulted in advances in diagnosis, treatment, and prevention of many diseases. Basic medical research continues to build the foundation for new vaccines, drugs, and treatment procedures. Medical scientists engage in laboratory research, clinical investigation, technical writing, drug application review, and related activities.

Medical scientists study biological systems to understand the causes of disease and other health problems. They develop treatments and design research tools and techniques that have medical applications. Some try to identify changes in cells or in chromosomes that signal the development of medical problems. For example, medical scientists involved in cancer research may formulate a combination of drugs that will lessen the effects of the disease. Medical scientists who are also physicians can administer these drugs to patients in clinical trials, monitor their reactions, and observe the results. They may draw blood, excise tissue, or perform other invasive procedures. Those who are not physicians normally collaborate with physicians who deal directly with patients. Medical scientists examine the results of clinical trials and adjust the dosage levels to reduce negative side effects or to induce better results. In addition to developing treatments for medical conditions, medical scientists attempt to discover ways to prevent health problems. For example, they may study the link between smoking and lung cancer or between alcoholism and liver disease.

Medical scientists who work in applied research or product development use knowledge discovered through basic research to develop new drugs and medical treatments. They usually have less autonomy than basic medical researchers do to choose the emphasis of their research. They spend more time working on marketable treatments to meet the business goals of their employers. Medical scientists doing applied research and product development in private industry may also be required to explain their research plans or results to nonscientists who are in a position to reject or approve their ideas. These scientists must consider the business effects of their work. Scientists increasingly

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work as part of teams, interacting with engineers, scientists of other disciplines, business managers, and technicians.

Swift advances in basic medical knowledge related to genetics and organic molecules have spurred growth in the field of biotechnology. Discovery of important drugs, including human insulin and growth hormone, is the result of research using biotechnology techniques, such as recombining DNA. Many other substances not previously available in large quantities are now produced by biotechnological means; some may one day be useful in treating diseases such as Parkinson's or Alzheimer's. Today, many medical scientists are involved in the science of genetic engineering—isolating, identifying, and sequencing human genes to determine their functions. This work continues to lead to the discovery of genes associated with specific diseases and inherited health risks, such as sickle cell anemia. These advances in biotechnology have opened up research opportunities in almost all areas of medical science.

Some medical scientists specialize in epidemiology. This branch of medical science investigates and describes the causes and spread of disease and develops the means for prevention or control. Epidemiologists may study many different illnesses, often focusing on major infectious diseases such as influenza or cholera. Epidemiologists can be separated into two groups—research and clinical.

Research epidemiologists conduct research in an effort to eradicate or control infectious diseases. Many work on illnesses that affect the entire body, such as AIDS or typhus, while others focus on localized infections such as those of the brain, lungs, or digestive tract. Research epidemiologists work at colleges and universities, schools of public health, medical schools, and independent research firms. For example, Federal Government agencies, such as the U.S. Department of Defense, may contract with a research firm to evaluate the incidence of malaria in certain parts of the world. Other research epidemiologists may work as college and university faculty and are counted as postsecondary teachers.

Clinical epidemiologists work primarily in consulting roles at hospitals, informing the medical staff of infectious outbreaks and providing containment solutions. These epidemiologists sometimes are referred to as infection control professionals, and some of them are also physicians. Clinical epidemiologists who are not also physicians often collaborate with physicians to find ways to contain outbreaks of diseases. In addition to traditional duties of studying and controlling diseases, clinical epidemiologists also may be required to develop standards and guidelines for the treatment and control of communicable diseases. Some clinical epidemiologists may work in outpatient settings.

Work environment. Many medical scientists work independently in private industry, university, or government laboratories, exploring new areas of research or expanding on specialized research that they began in graduate school. Medical scientists working in colleges and universities, hospitals, and nonprofit medical research organizations typically submit grant proposals to obtain funding for their projects. Colleges and universities, private industry, and Federal Government agencies—particularly the National Institutes of Health and the National Science Foundation—provide the primary support for researchers whose proposals are determined to be financially feasible and to have the potential to advance new ideas or processes. Medical scientists who rely on grant money may be under pressure to meet deadlines and to conform to rigid grant-writing specifications when preparing proposals to seek new or extended funding.



Opportunities will be best for medical scientists with both a Ph.D. and M.D.

Medical scientists who conduct research usually work in laboratories and use a wide variety of equipment. Some may work directly with individual patients or larger groups as they administer drugs and monitor patients during clinical trials. Often, these medical scientists also spend time working in clinics and hospitals.

Medical scientists usually are not exposed to unsafe or unhealthy conditions; however, those scientists who work with dangerous organisms or toxic substances must follow strict safety procedures to avoid contamination.

Medical scientists typically work regular hours in offices or laboratories, but longer hours are not uncommon. Researchers may be required to work odd hours in laboratories or other locations, depending on the nature of their research. On occasion, epidemiologists may be required to travel to meetings and hearings for medical investigations.

Training, Other Qualifications, and Advancement

A Ph.D. in a biological science is the minimum education required for most prospective medical scientists, except epidemiologists. However, some medical scientists pursue medical degrees to perform clinical work. Epidemiologists typically need at least a master's degree in public health, but some work requires a Ph.D. or medical degree. A period of postdoctoral work in the laboratory of a senior researcher is becoming increasingly common for medical scientists.

Education and training. A Ph.D. typically qualifies people to research basic life processes or particular medical problems and to analyze the results of experiments. Some medical sci-

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entists obtain a medical degree instead of a Ph.D., but some do not become licensed physicians because they prefer research to clinical practice. It is particularly helpful for medical scientists to earn both a Ph.D. and a medical degree.

Students planning careers as medical scientists should have a bachelor's degree in a biological science. In addition to required courses in chemistry and biology, undergraduates should study allied disciplines, such as mathematics, engineering, physics, and computer science, or courses in their field of interest. Once they have completed undergraduate studies, they can then select a specialty for their advanced degree, such as cytology, bioinformatics, genomics, or pathology.

The minimum educational requirement for epidemiologists is a master's degree from a school of public health. Some jobs may require a Ph.D. or medical degree, depending on the work performed. Epidemiologists who work in hospitals and health care centers often must have a medical degree with specific training in infectious diseases. Some employees in research epidemiology positions are required to be licensed physicians because they must administer drugs in clinical trials.

Few students select epidemiology for undergraduate study. Undergraduates, nonetheless, should study biological sciences and should have a solid background in chemistry, mathematics, and computer science. Once a student is prepared for graduate studies, he or she can choose a specialty within epidemiology. For example, those interested in studying environmental epidemiology should focus on environmental coursework, such as water pollution, air pollution, pesticide use, toxicology, and molecular biology. Other specialties include occupational epidemiology, infection processes, infection control precautions, surveillance methodology, and outbreak investigation. Some epidemiologists begin their careers in other health care occupations, such as registered nurse or medical technologist.

In addition to formal education, medical scientists usually spend some time in a postdoctoral position before they apply for permanent jobs. Postdoctoral work provides valuable laboratory experience, including experience in specific processes and techniques such as gene splicing, which is transferable to other research projects. In some institutions, the postdoctoral position can lead to a permanent job.

Licensure. Medical scientists who administer drug or gene therapy to human patients, or who otherwise interact medically with patients—drawing blood, excising tissue, or performing other invasive procedures—must be licensed physicians. To be licensed, physicians must graduate from an accredited medical school, pass a licensing examination, and complete 1 to 7 years of graduate medical education. (See the statement on physicians and surgeons elsewhere in the *Handbook*.)

Epidemiologists who perform laboratory tests often require the knowledge and expertise of a licensed physician to administer drugs to patients in clinical trials. Epidemiologists who are not physicians frequently work closely with one.

Other qualifications. Medical scientists should be able to work independently or as part of a team and be able to communicate clearly and concisely, both orally and in writing. Those in private industry, especially those who aspire to consulting and administrative positions, should possess strong communication skills so that they can provide instruction and advice to physicians and other health care professionals.

Certification and advancement. The Association for Professionals in Infection Control and Epidemiology offers continuing education courses and certification programs in infection prevention and control and applied epidemiology. To become certified as an infection control professional, applicants must pass an examination. Certification can be an advantage for those seeking advancement in this rapidly evolving field.

Advancement among medical scientists usually takes the form of greater independence in their work, larger budgets, or tenure in university positions. Others choose to move into managerial positions and become natural science managers (see engineering and natural science managers elsewhere in the *Handbook*). Those who pursue management careers spend more time preparing budgets and schedules.

Employment

Medical scientists held about 92,000 jobs in 2006. Epidemiologists accounted for only 5 percent of that total. In addition, many medical scientists held faculty positions in colleges and universities, but they are classified as college or university faculty. (See teachers—postsecondary, elsewhere in the *Handbook*.)

About 34 percent of medical scientists, except epidemiologists, were employed in colleges and universities. About 28 percent were employed in scientific research and development services firms; 12 percent were employed in pharmaceutical and medicine manufacturing; 9 percent were employed in hospitals; and most of the remainder were employed in private educational services and ambulatory health care services.

Among epidemiologists, 57 percent were employed in government; 12 percent were employed in hospitals; 11 percent were employed in colleges and universities; and 9 percent were employed in scientific research and development services.

Job Outlook

Medical scientists can expect to face competition for most jobs, in part because of the attractiveness of the career. However,

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Medical scientists	19-1040	92,000	110,000	18,000	20
Epidemiologists	19-1041	4,500	5,100	600	14
Medical scientists, except epidemiologists	19-1042	87,000	105,000	18,000	20

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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those with both a Ph.D. and M.D. are likely to experience very good opportunities.

Employment change. Employment of medical scientists is expected to increase 20 percent over the 2006-16 decade, faster than the average for all occupations. The Federal Government funds much basic research and development, including many areas of medical research. Although previous budget increases at the National Institutes of Health have led to large increases in the number of grants awarded to researchers, the increase in expenditures has slowed significantly, causing expected future employment growth to be more modest than in the past despite the faster than average projected growth.

Medical scientists enjoyed rapid gains in employment since the 1980s—reflecting, in part, the growth of biotechnology companies. Job growth should be dampened somewhat as fewer new biotechnology firms are founded and as existing firms merge or are absorbed by larger biotechnology or pharmaceutical firms. Some companies may conduct a portion of their research and development in other lower-wage countries, further limiting employment growth. However, much of the basic medical research done in recent years has resulted in new knowledge, including the isolation and identification of new genes. Medical scientists will be needed to take this knowledge to the next stage—understanding how certain genes function within an entire organism—so that medical treatments can be developed for various diseases. Even pharmaceutical and other firms not solely engaged in biotechnology have largely adopted biotechnology techniques, thus creating employment for medical scientists.

Employment growth should also occur as a result of the expected expansion in research related to illnesses such as AIDS, cancer, and avian influenza, along with growing treatment problems such as antibiotic resistance. Moreover, environmental conditions such as overcrowding and the increasing frequency of international travel will tend to spread existing diseases and give rise to new ones. Medical scientists will continue to be needed because they greatly contribute to the development of treatments and medicines that improve human health.

An increasing focus on monitoring patients at hospitals and health care centers to ensure positive patient outcomes will contribute to job growth for epidemiologists. In addition, a heightened awareness of bioterrorism and rare, but infectious diseases such as West Nile Virus or severe acute respiratory syndrome (SARS) should spur demand for these workers. As hospitals enhance their infection control programs, many will seek to boost the quality and quantity of their staff.

Job prospects. Besides job openings due to employment growth, openings will arise as workers leave the labor force or transfer to other occupations. However, doctoral degree holders can expect to face considerable competition for basic research positions and for research grants. If the number of advanced degrees awarded continues to grow, applicants are likely to face even more competition.

Although medical scientists can expect competition for jobs, those with both doctoral and medical degrees are likely to experience very good opportunities. As funding for research becomes more difficult to obtain, those with both a biological and professional medical background will have a distinct advantage. Opportunities in epidemiology also should be highly competitive, as the number of available positions will continue to be limited.

Medical scientists and epidemiologists are less likely to lose their jobs during recessions than are those in many other occupations because they are employed on long-term research projects. However, a recession could influence the amount of money allocated to new research and development, particularly in areas of risky or innovative medical research. A recession also could limit extensions or renewals of existing projects.

Earnings

Median annual earnings of wage and salary medical scientists, except epidemiologists, were $61,680 in May 2006. The middle 50 percent of these workers earned between $44,830 and $88,130. The lowest 10 percent earned less than $35,490, and the highest 10 percent earned more than $117,520. Median annual earnings in the industries employing the largest numbers of medical scientists were:

Pharmaceutical and medicine manufacturing	$82,640
Research and development in the physical, engineering, and life sciences	71,490
Offices of physicians	70,000
General medical and surgical hospitals	64,700
Colleges, universities, and professional schools	44,600

Median annual earnings of wage and salary epidemiologists were $56,670 in May 2006. The middle 50 percent earned between $45,220 and $71,080. The lowest 10 percent earned less than $36,920, and the highest 10 percent earned more than $87,300.

Related Occupations

Many other occupations deal with living organisms and require a level of training similar to that of medical scientists. These occupations include biological scientists, agricultural and food scientists, pharmacists, engineering and natural sciences managers, and health occupations such as physicians and surgeons, dentists, and veterinarians.

Sources of Additional Information

For information on pharmaceutical scientists, contact:

➤ American Association of Pharmaceutical Scientists (AAPS), 2107 Wilson Blvd., Suite 700, Arlington, VA 22201. Internet: **http://www.aapspharmaceutica.org**

For information on careers in microbiology, contact:

➤ American Society for Microbiology, Career Information—Education Department, 1752 N St.NW., Washington, DC 20036. Internet: **http://www.asm.org**

For information on infectious diseases training programs, contact:

➤ Infectious Diseases Society of America, Guide to Training Programs, 66 Canal Center Plaza, Suite 600, Alexandria, VA 22314. Internet: **http://www.idsociety.org**

Information on obtaining a medical scientist position with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locat-

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ing and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result. For advice on how to find and apply for Federal jobs, see the Occupational Outlook Quarterly article "How to get a job in the Federal Government," online at: **http://www.bls.gov/opub/ooq/2004/summer/art01.pdf**.

Physical Scientists

Atmospheric Scientists

(O*NET 19-2021.00)

Significant Points

- About 37 percent of atmospheric scientists are employed by the Federal Government; most of these work in the National Weather Service.
- A bachelor's degree in meteorology, or in a closely related field with courses in meteorology, is the minimum educational requirement; a master's degree is necessary for some positions, and a Ph.D. degree is required for most basic research positions.
- Atmospheric scientists should have favorable job prospects, but opportunities as weather broadcasters are rare and highly competitive.

Nature of the Work

Atmospheric science is the study of the atmosphere—the blanket of air covering the Earth. Atmospheric scientists, commonly called *meteorologists*, study the atmosphere's physical characteristics, motions, and processes, and the way in which these factors affect the rest of our environment. The best known application of this knowledge is forecasting the weather. In addition to predicting the weather, atmospheric scientists attempt to identify and interpret climate trends, understand past weather, and analyze today's weather. Weather information and meteorological research are also applied in air-pollution control, agriculture, forestry, air and sea transportation, defense, and the study of possible trends in the Earth's climate, such as global warming, droughts, and ozone depletion.

Atmospheric scientists who forecast the weather are known as *operational meteorologists*; they are the largest group of specialists. These scientists study the Earth's air pressure, temperature, humidity, and wind velocity, and they apply physical and mathematical relationships to make short-range and long-range weather forecasts. Their data come from weather satellites, radars, sensors, and stations in many parts of the world. Meteorologists use sophisticated computer models of the world's atmosphere to make long-term, short-term, and local-area forecasts. More accurate instruments for measuring and observing weather conditions, as well as high-speed computers to process and analyze weather data, have revolutionized weather forecasting. Using satellite data, climate theory, and sophisticated computer models of the world's atmosphere, meteorologists can more effectively interpret the results of these models to make local-area weather predictions. These forecasts inform not only the general public, but also those who need accurate weather information for both economic and safety reasons, such as the shipping, air transportation, agriculture, fishing, forestry, and utilities industries.

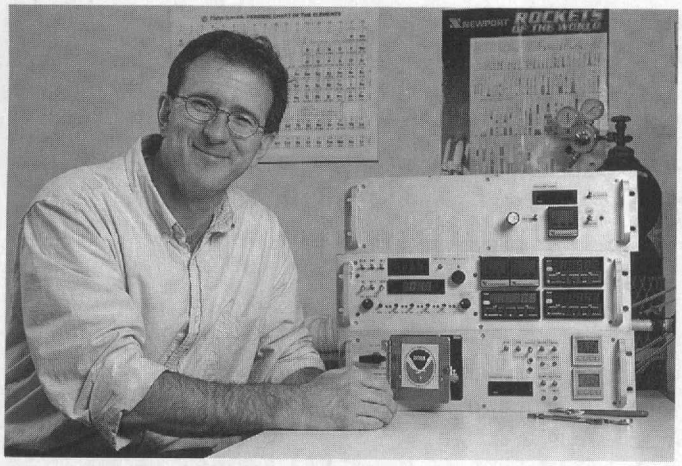
The use of weather balloons, launched a few times a day to measure wind, temperature, and humidity in the upper atmosphere, is currently supplemented by sophisticated atmospheric satellite monitoring equipment that transmits data as frequently as every few minutes. Doppler radar, for example, can detect airflow patterns in violent storm systems, allowing forecasters to better predict thunderstorms, flash floods, tornadoes, and other hazardous winds, and to monitor the direction and intensity of storms.

Some atmospheric scientists work in research. *Physical meteorologists*, for example, study the atmosphere's chemical and physical properties; the transmission of light, sound, and radio waves; and the transfer of energy in the atmosphere. They also study factors affecting the formation of clouds, rain, and snow; the dispersal of air pollutants over urban areas; and other weather phenomena, such as the mechanics of severe storms. *Synoptic meteorologists* develop new tools for weather forecasting using computers and sophisticated mathematical models of atmospheric activity. *Climatologists* study climactic variations spanning hundreds or even millions of years. They also may collect, analyze, and interpret past records of wind, rainfall, sunshine, and temperature in specific areas or regions. Their studies are used to design buildings, plan heating and cooling systems, and aid in effective land use and agricultural production. Environmental problems, such as pollution and shortages of fresh water, have widened the scope of the meteorological profession. *Environmental meteorologists* study these problems and may evaluate and report on air quality for environmental impact statements. Other research meteorologists examine the most effective ways to control or diminish air pollution.

Work environment. Weather stations are found everywhere—at airports, in or near cities, and in isolated and remote areas. Some atmospheric scientists also spend time observing weather conditions and collecting data from aircraft. Weather forecasters who work for radio or television stations broadcast their reports from station studios, and may work evenings and weekends. Meteorologists in smaller weather offices often work alone; in larger ones, they work as part of a team. Those who work for private consulting firms or for companies analyzing and monitoring emissions to improve air quality usually work with other scientists or engineers; fieldwork and travel may be common for these workers.

Most weather stations operate around the clock, 7 days a week. Jobs in such facilities usually involve night, weekend,

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Atmospheric scientists in smaller weather offices often work alone.

and holiday work, often with rotating shifts. During weather emergencies, such as hurricanes, meteorologists may work overtime. Operational meteorologists also are often under pressure to meet forecast deadlines. Meteorologists who are not involved in forecasting tasks work regular hours, usually in offices.

Training, Other Qualifications, and Advancement

A bachelor's degree in meteorology or atmospheric science, or in a closely related field with courses in meteorology, usually is the minimum educational requirement for an entry-level position as an atmospheric scientist. A master's degree is necessary for some positions, and a Ph.D. degree is required for most basic research positions.

Education and training. The preferred educational requirement for entry-level meteorologists in the Federal Government is a bachelor's degree—not necessarily in meteorology—with at least 24 semester hours of meteorology/atmospheric science courses, including 6 hours in the analysis and prediction of weather systems, 6 hours of atmospheric dynamics and thermodynamics, 3 hours of physical meteorology, and 2 hours of remote sensing of the atmosphere or instrumentation. Other required courses include 3 semester hours of ordinary differential equations, 6 hours of college physics, and at least 9 hours of courses appropriate for a physical science major—such as statistics, chemistry, physical oceanography, physical climatology, physical hydrology, radiative transfer, aeronomy (the study of the upper atmosphere), advanced thermodynamics, advanced electricity and magnetism, light and optics, and computer science. Sometimes, a combination of education and appropriate experience may be substituted for a degree.

Although positions in operational meteorology are available for those with only a bachelor's degree, obtaining a second bachelor's degree or a master's degree enhances employment opportunities, pay, and advancement potential. A master's degree usually is necessary for conducting applied research and development, and a Ph.D. is required for most basic research positions. Students planning on a career in research and development do not necessarily need to major in atmospheric science or meteorology as an undergraduate. In fact, a bachelor's degree in mathematics, physics, or engineering provides excellent preparation for graduate study in atmospheric science.

Because atmospheric science is a small field, relatively few colleges and universities offer degrees in meteorology or atmospheric science, although many departments of physics, earth science, geography, and geophysics offer atmospheric science and related courses. In 2007, the American Meteorological Society listed approximately 100 undergraduate and graduate atmospheric science programs. Many of these programs combine the study of meteorology with another field, such as agriculture, hydrology, oceanography, engineering, or physics. For example, hydrometeorology is the blending of hydrology (the science of Earth's water) and meteorology, and is the field concerned with the effect of precipitation on the hydrologic cycle and the environment.

Prospective students should make certain that courses required by the National Weather Service and other employers are offered at the college they are considering. Computer science courses, additional meteorology courses, a strong background in mathematics and physics, and good communication skills are important to prospective employers.

Students should also take courses in subjects that are most relevant to their desired area of specialization. For example, those who wish to become broadcast meteorologists for radio or television stations should develop excellent communication skills through courses in speech, journalism, and related fields. Students interested in air quality work should take courses in chemistry and supplement their technical training with coursework in policy or government affairs. Prospective meteorologists seeking opportunities at weather consulting firms should possess knowledge of business, statistics, and economics, as an increasing emphasis is being placed on long-range seasonal forecasting to assist businesses.

Beginning atmospheric scientists often do routine data collection, computation, or analysis, and some basic forecasting. Entry-level operational meteorologists in the Federal Government usually are placed in intern positions for training and experience. During this period, they learn about the Weather Service's forecasting equipment and procedures, and rotate to different offices to learn about various weather systems. After completing the training period, they are assigned to a permanent duty station.

Certification and advancement. The American Meteorological Society (AMS) offers professional certification for consulting meteorologists, administered by a Board of Certified Consulting Meteorologists. Applicants must meet formal education requirements, pass an examination to demonstrate thorough meteorological knowledge, have a minimum of 5 years of experience or a combination of experience plus an advanced degree, and provide character references from fellow professionals. In addition, AMS also offers professional certification for broadcast meteorologists.

Experienced meteorologists may advance to supervisory or administrative jobs, or may handle more complex forecasting jobs. After several years of experience, some meteorologists establish their own weather consulting services.

Employment

Atmospheric scientists held about 8,800 jobs in 2006. Although several hundred people teach atmospheric science and related

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courses in college and university departments of meteorology or atmospheric science, physics, earth science, or geophysics, these individuals are classified as college or university faculty, rather than atmospheric scientists. (See the statement on postsecondary teachers elsewhere in the *Handbook*.)

The Federal Government was the largest single employer of civilian meteorologists, accounting for about 37 percent. The National Oceanic and Atmospheric Administration (NOAA) employed most Federal meteorologists in National Weather Service stations throughout the Nation; the remainder of NOAA's meteorologists worked mainly in research and development or management. The U.S. Department of Defense employed several hundred civilian meteorologists. In addition to civilian meteorologists, hundreds of Armed Forces members are involved in forecasting and other meteorological work. (See the statement on job opportunities in the Armed Forces elsewhere in the *Handbook*.) Others worked for professional, scientific, and technical services firms, including private weather consulting services; radio and television broadcasting; air carriers; and State government.

Job Outlook

Employment is expected to increase about as fast as the average. Atmospheric scientists should have favorable job prospects, but opportunities in broadcasting are rare and highly competitive.

Employment change. Employment of atmospheric scientists is projected to grow 11 percent over the 2006-16 decade, about as fast as the average for all occupations. The National Weather Service has completed an extensive modernization of its weather forecasting equipment and finished all hiring of meteorologists needed to staff the upgraded stations. The Service has no plans to increase the number of weather stations or the number of meteorologists in existing stations. Employment of meteorologists in other Federal agencies is expected to decline.

In private industry, on the other hand, job opportunities for atmospheric scientists are expected to be better than in the Federal Government. As research leads to continuing improvements in weather forecasting, demand should grow for private weather consulting firms to provide more detailed information than has formerly been available, especially to climate-sensitive industries. Farmers, commodity investors, radio and television stations, and utilities, transportation, and construction firms can greatly benefit from additional weather information more closely targeted to their needs than the general information provided by the National Weather Service. Additionally, research on seasonal and other long-range forecasting is yielding positive results, which should spur demand for more atmospheric scientists to interpret these forecasts and advise climate-sensitive industries. However, because many customers for private weather services are in industries sensitive to fluctuations in the economy, the sales and growth of private weather services depend on the health of the economy.

There will continue to be demand for atmospheric scientists to analyze and monitor the dispersion of pollutants into the air to ensure compliance with Federal environmental regulations, but related employment increases are expected to be small. Efforts toward making and improving global weather observations also could have a positive impact on employment.

Job prospects. Atmospheric scientists should have favorable job prospects, as the number of graduates is expected to be in rough balance with the number of openings. Opportunities in broadcasting are rare and there will be very few job openings in this industry. Openings for academic and government positions should result primarily from replacement needs as older workers retire or leave the occupation for other reasons.

Earnings

Median annual earnings of atmospheric scientists in May 2006 were $77,150. The middle 50 percent earned between $55,530 and $96,490. The lowest 10 percent earned less than $39,090, and the highest 10 percent earned more than $119,700.

The average salary for meteorologists employed by the Federal Government was $84,882 in 2007. Many meteorologists in the Federal Government with a bachelor's degree received a starting salary of $35,752, or slightly higher in areas of the country where the prevailing local pay level is higher.

Related Occupations

Workers in other occupations concerned with the physical environment include environmental scientists and hydrologists, geoscientists, physicists and astronomers, mathematicians, and engineers.

Sources of Additional Information

Information about careers in meteorology and a listing of colleges and universities offering meteorology programs is provided by the American Meteorological Society on the Internet at: **http://www.ametsoc.org**

General information about meteorology and careers in atmospheric science can also be obtained from the National Oceanic and Atmospheric Administration on the Internet at: **http://www.noaa.gov**

Information on obtaining a position as a meteorologist with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Atmospheric and space scientists	19-2021	8,800	9,700	900	11

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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Chemists and Materials Scientists

(O*NET 19-2031.00, 19-2032.00)

Significant Points

- A bachelor's degree in chemistry or a related discipline is the minimum educational requirement; however, many research jobs require a master's degree or, more often, a Ph.D.
- Job growth will occur in professional, scientific, and technical services firms as manufacturing companies continue to outsource their research and development and testing operations to these smaller, specialized firms.
- New chemists at all levels may experience competition for jobs, particularly in declining chemical manufacturing industries; graduates with a master's degree, and particularly those with a Ph.D., will enjoy better opportunities at larger pharmaceutical and biotechnology firms.

Nature of the Work

Everything in the environment, whether naturally occurring or of human design, is composed of chemicals. Chemists and materials scientists search for and use new knowledge about chemicals. Chemical research has led to the discovery and development of new and improved synthetic fibers, paints, adhesives, drugs, cosmetics, electronic components, lubricants, and thousands of other products. Chemists and materials scientists also develop processes such as improved oil refining and petrochemical processing that save energy and reduce pollution. Applications of materials science include studies of superconducting materials, graphite materials, integrated-circuit chips, and fuel cells. Research on the chemistry of living things spurs advances in medicine, agriculture, food processing, and other fields.

Many chemists and materials scientists work in research and development (R&D). In basic research, they investigate the properties, composition, and structure of matter and the laws that govern the combination of elements and reactions of substances to each other. In applied R&D, these scientists create new products and processes or improve existing ones, often using knowledge gained from basic research. For example, synthetic rubber and plastics resulted from research on small molecules uniting to form large ones, a process called polymerization. R&D chemists and materials scientists use computers and a wide variety of sophisticated laboratory instrumentation for modeling, simulation, and experimental analysis.

The use of computers to analyze complex data has allowed chemists and materials scientists to practice combinatorial chemistry. This technique makes and tests large quantities of chemical compounds simultaneously to find those with certain desired properties. Combinatorial chemistry has allowed chemists to produce thousands of compounds more quickly and inexpensively than was formerly possible and assisted in the sequencing of human genes. Specialty chemists, such as medicinal and organic chemists, work with life scientists to translate this knowledge into new drugs.

Developments in the field of chemistry that involve life sciences will expand, resulting in more interaction among biologists, engineers, computer specialists, and chemists. (*Biochemists*, whose work encompasses both biology and chemistry, are discussed in the *Handbook* statement on biological scientists.)

Chemists also work in production and quality control in chemical manufacturing plants. They prepare instructions for plant workers that specify ingredients, mixing times, and temperatures for each stage in the process. They also monitor automated processes to ensure proper product yield and test samples of raw materials or finished products to ensure that they meet industry and government standards, including regulations governing pollution. Chemists report and document test results and analyze those results in hopes of improving existing theories or developing new test methods.

Chemists often specialize. *Analytical chemists* determine the structure, composition, and nature of substances by examining and identifying their various elements or compounds. These chemists are absolutely crucial to the pharmaceutical industry because pharmaceutical companies need to know the identity of compounds that they hope to turn into drugs. Furthermore, analytical chemists develop analytical techniques and study the relationships and interactions among the parts of compounds. They also identify the presence and concentration of chemical pollutants in air, water, and soil.

Organic chemists study the chemistry of the vast number of carbon compounds that make up all living things. Organic chemists who synthesize elements or simple compounds to create new compounds or substances that have different properties and applications have developed many commercial products, such as drugs, plastics, and elastomers (elastic substances similar to rubber). *Inorganic chemists* study compounds consisting mainly of elements other than carbon, such as those in electronic components.

Physical and *theoretical chemists* study the physical characteristics of atoms and molecules and the theoretical properties of matter; and they investigate how chemical reactions work. Their research may result in new and better energy sources. *Macromolecular chemists* study the behavior of atoms and molecules. *Medicinal chemists* study the structural properties of compounds intended for applications to human medicine.

Materials chemists study and develop new materials to improve existing products or make new ones. In fact, virtually all chemists are involved in this quest in one way or another.

The work of materials chemists is similar to, but separate from, the work of materials scientists. Materials scientists apply physics as well as chemistry to study all aspects of materials. Chemistry, however, plays an increasingly dominant role in materials science because it provides information about the structure and composition of materials.

Materials scientists study the structures and chemical properties of various materials to develop new products or enhance existing ones. They also determine ways to strengthen or com-

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bine materials or develop new materials for use in a variety of products. Materials science encompasses the natural and synthetic materials used in a wide range of products and structures, from airplanes, cars, and bridges to clothing and household goods. Materials scientists often specialize in specific areas such as ceramics or metals.

Work environment. Chemists and materials scientists usually work regular hours in offices and laboratories. R&D chemists and materials scientists spend much time in laboratories but also work in offices when they do theoretical research or plan, record, and report on their lab research. Although some laboratories are small, others are large enough to incorporate prototype chemical manufacturing facilities as well as advanced testing equipment. In addition to working in a laboratory, materials scientists also work with engineers and processing specialists in industrial manufacturing facilities. Chemists do some of their work in a chemical plant or outdoors—gathering water samples to test for pollutants, for example. Some chemists are exposed to health or safety hazards when handling certain chemicals, but there is little risk if proper procedures are followed.

Chemists and materials scientists typically work regular hours. A 40-hour workweek is usual, but longer hours are not uncommon. Researchers may be required to work odd hours in laboratories or other locations, depending on the nature of their research.



Opportunities will be best for chemists and material scientists at large biotechnology and pharmaceutical firms.

Training, Other Qualifications, and Advancement

A bachelor's degree in chemistry or a related discipline is the minimum educational requirement; however, many research jobs require a master's degree or, more often, a Ph.D.

Education and training. A bachelor's degree in chemistry or a related discipline usually is the minimum educational requirement for entry-level chemist jobs. While some materials scientists hold a degree in materials science, degrees in chemistry, physics, or electrical engineering are also common. Most research jobs in chemistry and materials science require a master's degree or, more frequently, a Ph.D.

Many colleges and universities offer degree programs in chemistry. In 2007, the American Chemical Society (ACS) had approved approximately 640 bachelors, 310 masters, and 200 doctoral degree programs. In addition to these programs, other advanced degree programs in chemistry were offered at several hundred colleges and universities. The number of colleges that offer a degree program in materials science is small but gradually increasing.

Students planning careers as chemists and materials scientists should take courses in science and mathematics, should like working with their hands building scientific apparatus and performing laboratory experiments, and should like computer modeling.

In addition to taking required courses in analytical, inorganic, organic, and physical chemistry, undergraduate chemistry majors usually study biological sciences; mathematics; physics; and increasingly, computer science. Computer courses are essential because employers prefer job applicants who are able to apply computer skills to modeling and simulation tasks and operate computerized laboratory equipment. This is increasingly important as combinatorial chemistry and advanced screening techniques are more widely applied. Courses in statistics are useful because both chemists and materials scientists need the ability to apply basic statistical techniques.

People interested in environmental specialties also should take courses in environmental studies and become familiar with current legislation and regulations. Specific courses should include atmospheric, water, and soil chemistry, and energy.

Graduate students studying chemistry commonly specialize in a subfield, such as analytical chemistry or polymer chemistry, depending on their interests and the kind of work they wish to do. For example, those interested in doing drug research in the pharmaceutical industry usually develop a strong background in medicinal or synthetic organic chemistry. However, students normally need not specialize at the undergraduate level. In fact, undergraduates who are broadly trained have more flexibility when searching for jobs than if they have narrowly defined their interests. Most employers provide new graduates additional training or education.

In government or industry, beginning chemists with a bachelor's degree work in quality control, perform analytical testing, or assist senior chemists in R&D laboratories. Many employers prefer chemists and materials scientists with a Ph.D., or at least a master's degree, to lead basic and applied research. Within materials science, a broad background in various sciences is preferred. This broad base may be obtained through degrees in physics, engineering, or chemistry. Although many compa-

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nies prefer hiring Ph.D.s, some may employ materials scientists with bachelor's and master's degrees.

Other qualifications. Because R&D chemists and materials scientists are increasingly expected to work on interdisciplinary teams, some understanding of other disciplines, including business and marketing or economics, is desirable, along with leadership ability and good oral and written communication skills. Interaction among specialists in this field is increasing, especially for specialty chemists in drug development. One type of chemist often relies on the findings of another type of chemist. For example, an organic chemist must understand findings on the identity of compounds prepared by an analytical chemist.

Experience, either in academic laboratories or through internships, fellowships, or work-study programs in industry, also is useful. Some employers of research chemists, particularly in the pharmaceutical industry, prefer to hire individuals with several years of postdoctoral experience.

Perseverance, curiosity, and the ability to concentrate on detail and to work independently are essential.

Advancement. Advancement among chemists and materials scientists usually takes the form of greater independence in their work or larger budgets. Others choose to move into managerial positions and become natural science managers (listed elsewhere in the *Handbook*). Those who pursue management careers spend more time preparing budgets and schedules and setting research strategy. Chemists or materials scientists who develop new products or processes sometimes form their own companies or join new firms to develop these ideas.

Employment

Chemists and materials scientists held about 93,000 jobs in 2006. Chemists accounted for about 84,000 of these, while materials scientists accounted for about 9,700 jobs. In addition, many chemists and materials scientists held faculty positions in colleges and universities but are not included in these numbers. (See the statement on teachers—postsecondary, elsewhere in the *Handbook*.)

About 41 percent of all chemists and material scientists are employed in manufacturing firms—mostly in the chemical manufacturing industry; firms in this industry produce plastics and synthetic materials, drugs, soaps and cleaners, pesticides and fertilizers, paint, industrial organic chemicals, and other chemical products. About 18 percent of chemists and material scientists work in scientific research and development services; 12 percent work in architectural, engineering, and related services. Companies whose products are made of metals, ceramics, and rubber employ most materials scientists. In addition, thousands of people with a background in chemistry and materials science hold teaching positions in high schools and in colleges and universities. (See the statements on teachers—postsecondary, and teachers—preschool, kindergarten, elementary, middle, and secondary, elsewhere in the *Handbook*.)

Chemists and materials scientists are employed in all parts of the country, but they are mainly concentrated in large industrial areas.

Job Outlook

Average job growth is expected. New chemists at all levels may experience competition for jobs, particularly in declining chemical manufacturing industries. Graduates with a master's degree or a Ph.D., will enjoy better opportunities, especially at larger pharmaceutical and biotechnology firms.

Employment change. Employment of chemists and materials scientists is expected to grow 9 percent over the 2006-16 decade, about as fast as the average for all occupations. Job growth will occur in professional, scientific, and technical services firms as manufacturing companies continue to outsource their R&D and testing operations to these smaller, specialized firms.

Chemists should experience employment growth in pharmaceutical and biotechnology research, as recent advances in genetics open new avenues of treatment for diseases. Employment of chemists in the nonpharmaceutical chemical manufacturing industries is expected to decline over the projection period, along with overall declining employment in these industries.

Employment of materials scientists should continue to grow as manufacturers of diverse products seek to improve their quality by using new materials and manufacturing processes.

Within the chemical manufacturing industries, job growth for chemists is expected to be strongest in pharmaceutical and biotechnology firms. Biotechnological research, including studies of human genes, continues to offer possibilities for the development of new drugs and products to combat illnesses and diseases that have previously been unresponsive to treatments derived by traditional chemical processes. Stronger competition among drug companies and an aging population are contributing to the need for new drugs.

The remaining chemical manufacturing industries are expected to employ fewer chemists as companies divest their R&D operations. To control costs, most chemical companies, including many large pharmaceutical and biotechnology companies, will increasingly turn to scientific R&D services firms to perform specialized research and other work formerly done by in-house chemists. As a result, these firms will experience healthy growth. Also, some companies are expected to conduct an increasing amount of manufacturing and research in lower-wage countries, further limiting domestic employment growth. Quality control will continue to be an important issue in chemical manufacturing and other industries that use chemicals in their manufacturing processes.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Chemists and materials scientists	19-2030	93,000	102,000	8,500	9
Chemists	19-2031	84,000	91,000	7,600	9
Materials scientists	19-2032	9,700	11,000	800	9

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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Chemists also will be employed to develop and improve the technologies and processes used to produce chemicals for all purposes, and to monitor and measure air and water pollutants to ensure compliance with local, State, and Federal environmental regulations. Environmental research will offer many new opportunities for chemists and materials scientists. To satisfy public concerns and to comply with government regulations, chemical manufacturing industries will continue to invest billions of dollars each year in technology that reduces pollution and cleans up existing waste sites. Research into traditional and alternative energy sources should also lead to employment growth among chemists.

Job prospects. New chemists at all levels may experience competition for jobs, particularly in declining chemical manufacturing industries. Graduates with a bachelor's degree in chemistry may find science-related jobs in sales, marketing, and middle management. Some become chemical technicians or technologists or high school chemistry teachers. In addition, bachelor's degree holders are increasingly finding assistant research positions at smaller research organizations.

Graduates with an advanced degree, and particularly those with a Ph.D., will enjoy better opportunities. Larger pharmaceutical and biotechnology firms will offer more openings for these workers. Furthermore, chemists with an advanced degree will continue to fill most senior research and upper management positions; however, similar to other occupations, applicants face strong competition for the limited number of upper management jobs.

In addition to jobs openings resulting from employment growth, some job openings will result from the need to replace chemists and materials scientists who retire or otherwise leave the labor force, although not all positions will be filled.

During periods of economic recession, layoffs of chemists may occur—especially in the industrial chemicals industry. Layoffs are less likely in the pharmaceutical industry, where long development cycles generally overshadow short-term economic conditions. The traditional chemical industries, however, provide many raw materials to the automotive manufacturing and construction industries, both of which are vulnerable to temporary slowdowns during recessions.

Earnings

Median annual earnings of chemists in 2006 were $59,870. The middle 50 percent earned between $44,780 and $82,610. The lowest 10 percent earned less than $35,480, and the highest 10 percent earned more than $106,310. Median annual earnings of materials scientists in 2006 were $74,610. The middle 50 percent earned between $55,170 and $96,800. The lowest 10 percent earned less than $41,810, and the highest 10 percent earned more than $118,670. Median annual earnings in the industries employing the largest numbers of chemists in 2006 are shown below:

Federal executive branch	$88,930
Scientific research and development services	68,760
Basic chemical manufacturing	62,340
Pharmaceutical and medicine manufacturing	57,210
Testing laboratories	45,730

According to the National Association of Colleges and Employers, beginning salary offers in July 2007 for graduates with bachelor's degrees in chemistry averaged $41,506 a year.

In 2007, annual earnings of chemists in nonsupervisory, supervisory, and managerial positions in the Federal Government averaged $89,954.

Related Occupations

The research and analysis conducted by chemists and materials scientists is closely related to work done by agricultural and food scientists, biological scientists, medical scientists, engineering and natural sciences managers, chemical engineers, materials engineers, physicists and astronomers, and science technicians.

Sources of Additional Information

General information on career opportunities and earnings for chemists is available from:

➤ American Chemical Society, Education Division, 1155 16th St.NW., Washington, DC 20036. Internet: **http://www.acs.org**

Information on obtaining a position as a chemist with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result.

Environmental Scientists and Hydrologists

(O*NET 19-2041.00, 19-2043.00)

Significant Points

- Environmental scientists and hydrologists often work in offices, laboratories, and field sites.
- Federal, State, and local governments employ 43 percent of all environmental scientists and hydrologists.
- Although a bachelor's degree in an earth science is adequate for a few entry-level jobs, employers prefer a master's degree; a Ph.D. degree generally is required for research or college teaching positions.
- Job prospects are expected to be favorable, particularly for hydrologists.

Nature of the Work

Environmental scientists and hydrologists use their knowledge of the physical makeup and history of the Earth to protect the environment, study the properties of underground and surface waters, locate water and energy resources, predict water-related geologic hazards, and provide environmental site assessments and advice on indoor air quality and hazardous-waste-site remediation.

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Environmental scientists conduct research to identify, abate, and eliminate hazards that affect people, wildlife, and their environments. These workers analyze measurements or observations of air, food, water, and soil to determine the way to clean and preserve the environment. Understanding the issues involved in protecting the environment—degradation, conservation, recycling, and replenishment—is central to the work of environmental scientists. They often use this understanding to design and monitor waste disposal sites, preserve water supplies, and reclaim contaminated land and water to comply with Federal environmental regulations. They also write risk assessments, describing the likely affect of construction and other environmental changes; write technical proposals; and give presentations to managers and regulators.

Hydrologists study the quantity, distribution, circulation, and physical properties of bodies of water. Often, they specialize in either underground water or surface water. They examine the form and intensity of precipitation, its rate of infiltration into the soil, its movement through the Earth, and its return to the ocean and atmosphere. Hydrologists use sophisticated techniques and instruments. For example, they may use remote sensing technology, data assimilation, and numerical modeling to monitor the change in regional and global water cycles. Some surface-water hydrologists use sensitive stream-measuring devices to assess flow rates and water quality.

Many environmental scientists and hydrologists work at consulting firms, helping businesses and government agencies comply with environmental policy, particularly with regard to ground-water decontamination and flood control. They are usually hired to solve problems. Most consulting firms fall into two categories: large multidisciplinary engineering companies, the largest of which may employ thousands of workers, and small niche firms that may employ only a few workers. When looking for jobs, environmental scientists and hydrologists should consider the type of firm and the scope of the projects it undertakes. In larger firms, environmental scientists are more likely to engage in large, long-term projects in which they will work with people in other scientific disciplines. In smaller specialty firms, however, they work more often with business professionals and clients in government and the private sector.

Environmental scientists who work on policy formation may help identify ways that human behavior can be modified in the future to avoid such problems as ground-water contamination and depletion of the ozone layer. Some environmental scientists work in managerial positions, usually after spending some time performing research or learning about environmental laws and regulations.

Many environmental scientists do work and have training that is similar to other physical or life scientists, but they focus on environmental issues. Many specialize in subfields such as environmental ecology and conservation, environmental chemistry, environmental biology, or fisheries science. Specialties affect the specific activities that environmental scientists perform, although recent understandings of the interconnectedness of life processes have blurred some traditional classifications. For example, *environmental ecologists* study the relationships between organisms and their environments and the effects of factors such as population size, pollutants, rainfall, temperature, and altitude, on both. They may collect, study, and report data on air, soil, and water using their knowledge of various scientific disciplines. *Ecological modelers* study ecosystems, pollution control, and resource management using mathematical modeling, systems analysis, thermodynamics, and computer techniques. *Environmental chemists* study the toxicity of various chemicals, that is, how those chemicals affect plants, animals, and people. (Information on geoscientists, who also study the Earth, is located elsewhere in the *Handbook*.)



Environmental scientists and hydrologists work in labratories, offices, and in the field.

Environmental scientists and hydrologists in research positions with the Federal Government or in colleges and universities often have to find funding for their work by writing grant proposals. Consultants face similar pressures to market their skills and write proposals so that they will have steady work.

Work environment. Most entry-level environmental scientists and hydrologists spend the majority of their time in the field, while more experienced workers generally devote more time to office or laboratory work. Many beginning hydrologists and some environmental scientists, such as environmental ecologists and environmental chemists, often take field trips that involve physical activity. Environmental scientists and hydrologists in the field may work in warm or cold climates, in all kinds of weather. In their research, they may dig or chip with a hammer, scoop with a net, come in contact with water, and carry equipment. Travel often is required to meet with prospective clients or investors.

Researchers and consultants might face stress when looking for funding. Occasionally, those who write technical reports to business clients and regulators may be under pressure to meet deadlines and thus have to work long hours.

Training, Other Qualifications, and Advancement

Most environmental scientists and hydrologists need a master's degree. A Ph.D. is usually necessary for jobs in college teaching or research.

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Education and training. A bachelor's degree in an earth science is adequate for a few entry-level positions, but environmental scientists increasingly need a master's degree in environmental science, hydrology, or a related natural science. A master's degree also is the minimum educational requirement for most entry-level applied research positions in private industry, in State and Federal agencies, and at State geological surveys. A doctoral degree generally is necessary for college teaching and most research positions.

Some environmental scientists have a degree in environmental science. Many, however, earn degrees in life science, chemistry, geology, geophysics, atmospheric science, or physics and then apply their education to the environment. They often need research or work experience related to environmental science.

A bachelor's degree in environmental science offers an interdisciplinary approach to the natural sciences, with an emphasis on biology, chemistry, and geology. Undergraduate environmental science majors typically focus on data analysis and physical geography, which are particularly useful in studying pollution abatement, water resources, or ecosystem protection, restoration, and management. Understanding the geochemistry of inorganic compounds is becoming increasingly important in developing remediation goals. Students interested in working in the environmental or regulatory fields, either in environmental consulting firms or for Federal or State governments, should take courses in hydrology, hazardous-waste management, environmental legislation, chemistry, fluid mechanics, and geologic logging, which is the gathering of geologic data. An understanding of environmental regulations and government permit issues also is valuable for those planning to work in mining and oil and gas extraction.

Students interested in hydrology should take courses in the physical sciences, geophysics, chemistry, engineering science, soil science, mathematics, aquatic biology, atmospheric science, geology, oceanography, hydrogeology, and the management or conservation of water resources. In some cases, a bachelor's degree in a hydrologic science is sufficient for positions consulting about water quality or wastewater treatment.

For environmental scientists and hydrologists who consult, courses in business, finance, marketing, or economics may be useful. In addition, combining environmental science training with other disciplines such as engineering or business, qualifies these scientists for the widest range of jobs.

Other qualifications. Computer skills are essential for prospective environmental scientists and hydrologists. Students who have some experience with computer modeling, data analysis and integration, digital mapping, remote sensing, and Geographic Information Systems (GIS) will be the most prepared to enter the job market. Familiarity with the Global Positioning System (GPS)—a locator system that uses satellites—is vital.

Environmental scientists and hydrologists must have good interpersonal skills, because they usually work as part of a team with other scientists, engineers, and technicians. Strong oral and written communication skills also are essential because writing technical reports and research proposals and communicating results to company managers, regulators, and the public are important aspects of the work. Because international work is becoming increasingly pervasive, knowledge of a second language can be an advantage. Those involved in fieldwork must have physical stamina.

Certification and advancement. Environmental scientists and hydrologists often begin their careers in field exploration or, occasionally, as research assistants or technicians in laboratories or offices. They are given more difficult assignments as they gain experience. Eventually, they may be promoted to project leader, program manager, or some other management and research position. (Information on engineering and natural science managers is located elsewhere in the *Handbook*.)

The American Institute of Hydrology offers certification programs in professional hydrology. Certification may be beneficial for those seeking advancement.

Employment

Environmental scientists and hydrologists held about 92,000 jobs in 2006. Jobs for hydrologists accounted for only 9 percent of the total. Many more individuals held environmental science faculty positions in colleges and universities, but they are classified as postsecondary teachers. (See the statement on teachers—postsecondary elsewhere in the *Handbook*.)

About 35 percent of environmental scientists were employed in State and local governments; 21 percent in management, scientific, and technical consulting services; 15 percent in architectural, engineering and related services; and 8 percent in the Federal Government. About 2 percent were self-employed.

Among hydrologists, 26 percent were employed in architectural, engineering, and related services, and 18 percent worked for management, scientific, and technical consulting services. In 2006, the Federal Government employed about 28 percent of hydrologists, mostly within the U.S. Department of the Interior for the U.S. Geological Survey (USGS) and within the U.S. Department of Defense. Another 21 percent worked for State agencies, such as State geological surveys and State departments of conservation. About 2 percent of hydrologists were self-employed, most as consultants to industry or government.

Job Outlook

Employment of environmental scientists and hydrologists is expected to grow much faster than the average for all occupations. Job prospects are expected to be favorable, particularly for hydrologists.

Employment change. Employment of environmental scientists is expected to increase by 25 percent between 2006 and 2016, much faster than the average for all occupations. Over the same period, employment of hydrologists should increase by 24 percent, also much faster than the average. Job growth for environmental scientists and hydrologists should be strongest in private-sector consulting firms. Growth in employment of environmental scientists and hydrologists will be spurred largely by the increasing demands placed on the environment and water resources by population growth. Further demand should result from the need to comply with complex environmental laws and regulations, particularly those regarding ground-water decontamination, clean air, and flood control.

Much job growth will result from a continued need to monitor the quality of the environment, to interpret the impact of human actions on terrestrial and aquatic ecosystems, and to develop strategies for restoring ecosystems. In addition, environmental

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Environmental scientists and hydrologists	—	92,000	114,000	23,000	25
Environmental scientists and specialists, including health	19-2041	83,000	104,000	21,000	25
Hydrologists	19-2043	8,300	10,000	2,000	24

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

scientists will be needed to help planners develop and construct buildings, transportation corridors, and utilities that protect water resources and reflect efficient and beneficial land use.

Demand for hydrologists should also be strong as the population increases and moves to more environmentally sensitive locations. As people increasingly migrate toward coastal regions, for example, hydrologists will be needed to assess building sites for potential geologic hazards and to mitigate the effects of natural hazards such as floods, landslides, and hurricanes. Hydrologists also will be needed to study hazardous-waste sites and determine the effect of pollutants on soil and ground water so that engineers can design remediation systems. Increased government regulations, such as those regarding the management of storm water, and issues related to water conservation, deteriorating coastal environments, and rising sea levels also will stimulate employment growth for these workers.

Many environmental scientists and hydrologists work in consulting. Consulting firms have hired these scientists to help businesses and government address issues related to underground tanks, land disposal areas, and other hazardous-waste-management facilities. Currently, environmental consulting is evolving from investigations to creating remediation and engineering solutions. At the same time, the regulatory climate is moving from a rigid structure to a more flexible risk-based approach. These factors, coupled with new Federal and State initiatives that integrate environmental activities into the business process itself, will result in a greater focus on waste minimization, resource recovery, pollution prevention, and the consideration of environmental effects during product development. This shift in focus to preventive management will provide many new opportunities for environmental scientists and hydrologists in consulting roles.

Job prospects. In addition to job openings due to growth, there will be additional demand for new environmental scientists and hydrologists to replace those who retire, advance to management positions, or change careers. Job prospects for hydrologists should be favorable, particularly for those with field experience. Demand for hydrologists who understand both the scientific and engineering aspects of waste remediation should be strong. Few colleges and universities offer programs in hydrology, so the number of qualified workers may be limited.

Job prospects for environmental scientists also will be good, but less favorable than for hydrologists because of the larger number of workers seeking to enter the field.

Funding for Federal and State geological surveys depend largely on the political climate and the current budget. Thus, job security for environmental scientists and hydrologists may vary. During periods of economic recession, layoffs of environmental scientists and hydrologists may occur in consulting firms; layoffs are much less likely in government.

Earnings

Median annual earnings of environmental scientists were $56,100 in May 2006. The middle 50 percent earned between $42,840 and $74,480. The lowest 10 percent earned less than $34,590, and the highest 10 percent earned more than $94,670.

Median annual earnings of hydrologists were $66,260 in 2006, with the middle 50 percent earning between $51,370 and $82,140, the lowest 10 percent earning less than $42,080, and the highest 10 percent earning more than $98,320.

Median annual earnings in the industries employing the largest number of environmental scientists in 2006 were as follows:

Federal executive branch	$82,490
Management, scientific, and technical consulting services	57,280
Engineering services	56,080
Local government	52,100
State government	50,590

According to the National Association of Colleges and Employers, beginning salary offers in July 2007 for graduates with bachelor's degrees in an environmental science averaged $38,336 a year.

In 2007, the Federal Government's average salary for hydrologists was $82,217.

Related Occupations

Environmental scientists and hydrologists perform investigations for the purpose of abating or eliminating pollutants or hazards that affect the environment or plants, animals, and humans. Many other occupations deal with preserving or researching the natural environment, including conservation scientists and foresters, atmospheric scientists, and some biological scientists, science technicians, and engineering technicians. Environmental scientists and hydrologists have extensive training in physical sciences, and many apply their knowledge of chemistry, physics, biology, and mathematics to the study of the Earth, work closely related to that of geoscientists.

Using problem-solving skills, physicists; chemists; engineers; mathematicians; surveyors, cartographers, photogrammetrists, and surveying technicians; computer systems analysts; and computer scientists and database administrators may also perform similar work related to the environment.

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Sources of Additional Information

Information on training and career opportunities for environmental scientists is available from:

➤ American Geological Institute, 4220 King St., Alexandria, VA 22302. Internet: **http://www.agiweb.org**

For information on careers in hydrology, contact:

➤ American Institute of Hydrology, 300 Village Green Circle, Suite #201, Smyrna, GA 30080.
Internet: **http://www.aihydro.org**

Information on obtaining a position as a hydrologist or an environmental protection specialist with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result.

Geoscientists

(O*NET 19-2042)

Significant Points

- Work at remote field sites is common.
- Federal, State, and local governments employ 18 percent of all geoscientists.
- Employers prefer applicants with a master's degree for most positions; a Ph.D. degree is required for most high-level research and college teaching positions.
- Excellent job opportunities are expected for graduates with a master's degree.

Nature of the Work

Geoscientists study the composition, structure, and other physical aspects of the Earth. They study the Earth's geologic past and present by using sophisticated instruments to analyze the composition of earth, rock, and water. Many geoscientists help to search for natural resources such as groundwater, metals, and petroleum. Others work closely with environmental and other scientists to preserve and clean up the environment.

Geoscientists usually study and work in one of several closely related fields of geoscience. *Geologists* study the composition, processes, and history of the Earth. They try to find out how rocks were formed and what has happened to them since their formation. They also study the evolution of life by analyzing plant and animal fossils. *Geophysicists* use the principles of physics, mathematics, and chemistry to study not only the Earth's surface, but also its internal composition, ground and surface waters, atmosphere, oceans, and magnetic, electrical, and gravitational forces.

Within these two major disciplines of geology and geophysics are numerous subspecialties. For example, *petroleum geologists* map the subsurface of the ocean or land as they explore the terrain for oil and gas deposits. They use sophisticated instrumentation and computers to interpret geological information. *Engineering geologists* apply geologic principles to the fields of civil and environmental engineering, offering advice on major construction projects and assisting in environmental remediation and natural hazard-reduction projects. *Mineralogists* analyze and classify minerals and precious stones according to their composition and structure. They study the environment surrounding rocks in order to find new mineral resources. *Sedimentologists* study the nature, origin, distribution, and alteration of sediments, such as sand, silt, and mud. These sediments may contain oil, gas, coal, and many other mineral deposits. *Paleontologists* study fossils found in geological formations to trace the evolution of plant and animal life and the geologic history of the Earth. *Stratigraphers* examine the formation and layering of rocks to understand the environment which formed them. *Volcanologists* investigate volcanoes and volcanic phenomena to try to predict the potential for future eruptions and hazards to human health and welfare. *Glacial geologists* study the physical properties and movement of glaciers and ice sheets. *Geochemists* study the nature and distribution of chemical elements in groundwater and earth materials.

Geophysicists specialize in areas such as geodesy, seismology, and magnetic geophysics. *Geodesists* study the Earth's size, shape, gravitational field, tides, polar motion, and rotation. *Seismologists* interpret data from seismographs and other geophysical instruments to detect earthquakes and locate earthquake-related faults. *Geomagnetists* measure the Earth's magnetic field and use measurements taken over the past few centuries to devise theoretical models that explain the Earth's origin. *Paleomagnetists* interpret fossil magnetization in rocks and sediments from the continents and oceans to record the spreading of the sea floor, the wandering of the continents, and the many reversals of polarity that the Earth's magnetic field has undergone through time. Other geophysicists study atmospheric sciences and space physics. (See the statement on atmospheric scientists, and physicists and astronomers, elsewhere in the *Handbook*.)

Oceanographers use their knowledge of geology and geophysics, in addition to biology and chemistry, to study the world's oceans and coastal waters. They study the motion and circulation of the ocean waters; the physical and chemical properties of the oceans; and how these properties affect coastal areas, climate, and weather. Oceanographers are further broken down according to their areas of expertise. For example, *physical oceanographers* study the tides, waves, currents, temperatures, density, and salinity of the ocean. They examine the interaction of various forms of energy, such as light, radar, sound, heat, and wind, with the sea, in addition to investigating the relationship between the sea, weather, and climate. *Chemical oceanographers* study the distribution of chemical compounds and chemical interactions that occur in the ocean and on the sea floor. They may investigate how pollution affects the chemistry of the ocean. *Geological and geophysical oceanographers* study the topographic features and the physical makeup of the ocean floor. Their knowledge can help companies find oil and gas off coastal waters. (*Biological oceanographers*, often called marine biologists, study the distribution and migration patterns of the many diverse forms of sea life in the ocean; the statement on biological scientists discusses this occupation elsewhere in the *Handbook*.)

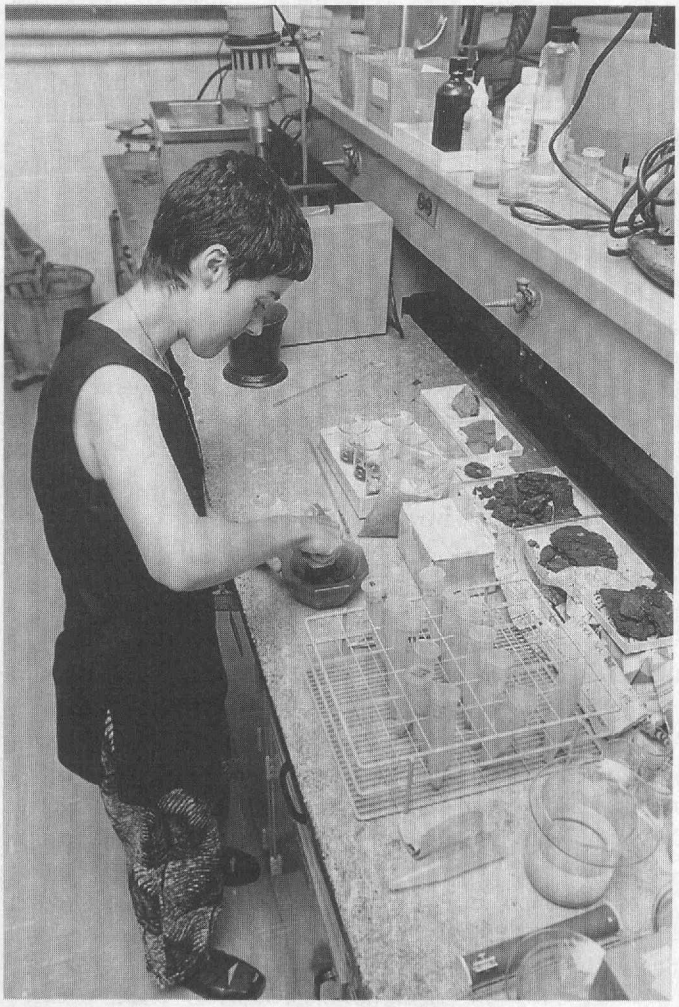
Geoscientists in research positions with the Federal Government or in colleges and universities frequently are required to design programs and write grant proposals in order to fund their

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research. Geoscientists in consulting jobs face similar pressures to market their skills and write proposals so that they will have steady work.

Work environment. Geoscientists can spend a large part of their time in the field, identifying and examining rocks, studying information collected by remote sensing instruments in satellites, conducting geological surveys, constructing field maps, and using instruments to measure the Earth's gravity and magnetic field. They often perform seismic studies, for example, which involve bouncing energy waves off buried layers of rock, to search for oil and gas or to understand the structure of the subsurface layers. Similarly, they use seismic signals generated by an earthquake to determine the earthquake's location and intensity. In laboratories, geologists and geophysicists examine the chemical and physical properties of specimens. They study fossil remains of animal and plant life or experiment with the flow of water and oil through rocks.

Some geoscientists spend the majority of their time in an office, but many others divide their time between fieldwork and office or laboratory work. Work at remote field sites is common. Many geoscientists, such as volcanologists, often take field trips that involve physical activity. Geoscientists in the field may work in warm or cold climates and in all kinds of weather. In their research, they may dig or chip with a hammer, scoop with a net, and carry equipment in a backpack. Oceanographers may spend considerable time at sea on academic research ships. Geologists frequently travel to remote field sites by helicopter or 4-wheel-drive vehicles and cover large areas on foot. Many exploration geologists and geophysicists work in foreign countries, sometimes in remote areas and under difficult conditions. Travel often is required to meet with prospective clients or investors. Fieldwork often requires working long hours.



Excellent employment opportunities are expected for geoscientists with a master's degree.

Training, Other Qualifications, and Advancement

A master's degree is the primary educational requirement for most entry-level positions. A Ph.D. is necessary for most high-level research and college teaching positions, but a master's degree is preferred for most other geoscience jobs.

Education and training. A bachelor's degree is adequate for a few entry-level positions, but most geoscientists need a master's degree in geology or earth science. A master's degree is the preferred educational requirement for most entry-level research positions in private industry, Federal agencies, and State geological surveys. A Ph.D. is necessary for most high-level research and college teaching positions, but it may not be preferred for other jobs.

Many colleges and universities offer a bachelor's or higher degree in a geoscience. Traditional geoscience courses emphasizing classical geologic methods and topics (such as mineralogy, petrology, paleontology, stratigraphy, and structural geology) are important for all geoscientists. People who study physics, chemistry, biology, mathematics, engineering, or computer science may also qualify for some geoscience positions if their course work includes geology.

Licensure. A number of States require geoscientists who offer their services directly to the public, particularly geologists, to obtain a license from a State licensing board. Licensing requirements vary but often include education, experience, and a passing score on an examination.

Other qualifications. Computer skills are essential for prospective geoscientists; students who have experience with computer modeling, data analysis and integration, digital mapping, remote sensing, and Geographic Information Systems (GIS) will be the most prepared entering the job market. Knowledge of the Global Positioning System (GPS)—a locator system that uses satellites—has also become essential. Some employers seek applicants with field experience, so a summer internship is often helpful.

Geoscientists must have good interpersonal skills because they usually work as part of a team with other geoscientists and with environmental scientists, engineers, and technicians. Strong oral and written communication skills also are important because writing technical reports and research proposals and explaining research results in person are important aspects of the work. Because many jobs require foreign travel, knowledge of a second language is becoming increasingly beneficial.

Geoscientists must be inquisitive, able to think logically, and capable of complex analytical thinking, including spatial visualization and the ability to infer conclusions from sparse data. Those involved in fieldwork must have physical stamina.

Advancement. Geoscientists often begin their careers in field exploration or as research assistants or technicians in laboratories or offices. As they gain experience, they get more assignments that are difficult. Eventually, some are promoted to project lead-

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er, program manager, or to a senior research position. Those who choose to work in management will spend more time scheduling, budgeting, and reporting to top executives or clients. (See the statement on engineering and natural sciences managers elsewhere in the *Handbook*.)

Employment

Geoscientists held about 31,000 jobs in 2006. Many more individuals held geoscience faculty positions in colleges and universities, but they are classified as college and university faculty. (See the statement on teachers—postsecondary elsewhere in the *Handbook*.)

About 24 percent of geoscientists were employed in architectural, engineering, and related services, and 18 percent worked for oil and gas extraction companies. In 2006, State agencies such as State geological surveys and State departments of conservation employed about 2,900 geoscientists. Another 2,600 worked for the Federal Government, including geologists, geophysicists, and oceanographers, mostly within the U.S. Department of the Interior for the U.S. Geological Survey (USGS) and within the U.S. Department of Defense. About 2 percent of geoscientists were self-employed, most as consultants to industry or government.

Job Outlook

Although employment growth will vary by industry, overall employment of geoscientists is expected to grow much faster than the average for all occupations. Graduates with a master's degree can expect excellent job opportunities; very few geoscientist jobs are available to bachelor's degree holders. Ph.D.s should face competition for basic research and college teaching jobs.

Employment change. Employment growth of 22 percent for geoscientists is expected between 2006 and 2016, much faster than the average for all occupations. The need for energy, environmental protection, and responsible land and water management will spur employment demand. Employment in management, scientific, and technical consulting services should continue to grow as more geoscientists work as consultants. These services have increased their hiring of geoscientists in recent years because of increased government contracting, and private corporations' need for technical assistance and environmental management plans. Moreover, many geoscientists monitor the quality of the environment, including aquatic ecosystems, deteriorating coastal environments, and rising sea levels—all of which will create employment growth for them. An expected increase in highway building and other infrastructure projects will also be a source of jobs for engineering geologists.

Employment is also expected to increase in the oil and gas extraction industry. Many geoscientists work in the exploration and production of oil and gas. Historically, employment of petroleum geologists, geophysicists, and some other geoscientists has been cyclical and affected considerably by the price of oil and gas. When prices are low, oil and gas producers curtail exploration activities and lay off geologists. When prices were higher, companies had the funds and incentive to renew exploration efforts and to hire geoscientists in larger numbers. In recent years, however, a growing worldwide demand for oil and gas and for new exploration and recovery techniques—particularly in deep water and previously inaccessible sites in Alaska and the Gulf of Mexico—has created some stability to the petroleum industry. Geoscientists who speak a foreign language and who are willing to work abroad should enjoy the best opportunities, as the need for energy, construction materials, and a broad range of geoscience expertise grows in developing nations.

Job prospects. Graduates with a master's degree should have excellent opportunities, especially in the management, scientific and technical consulting industry and in the engineering services industries. In addition to demand resulting from job growth, replacing those who leave the occupation for retirement, managerial positions, or other careers will generate a number of jobs. With relatively few students earning master's degrees in the geosciences, job openings may exceed the number of qualified job seekers over the 2006-16 projection decade. However, geoscientists with doctoral degrees, who primarily work as college and university faculty or do basic research, may face competition. There are few openings for new graduates with only a bachelor's degree in geoscience, but these graduates may have favorable opportunities in related occupations, such as high school science teacher or science technician.

There will be fewer opportunities for geoscientists in Federal and State government, mostly because of budget constraints at key agencies, such as the USGS, and the trend among governments toward contracting out to consulting firms instead of hiring new government employees. However, departures of geoscientists who retire or leave the government for other reasons will result in some job openings over the next decade.

Geoscientists may face layoffs during periods of economic recession. Especially vulnerable are those in consulting and, to a lesser extent, workers in Government. Employment for those working in the production of oil and gas, however, will largely be dictated by the cyclical nature of the energy sector and changes in government policy, although less so than in the past.

Earnings

Median annual earnings of geoscientists were $72,660 in May 2006. The middle 50 percent earned between $51,860 and $100,650; the lowest 10 percent earned less than $39,740, the highest 10 percent more than $135,950.

The petroleum, mineral, and mining industries offer higher salaries, but less job security, than other industries because economic downturns sometimes cause layoffs.

According to the National Association of Colleges and Employers, beginning salary offers in July 2007 for graduates with bachelor's degrees in geology and related sciences averaged $40,786 a year.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Geoscientists, except hydrologists and geographers	19-2042	31,000	38,000	6,800	22

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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In 2007, the Federal Government's average salary was $87,392 for geologists, $100,585 for geophysicists, and 93,461 for oceanographers.

Related Occupations

Many geoscientists work in the petroleum and natural gas industry, an industry that also employs numerous other workers whose jobs deal with the scientific and technical aspects of the exploration and extraction of petroleum and natural gas. Among these other workers are engineering technicians; science technicians; petroleum engineers; and surveyors, cartographers, photogrammetrists, and surveying technicians. Also, some physicists and astronomers, chemists and materials scientists, atmospheric scientists, biological scientists, and environmental scientists and hydrologists perform related work both in the exploration and extraction of petroleum and natural gas and in activities having to do with the environment.

Sources of Additional Information

Information on training and career opportunities for geologists is available from either of the following organizations:

➤ American Association of Petroleum Geologists, P.O. Box 979, Tulsa, OK 74101. Internet: **http://www.aapg.org**

➤ American Geological Institute, 4220 King St., Alexandria, VA 22302-1502. Internet: **http://www.agiweb.org**

Information on obtaining a position as a geologist, geophysicist, or oceanographer with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result.

Physicists and Astronomers

(O*NET 19-2011.00, 19-2012.00)

Significant Points

- Scientific research and development services firms and the Federal Government employ over half of all physicists and astronomers.
- Most jobs are in basic research, usually requiring a doctoral degree; master's degree holders qualify for some jobs in applied research and development; bachelor's degree holders often qualify as research assistants or for other physics-related occupations, such as technicians.
- Applicants may face competition for basic research positions due to limited funding; however, those with a background in physics or astronomy may have good opportunities in related occupations.

Nature of the Work

Physicists and astronomers conduct research to understand the nature of the universe and everything in it. These researchers observe, measure, interpret, and develop theories to explain celestial and physical phenomena using mathematics. From the vastness of space to the infinitesimal scale of subatomic particles, they study the fundamental properties of the natural world and apply the knowledge gained to design new technologies.

Physicists explore and identify basic principles and laws governing the motion, energy, structure, and interactions of matter. Some physicists study theoretical areas, such as the nature of time and the origin of the universe; others apply their knowledge of physics to practical areas, such as the development of advanced materials, electronic and optical devices, and medical equipment.

Physicists design and perform experiments with lasers, particle accelerators, electron microscopes, mass spectrometers, and other equipment. On the basis of their observations and analysis, they attempt to discover and explain laws describing the forces of nature, such as gravity, electromagnetism, and nuclear interactions. Experiments also help physicists find ways to apply physical laws and theories to problems in nuclear energy, electronics, optics, materials, communications, aerospace technology, and medical instrumentation.

Astronomers use the principles of physics and mathematics to learn about the fundamental nature of the universe, including the sun, moon, planets, stars, and galaxies. As such, astronomy is sometimes considered a subfield of physics. They also apply their knowledge to solve problems in navigation, space flight, and satellite communications and to develop the instrumentation and techniques used to observe and collect astronomical data.

Most physicists work in research and development. Some do basic research to increase scientific knowledge. Others conduct applied research to build upon the discoveries made through basic research and work to develop new devices, products, and processes. For example, basic research in solid-state physics led to the development of transistors and, then, integrated circuits used in computers.

Physicists also design research equipment, which often has additional unanticipated uses. For example, lasers are used in surgery, microwave devices function in ovens, and measuring instruments can analyze blood or the chemical content of foods.

A small number of physicists work in inspection, testing, quality control, and other production-related jobs in industry.

Much physics research is done in small or medium-sized laboratories. However, experiments in plasma, nuclear, and high-energy physics, as well as in some other areas of physics, require extremely large, expensive equipment, such as particle accelerators. Physicists in these subfields often work in large teams. Although physics research may require extensive experimentation in laboratories, research physicists still spend much time in offices planning, recording, analyzing, and reporting on research.

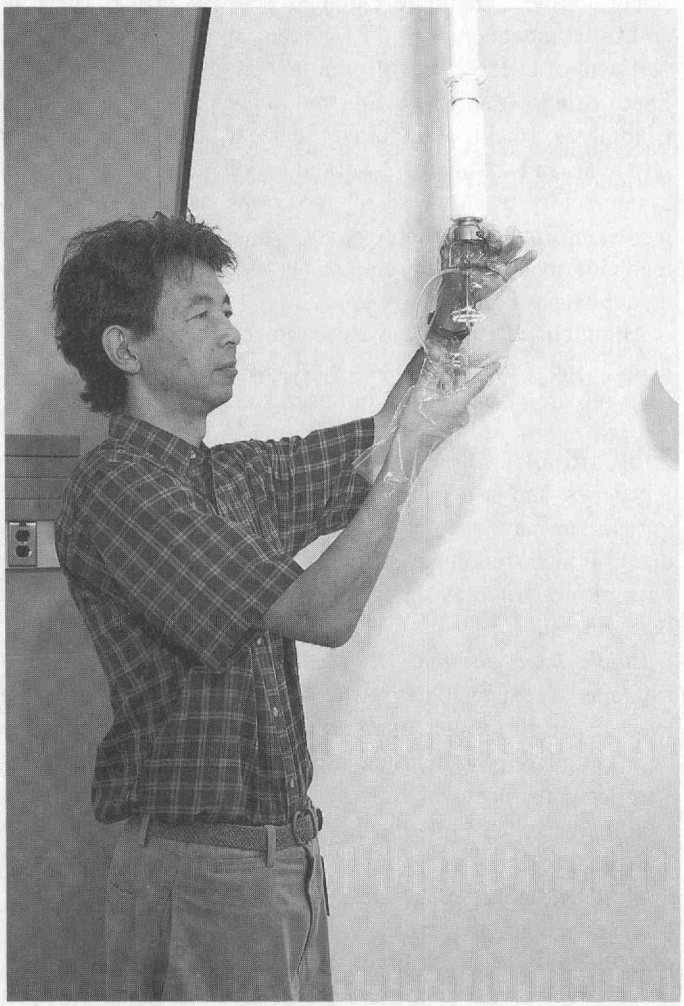
Physicists generally specialize in one of many subfields: elementary particle physics, nuclear physics, atomic and mo-

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lecular physics, condensed matter physics (solid-state physics), optics, acoustics, space physics, plasma physics, or the physics of fluids. Some specialize in a subdivision of one of these subfields. For example, within condensed-matter physics, specialties include superconductivity, crystallography, and semiconductors. However, all physics involves the same fundamental principles, so specialties may overlap, and physicists may switch from one subfield to another. Also, growing numbers of physicists work in interdisciplinary fields, such as biophysics, chemical physics, and geophysics.

Almost all astronomers do research. Some are theoreticians, working on the laws governing the structure and evolution of astronomical objects. Others analyze large quantities of data gathered by observatories and satellites and write scientific papers or reports on their findings. Some astronomers actually operate large space-based or ground-based telescopes, usually as part of a team. However, astronomers may spend only a few weeks each year making observations with optical telescopes, radio telescopes, and other instruments.

For many years, satellites and other space-based instruments, such as the Hubble space telescope, have provided prodigious amounts of astronomical data. New technology has lead to improvements in analytical techniques and instruments, such as computers and optical telescopes and mounts, and is creating a resurgence in ground-based research.



Most jobs for physicists and astronomers are in research and usually require a doctoral degree.

A small number of astronomers work in museums housing planetariums. These astronomers develop and revise programs presented to the public and may direct planetarium operations.

Work environment. Most physicists and astronomers do not encounter unusual hazards in their work. Some physicists temporarily work away from home at national or international facilities with unique equipment, such as particle accelerators. Astronomers who make observations with ground-based telescopes may spend many hours working in observatories; this work usually involves travel to remote locations and may require working at night. Physicists and astronomers whose work depends on grant money often are under pressure to write grant proposals to keep their work funded.

Physicists often work regular hours in laboratories and offices. At times, however, those who are deeply involved in research may work long or irregular hours. Astronomers may need to work at odd hours to observe celestial phenomena, particularly those working with ground-based telescopes.

Training, Other Qualifications, and Advancement

Because most jobs are in basic research and development, a doctoral degree is the usual educational requirement for physicists and astronomers. Master's degree holders qualify for some jobs in applied research and development, whereas bachelor's degree holders often qualify as research assistants or for other occupations related to physics.

Education and training. A Ph.D. degree in physics or closely related fiends is typically required for basic research positions, independent research in industry, faculty positions, and advancement to managerial positions. This prepares students for a career in research through rigorous training in theory, methodology, and mathematics. Most physicists specialize in a subfield during graduate school and continue working in that area afterwards.

Additional experience and training in a postdoctoral research appointment, although not required, is important for physicists and astronomers aspiring to permanent positions in basic research in universities and government laboratories. Many physics and astronomy Ph.D. holders ultimately teach at the college or university level.

Master's degree holders usually do not qualify for basic research positions, but may qualify for many kinds of jobs requiring a physics background, including positions in manufacturing and applied research and development. Increasingly, many master's degree programs are specifically preparing students for physics-related research and development that does not require a Ph.D. degree. These programs teach students specific research skills that can be used in private-industry jobs. In addition, a master's degree coupled with State certification usually qualifies one for teaching jobs in high schools or at 2-year colleges.

Those with bachelor's degrees in physics are rarely qualified to fill positions in research or in teaching at the college level. They are, however, usually qualified to work as technicians or research assistants in engineering-related areas, in software de-

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velopment and other scientific fields, or in setting up computer networks and sophisticated laboratory equipment. Increasingly, some may qualify for applied research jobs in private industry or take on nontraditional physics roles, often in computer science, such as systems analysts or database administrators. Some become science teachers in secondary schools.

Holders of a bachelor's or master's degree in astronomy often enter an unrelated field. However, they are also qualified to work in planetariums running science shows, to assist astronomers doing research, and to operate space-based and ground-based telescopes and other astronomical instrumentation. (See the statements on engineers, geoscientists, computer programmers, computer scientists and database administrators, computer software engineers, and computer systems analysts elsewhere in the *Handbook*.)

About 760 colleges and universities offer a bachelor's degree in physics. Undergraduate programs provide a broad background in the natural sciences and mathematics. Typical physics courses include electromagnetism, optics, thermodynamics, atomic physics, and quantum mechanics.

Approximately 185 colleges and universities have departments offering Ph.D. degrees in physics; about 70 additional colleges offer a master's as their highest degree in physics. Graduate students usually concentrate in a subfield of physics, such as elementary particles or condensed matter. Many begin studying for their doctorate immediately after receiving their bachelor's degree.

About 80 universities grant degrees in astronomy, either through an astronomy, physics, or combined physics-astronomy department. Currently, about 40 astronomy departments are combined with physics departments, and the same number are administered separately. With about 40 doctoral programs in astronomy, applicants face considerable competition for available slots. Those planning a career in the subject should have a strong physics background. In fact, an undergraduate degree in either physics or astronomy is excellent preparation, followed by a Ph.D. in astronomy.

Many physics and astronomy Ph.D. holders begin their careers in a postdoctoral research position, in which they may work with experienced physicists as they continue to learn about their specialties or develop a broader understanding of related areas of research. Initial work may be under the close supervision of senior scientists. As they gain experience, physicists perform increasingly complex tasks and achieve greater independence in their work. Experience, either in academic laboratories or through internships, fellowships, or work-study programs in industry, also is useful. Some employers of research physicists, particularly in the information technology industry, prefer to hire individuals with several years of postdoctoral experience.

Other qualifications. Mathematical ability, problem-solving and analytical skills, an inquisitive mind, imagination, and initiative are important traits for anyone planning a career in physics or astronomy. Prospective physicists who hope to work in industrial laboratories applying physics knowledge to practical problems should broaden their educational background to include courses outside of physics, such as economics, information technology, and business management. Good oral and written communication skills also are important because many physicists work as part of a team, write research papers or proposals, or have contact with clients or customers with nonphysics backgrounds.

Advancement. Advancement among physicists and astronomers usually takes the form of greater independence in their work, larger budgets, or tenure in university positions. Others choose to move into managerial positions and become natural science managers (listed elsewhere in the *Handbook*). Those who pursue management careers spend more time preparing budgets and schedules. Those who develop new products or processes sometimes form their own companies or join new firms to develop these ideas.

Employment

Physicists and astronomers held about 18,000 jobs in 2006. Physicists accounted for about 17,000 of these, while astronomers accounted for only about 1,700 jobs. Many physicists and astronomers held faculty positions in colleges and universities. Those classified as postsecondary teachers are not included in these employment numbers. (See the statement on teachers—postsecondary elsewhere in the *Handbook*.)

About 38 percent of physicists and astronomers worked for scientific research and development services firms. The Federal Government employed 21 percent, mostly in the U.S. Department of Defense, but also in the National Aeronautics and Space Administration (NASA) and in the U.S. Departments of Commerce, Health and Human Services, and Energy. Other physicists and astronomers worked in colleges and universities in nonfaculty, usually research, positions, or for State governments, information technology companies, pharmaceutical and medicine manufacturing companies, or electronic equipment manufacturers.

Although physicists and astronomers are employed in all parts of the country, most work in areas in which universities, large research laboratories, or observatories are located.

Job Outlook

Physicists and astronomers should experience average job growth but may face competition for basic research positions due to limited funding. However, those with a background in physics or astronomy may have good opportunities in related occupations.

Employment change. Employment of physicists and astronomers is expected to grow at 7 percent, about as fast as the average for all occupations during the 2006-16 decade. The need to replace physicists and astronomers who retire or otherwise leave the occupation permanently will account for many additional expected job openings.

Federal research expenditures are the major source of physics- and astronomy-related research funds, especially for basic research. Although these expenditures are expected to increase over the 2006-16 projection period, resulting in some growth in employment and opportunities, the limited science research funds available still will result in competition for basic research jobs among Ph.D. holders. However, research relating

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to biotechnology and nanotechnology should continue to see strong growth.

Although research and development expenditures in private industry will continue to grow, many research laboratories in private industry are expected to continue to reduce basic research, which includes much physics research, in favor of applied or manufacturing research and product and software development. Nevertheless, people with a physics background continue to be in demand in information technology, semiconductor technology, and other applied sciences. This trend is expected to continue; however, many of the new workers will have job titles such as computer software engineer, computer programmer, or systems analyst or developer, rather than physicist.

Job prospects. In recent years the number of doctorates granted in physics has been somewhat greater than the number of job openings for traditional physics research positions in colleges and universities and in research centers. Recent increases in undergraduate physics enrollments may also lead to growth in enrollments in graduate physics programs, so that there may be an increase in the number of doctoral degrees granted that could intensify the competition for basic research positions. However, demand has grown in other related occupations for those with advanced training in physics. Prospects should be favorable for physicists in applied research, development, and related technical fields.

Opportunities should also be numerous for those with a master's degree, particularly graduates from programs preparing students for related work in applied research and development, product design, and manufacturing positions in private industry. Many of these positions, however, will have titles other than physicist, such as engineer or computer scientist.

People with only a bachelor's degree in physics or astronomy are usually not qualified for physics or astronomy research jobs, but they may qualify for a wide range of positions related to engineering, mathematics, computer science, environmental science, and some nonscience fields, such as finance. Those who meet State certification requirements can become high school physics teachers, an occupation in strong demand in many school districts. Some States require new teachers to obtain a master's degree in education within a certain time. (See the statement on teachers—preschool, kindergarten, elementary, middle, and secondary elsewhere in the *Handbook*.) Despite competition for traditional physics and astronomy research jobs, graduates with a physics or astronomy degree at any level will find their knowledge of science and mathematics useful for entry into many other occupations.

Despite their small numbers, astronomers can expect good job prospects in government and academia over the projection period. Since astronomers are particularly dependent upon government funding, Federal budgetary decisions will have a sizable influence on job prospects for astronomers.

Earnings

Median annual earnings of physicists were 94,240 in May 2006. The middle 50 percent earned between $72,910 and $117,080. The lowest 10 percent earned less than $52,070, and the highest 10 percent earned 143,570.

Median annual earnings of astronomers were $95,740 in 2006. The middle 50 percent earned between $62,050 and $125,420, the lowest 10 percent less than $44,590, and the highest 10 percent more than $145,600.

According to a 2007 National Association of Colleges and Employers survey, the average annual starting salary offer to physics doctoral degree candidates was $52,469.

The American Institute of Physics reported a median annual salary of $80,000 in 2006 for its members with Ph.D.'s (excluding those in postdoctoral positions) who were employed by a university on a 9-10 month salary; the median was $112,700 for those who held a Ph.D. and worked at a federally funded research and development center; and $110,000 for self-employed physicists who hold a Ph.D. Those working in temporary postdoctoral positions earned significantly less.

The average annual salary for physicists employed by the Federal Government was $111,769 in 2007; for astronomy and space scientists, it was $117,570.

Related Occupations

The work of physicists and astronomers relates closely to that of engineers, chemists and materials scientists, atmospheric scientists, environmental scientists and hydrologists, geoscientists, computer systems analysts, computer scientists and database administrators, computer programmers, mathematicians, and engineering and natural sciences managers.

Sources of Additional Information

Further information on career opportunities in physics is available from the following organizations:

➤ American Institute of Physics, Career Services Division and Education and Employment Division, One Physics EllipSE., College Park, MD 20740-3843. Internet: **http://www.aip.org**

➤ American Physical Society, One Physics EllipSE., College Park, MD 20740-3844. Internet: **http://www.aps.org**

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Astronomers and physicists	19-2010	18,000	19,000	1,200	7
Astronomers	19-2011	1,700	1,700	100	6
Physicists	19-2012	17,000	18,000	1,100	7

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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Social Scientists and Related Occupations

Economists

(O*NET 19-3011.00)

Significant Points

- Slower than average job growth is expected as firms increasingly employ workers with titles that reflect specialized duties rather than the general title of economist.
- Job seekers with a background in economics should have opportunities in various occupations.
- Candidates who hold a master's or Ph.D. degree in economics will have the best employment prospects and advancement opportunities.
- Quantitative skills are important in all economics specialties.

Nature of the Work

Economists study how society distributes resources, such as land, labor, raw materials, and machinery, to produce goods and services. They may conduct research, collect and analyze data, monitor economic trends, or develop forecasts. Economists research a wide variety of issues including energy costs, inflation, interest rates, exchange rates, business cycles, taxes, and employment levels, among others.

Economists develop methods for obtaining the data they need. For example, sampling techniques may be used to conduct a survey and various mathematical modeling techniques may be used to develop forecasts. Preparing reports, including tables and charts, on research results also is an important part of an economist's job. Presenting economic and statistical concepts in a clear and meaningful way is particularly important for economists whose research is intended for managers and others who do not have a background in economics. Some economists also perform economic analysis for the media.

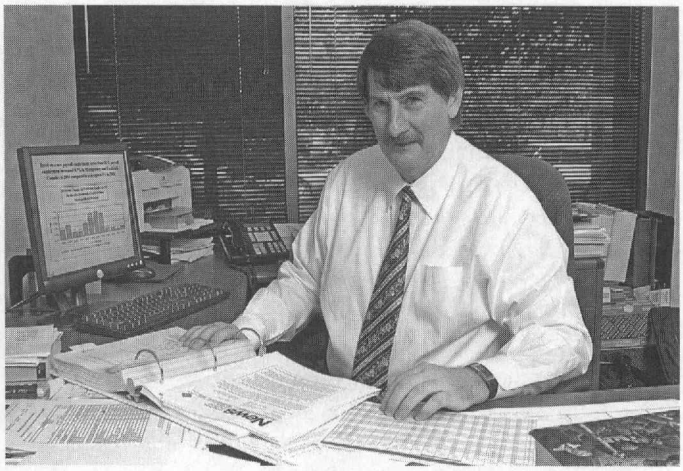
Many economists specialize in a particular area of economics, although general knowledge of basic economic principles is essential. *Microeconomists* study the supply and demand decisions of individuals and firms, such as how profits can be maximized and the quantity of a good or service that consumers will demand at a certain price. *Industrial economists* or *organizational economists* study the market structure of particular industries in terms of the number of competitors within those industries and examine the market decisions of competitive firms and monopolies. These economists also may be concerned with antitrust policy and its impact on market structure. *Macroeconomists* study historical trends in the whole economy and forecast future trends in areas such as unemployment, inflation, economic growth, productivity, and investment. Doing similar work as macroeconomists are *monetary economists* or *financial economists*, who study the money and banking system and the effects of changing interest rates. *International economists* study international financial markets, exchange rates, and the effects of various trade policies such as tariffs. *Labor economists* or *demographic economists* study the supply and demand for labor and the determination of wages. These economists also try to explain the reasons for unemployment and the effects of changing demographic trends, such as an aging population and increasing immigration, on labor markets. *Public finance economists* are involved primarily in studying the role of the government in the economy and the effects of tax cuts, budget deficits, and welfare policies. *Econometricians* investigate all areas of economics and apply mathematical techniques such as calculus, game theory, and regression analysis to their research. With these techniques, they formulate economic models that help explain economic relationships and that can be used to develop forecasts about business cycles, the effects of a specific rate of inflation on the economy, the effects of tax legislation on unemployment levels, and other economic phenomena.

Many economists apply these areas of economics to health, education, agriculture, urban and regional economics, law, history, energy, the environment, or other issues. Most economists are concerned with practical applications of economic policy. Economists working for corporations are involved primarily in microeconomic issues, such as forecasting consumer demand and sales of the firm's products. Some analyze their competitors' growth and market share and advise their company on how to handle the competition. Others monitor legislation passed by Congress, such as environmental and worker safety regulations, and assess how the new laws will affect the corporation. Corporations with many international branches or subsidiaries might employ economists to monitor the economic situations in countries where they do business or to provide a risk assessment of a country into which the company is considering expanding.

Economists working in economic consulting or research firms sometimes perform the same tasks as economists working for corporations. However, economists in consulting firms also perform much of the macroeconomic analysis and forecasting conducted in the United States. These economists collect data on various economic indicators, maintain databases, analyze historical trends, and develop models to forecast growth, inflation, unemployment, or interest rates. Their analyses and forecasts are frequently published in newspapers and journal articles.

Another large employer of economists is the government. Economists in the Federal Government administer most of the surveys and collect the majority of the economic data about the United States. For example, economists in the U.S. Department of Commerce collect and analyze data on the production, distribution, and consumption of commodities produced in the United States and overseas, and economists employed by the U.S. Department of Labor collect and analyze data on the domestic economy, including data on prices, wages, employment, productivity, and safety and health.

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Economists spend much of their time conducting research and writing reports.

Economists who work for government agencies also assess economic conditions in the United States or abroad to estimate the effects of specific changes in legislation or public policy. Government economists advise policy makers in areas such as the deregulation of industries, the effects of changes to Social Security, the effects of tax cuts on the budget deficit, and the effectiveness of imposing tariffs on imported goods. An economist working in State or local government might analyze data on the growth of school-age or prison populations and on employment and unemployment rates in order to project future spending needs.

Work environment. Economists have structured work schedules. They often work alone, writing reports, preparing statistical charts, and using computers, but they also may be an integral part of a research team. Most work under pressure of deadlines and tight schedules, which may require overtime. Their routine may be interrupted by special requests for data and by the need to attend meetings or conferences. Frequent travel may be necessary.

Training, Other Qualifications, and Advancement

Some entry-level positions for economists are available to those with a bachelor's degree, but higher degrees are required for many positions. Prospective economists need good quantitative skills.

Education and training. A master's or Ph.D. degree in economics is required for many private sector economist jobs and for advancement to more responsible positions. In the Federal Government, candidates for entry-level economist positions must have a bachelor's degree with a minimum of 21 semester hours of economics and 3 hours of statistics, accounting, or calculus.

Economics includes numerous specialties at the graduate level, such as econometrics, international economics, and labor economics. Students should select graduate schools that are strong in the specialties that interest them. Some schools help graduate students find internships or part-time employment in government agencies, economic consulting or research firms, or financial institutions before graduation.

Undergraduate economics majors can choose from a variety of courses, ranging from microeconomics, macroeconomics, and econometrics to more philosophical courses, such as the history of economic thought. Because of the importance of quantitative skills to economists, courses in mathematics, statistics, econometrics, sampling theory and survey design, and computer science are extremely helpful.

Whether working in government, industry, research organizations, or consulting firms, economists with a bachelor's degree usually qualify for entry-level positions as a research assistant, for administrative or management trainee positions, or for various sales jobs. A master's degree usually is required to qualify for more responsible research and administrative positions. A Ph.D. is necessary for top economist positions in many organizations. Also, many corporation and government executives have a strong background in economics.

Aspiring economists should gain experience gathering and analyzing data, conducting interviews or surveys, and writing reports on their findings while in college. This experience can prove invaluable later in obtaining a full-time position in the field because much of the economist's work, especially in the beginning, may center on these duties. With experience, economists eventually are assigned their own research projects. Related job experience, such as work as a stock or bond trader, might be advantageous.

Other qualifications. Those considering careers as economists should be able to pay attention to details because much time is spent on precise data analysis. Candidates also should have strong computer and quantitative skills and be able to perform complex research. Patience and persistence are necessary qualities, given that economists must spend long hours on independent study and problem solving. Good communication skills also are useful, as economists must be able to present their findings, both orally and in writing, in a clear, concise manner.

Advancement. With experience or an advanced degree, economists may advance into positions of greater responsibility, including administration and independent research.

Many people with an economics background become teachers. (See the statement on teachers—postsecondary elsewhere in the *Handbook*.) A master's degree usually is the minimum requirement for a job as an instructor in a junior or community college. In most colleges and universities, however, a Ph.D. is necessary for appointment as an instructor. A Ph.D. and extensive publications in academic journals are required for a professorship, tenure, and promotion.

Employment

Economists held about 15,000 jobs in 2006. Government employed 52 percent of economists, in a wide range of agencies, with 32 percent in Federal Government and 20 percent in State and local government. The remaining jobs were spread throughout private industry, particularly in scientific research and development services and management, scientific, and technical consulting services. A number of economists combine a full-time job in government, academia, or business with part-time or consulting work in another setting.

Employment of economists is concentrated in large cities. Some work abroad for companies with major international operations, for U.S. Government agencies, and for international

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organizations, such as the World Bank, International Monetary Fund, and United Nations.

In addition to the previously mentioned jobs, economists hold faculty positions in colleges and universities. Economics faculties have flexible work schedules and may divide their time among teaching, research, consulting, and administration. These workers are counted as postsecondary teachers, not economists.

Job Outlook

Employment of economists is expected to grow about as fast as the average for all occupations. The demand for workers who have knowledge and skill in economics is projected to grow faster, but these workers are often in occupations other than economist. Job prospects will be best for those with graduate degrees in economics.

Employment change. Employment of economists is expected to grow seven percent from 2006 to 2016, about as fast as the average for all occupations. Demand for economic analysis should grow, but the increase in the number of economist jobs will be tempered as firms hire workers for more specialized jobs with specialized titles. Many workers with economic backgrounds will work in related occupations with more specific job titles, such as financial analyst, market analyst, public policy consultant, researcher or research assistant, and purchasing manager. Overall employment growth also will be slowed because of the relatively high number of economists employed in slow growing or declining government sectors. Employment in Federal government agencies is expected to decrease, and employment in State and local government is expected to grow more slowly than employment in the private sector.

Employment growth should be fastest in private industry, especially in management, scientific, and technical consulting services. Rising demand for economic analysis in virtually every industry should stem from the growing complexity of the global economy, the effects of competition on businesses, and increased reliance on quantitative methods for analyzing and forecasting business, sales, and other economic trends. Some corporations choose to hire economic consultants to fill these needs, rather than keeping an economist on staff. This practice should result in more economists being employed in consulting services.

Job prospects. In addition to job openings from growth, the need to replace experienced workers who transfer to other occupations or who retire or leave the labor force for other reasons will create openings for economists.

Individuals with a background in economics should have opportunities in various occupations. As indicated earlier, some examples of job titles often held by those with an economics background are financial analyst, market analyst, public policy consultant, researcher or research assistant, and purchasing manager.

People who have a master's or Ph.D. degree in economics, who are skilled in quantitative techniques and their application to economic modeling and forecasting, and who also have good communications skills, should have the best job opportunities. Like those in many other disciplines, some economists leave the occupation to become professors, but competition for tenured teaching positions is expected to be keen.

Bachelor's degree holders may face competition for the limited number of economist positions for which they qualify. However, they will qualify for a number of other positions that can use their economic knowledge. Many graduates with bachelor's degrees will find jobs in industry and business as management or sales trainees. Bachelor's degree holders with good quantitative skills and a strong background in mathematics, statistics, survey design, and computer science also may be hired as researchers. Some will find jobs in government.

Candidates who meet State certification requirements may become high school economics teachers. The demand for secondary school economics teachers is expected to grow, as economics becomes an increasingly important and popular course. (See the statement on teachers—preschool, kindergarten, elementary, middle, and secondary elsewhere in the *Handbook*.)

Earnings

Median annual wage and salary earnings of economists were $77,010 in May 2006. The middle 50 percent earned between $55,740 and $103,500. The lowest 10 percent earned less than $42,280, and the highest 10 percent earned more than $136,550.

In the Federal Government, the starting salary for economists having a bachelor's degree was $35,752 in 2007. Those having a master's degree could qualify for positions with an annual salary of $43,731. Those with a Ph.D. could begin at $52,912, and some individuals with experience and an advanced degree could start at $63,417. Starting salaries were higher in selected geographical areas where the prevailing local pay was higher. The average annual salary for economists employed by the Federal Government was $94,098 a year in 2007.

Related Occupations

Economists are concerned with understanding and interpreting financial matters, among other subjects. Other occupations in this area include accountants and auditors; actuaries; budget analysts; cost estimators; financial analysts and personal financial advisors; financial managers; insurance underwriters; loan officers; and purchasing managers, buyers, and purchasing agents. Economists also rely heavily on quantitative analysis, as do mathematicians, statisticians, and operations research analysts. Other occupations involved in market research and

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Economists	19-3011	15,000	16,000	1,100	7

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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data collection are management analysts and market and survey researchers. Economists also study consumer behavior, similar to the work of sociologists.

Sources of Additional Information

For information on careers in business economics, contact:

➤ National Association for Business Economics, 1233 20th St.NW., Suite 505, Washington, DC 20036.

Information on obtaining positions as economists with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result. For advice on how to find and apply for Federal jobs, see the Occupational Outlook Quarterly article "How to get a job in the Federal Government," online at: **http://www.bls.gov/opub/ooq/2004/summer/art01.pdf**

Market and Survey Researchers

(O*NET 19-3021.00, 19-3022.00)

Significant Points

- Market and survey researchers need at least a bachelor's degree.
- Continuing education and keeping current with the latest methods of developing, conducting, and analyzing surveys and other data is important for advancement.
- Employment is expected to grow faster than average.
- Job opportunities should be best for those with a master's or Ph.D. degree in marketing or a related field and with strong quantitative skills.

Nature of the Work

Market and survey researchers gather information about what people think. *Market*, or *marketing*, *research analysts* help companies understand what types of products people want and at what price. They also help companies market their products to the people most likely to buy them. Gathering statistical data on competitors and examining prices, sales, and methods of marketing and distribution, they analyze data on past sales to predict future sales.

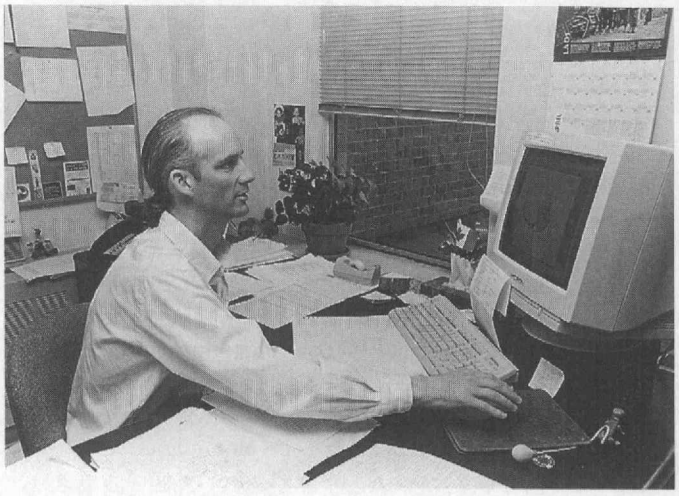
Market research analysts devise methods and procedures for obtaining the data they need. Often, they design surveys to assess consumer preferences through Internet, telephone, or mail responses. They conduct some surveys as personal interviews, going door-to-door, leading focus group discussions, or setting up booths in public places such as shopping malls. Trained interviewers usually conduct the surveys under the market research analyst's direction.

After compiling and evaluating the data, market research analysts make recommendations to their client or employer. They provide a company's management with information needed to make decisions on the promotion, distribution, design, and pricing of products or services. The information also may be used to determine the advisability of adding new lines of merchandise, opening branches of the company in a new location, or otherwise diversifying the company's operations. Market research analysts also might develop advertising brochures and commercials, sales plans, and product promotions such as rebates and giveaways.

Survey researchers also gather information about people and their opinions, but these workers focus exclusively on designing and conducting surveys. They work for a variety of clients, such as corporations, government agencies, political candidates, and providers of various services. The surveys collect information that is used in performing research, making fiscal or policy decisions, measuring the effectiveness of those decisions, or improving customer satisfaction. Analysts may conduct opinion research to determine public attitudes on various issues; the research results may help political or business leaders to measure public support for their electoral prospects or social policies. Like market research analysts, survey researchers may use a variety of mediums to conduct surveys, such as the Internet, personal or telephone interviews, or questionnaires sent through the mail. They also may supervise interviewers who conduct surveys in person or over the telephone.

Survey researchers design surveys in many different formats, depending upon the scope of their research and the method of collection. Interview surveys, for example, are common because they can increase participation rates. Survey researchers may consult with economists, statisticians, market research analysts, or other data users in order to design surveys. They also may present survey results to clients.

Work environment. Market and survey researchers generally have structured work schedules. They often work alone, writing reports, preparing statistical charts, and using computers, but they also may be an integral part of a research team. Market researchers who conduct personal interviews have frequent contact with the public. Most work under pressure of deadlines



Market and survey researchers conduct research and design surveys.

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and tight schedules, which may require overtime. Travel may be necessary.

Training, Other Qualifications, and Advancement

A bachelor's degree is usually sufficient for entry-level market and survey research positions. Higher degrees may be required for some positions, however. Continuing education and keeping current with the latest methods of developing, conducting, and analyzing surveys and other data also is important for advancement.

Education and training. A bachelor's degree is the minimum educational requirement for many market and survey research jobs. However, a master's degree may be required, especially for technical positions.

In addition to completing courses in business, marketing, and consumer behavior, prospective market and survey researchers should take other liberal arts and social science courses, including economics, psychology, English, and sociology. Because of the importance of quantitative skills to market and survey researchers, courses in mathematics, statistics, sampling theory and survey design, and computer science are extremely helpful. Market and survey researchers often earn advanced degrees in business administration, marketing, statistics, communications, or other closely related disciplines.

While in college, aspiring market and survey researchers should gain experience gathering and analyzing data, conducting interviews or surveys, and writing reports on their findings. This experience can prove invaluable later in obtaining a full-time position in the field, because much of the initial work may center on these duties. Some schools help graduate students find internships or part-time employment in government agencies, consulting firms, financial institutions, or marketing research firms prior to graduation.

Other qualifications. Market and survey researchers spend a lot of time performing precise data analysis, so those considering careers in the occupation should be able to pay attention to detail. Patience and persistence are also necessary qualities because these workers must spend long hours on independent study and problem solving. At the same time, they must work well with others; often, market and survey researchers oversee the interviewing of a wide variety of individuals. Communication skills are important, too, because researchers must be able to present their findings well both orally and in writing.

Certification and advancement. The Marketing Research Association (MRA) offers a certification program for professional researchers who wish to demonstrate their expertise. Certification is based on education and experience and requires ongoing continuing education.

Researchers and analysts often begin by assisting others. With experience, market and survey analysts are eventually are assigned their own research projects. Continuing education and advanced degrees will be helpful to those looking to advance to more responsible positions in this occupation. It also is important to keep current with the latest methods of developing, conducting, and analyzing surveys and other data.

Some people with expertise in marketing or survey research choose to teach others these skills. (See the statement on teachers—postsecondary elsewhere in the *Handbook*.) A master's degree usually is the minimum educational requirement for a job as a marketing or survey research instructor in junior and community colleges. In most colleges and universities, however, a Ph.D. is necessary for appointment as an instructor. A Ph.D. and extensive publications in academic journals are required for professorship, tenure, and promotion. Others advance to supervisory or managerial positions. Many corporation and government executives have a strong background in marketing.

Employment

Market and survey researchers held about 261,000 jobs in 2006, most of which—234,000—were held by market research analysts. Because of the applicability of market research to many industries, market research analysts are employed throughout the economy. The industries that employ the largest number of market research analysts were management of companies and enterprises; management, scientific, and technical consulting services; insurance carriers; computer systems design and related services; and other professional, scientific, and technical services—which includes marketing research and public opinion polling.

Survey researchers held about 27,000 jobs in 2006. Survey researchers were employed primarily by firms in other professional, scientific, and technical services—which include market research and public opinion polling; scientific research and development services; and management, scientific, and technical consulting services. Colleges, universities, and professional schools also provided many jobs for survey researchers.

A number of market and survey researchers combine a full-time job in government, academia, or business with part-time consulting work in another setting. About seven percent of market and survey researchers are self-employed.

Besides holding the previously mentioned jobs, many people who do market and survey research work held faculty positions in colleges and universities. These workers are counted as postsecondary teachers rather than market and survey researchers.

Job Outlook

Employment growth of market and survey researchers is projected to be faster than average. Bachelor's degree holders may face competition for employment in these occupations. Job opportunities should be best for jobseekers with a master's or Ph.D. degree in marketing or a related field and with strong quantitative skills.

Employment change. Employment of market and survey researchers is projected to grow 20 percent from 2006 to 2016, faster than the average for all occupations. As companies seek to expand their market and as consumers become better informed, the need for marketing professionals will increase. In addition, globalization of the marketplace creates a need for more market and survey researchers to analyze foreign markets and competition.

Marketing research provides organizations valuable feedback from purchasers, allowing companies to evaluate consumer satisfaction and plan more effectively for the future. Survey researchers also will be needed to meet the growing demand for market and opinion research as an increasingly competitive economy requires businesses to allocate advertising funds more effectively and efficiently.

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Market and survey researchers	19-3020	261,000	313,000	51,000	20
Market research analysts	19-3021	234,000	281,000	47,000	20
Survey researchers	19-3022	27,000	31,000	4,300	16

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

Job prospects. Bachelor's degree holders may face competition for jobs, as many positions, especially the more technical ones, require a master's or doctorate degree. Among bachelor's degree holders, those with good quantitative skills, including a strong background in mathematics, statistics, survey design, and computer science, will have the best opportunities. Job opportunities should be best for jobseekers with a master's or Ph.D. degree in marketing or a related field and with strong quantitative skills. Ph.D. holders in marketing and related fields should have a range of opportunities in many industries, especially in consulting firms. Like those in many other disciplines, however, Ph.D. holders probably will face keen competition for tenured teaching positions in colleges and universities.

Market research analysts should have the best opportunities in consulting firms and marketing research firms as companies find it more profitable to contract for market research services rather than support their own marketing department. However, other organizations, including computer systems design companies, software publishers, financial services organizations, health care institutions, advertising firms, and insurance companies, may also offer job opportunities for market research analysts. Increasingly, market research analysts not only collect and analyze information, but also help clients implement analysts' ideas and recommendations.

There will be fewer job opportunities for survey researchers since it is a relatively smaller occupation. The best prospects will come from growth in the market research and public opinion polling industry, which employs many survey researchers.

Earnings

Median annual earnings of market research analysts in May 2006 were $58,820. The middle 50 percent earned between $42,190 and $84,070. The lowest 10 percent earned less than $32,250, and the highest 10 percent earned more than $112,510. Median annual earnings in the industries employing the largest numbers of market research analysts in May 2006 were:

Computer systems design and related services	$76,220
Management of companies and enterprises	62,680
Other professional, scientific, and technical services	57,520
Management, scientific, and technical consulting services	54,040
Insurance carriers	53,430

Median annual earnings of survey researchers in May 2006 were $33,360. The middle 50 percent earned between $22,150 and $50,960. The lowest 10 percent earned less than $16,720, and the highest 10 percent earned more than $73,630. Median annual earnings of survey researchers in other professional, scientific, and technical services were $27,440.

Related Occupations

Market and survey researchers perform research to find out how well the market will receive products, services, and ideas. Such research may include planning, implementing, and analyzing surveys to determine the needs and preferences of people. Other jobs using these skills include economists, psychologists, sociologists, statisticians, operations research analysts, management analysts, and urban and regional planners. Market and survey researchers often work closely with advertising, marketing, promotions, public relations, and sales managers. When analyzing data, market and survey researchers must use quantitative skills similar to those of mathematicians, cost estimators, and actuaries. Also, market and survey researchers often are concerned with public opinion, as are public relations specialists.

Sources of Additional Information

For information about careers and certification in market research, contact:

➤ Marketing Research Association, 110 National Dr., Glastonbury, CT 06033. Internet: **http://www.mra-net.org**

For information about careers in survey research, contact:

➤ Council of American Survey Research Organizations, 170 North Country Rd., Suite 4, Port Jefferson, NY 11777. Internet: **http://www.casro.org**

Psychologists

(O*NET 19-3031.00, 19-3031.01, 19-3031.02, 19-3031.03, 19-3032.00, 19-3039.99)

Significant Points

- About 34 percent of psychologists are self-employed, compared with only 8 percent of all workers.
- Competition for admission to graduate psychology programs is keen.
- Overall employment of psychologists is expected to grow faster than average.
- Job prospects should be the best for people who have a doctoral degree in an applied specialty, such as counseling or health, and those with a specialist or doctoral degree in school psychology.

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Nature of the Work

Psychologists study the human mind and human behavior. Research psychologists investigate the physical, cognitive, emotional, or social aspects of human behavior. Psychologists in health service fields provide mental health care in hospitals, clinics, schools, or private settings. Psychologists employed in applied settings, such as business, industry, government, or nonprofit organizations, provide training, conduct research, design organizational systems, and act as advocates for psychology.

Like other social scientists, psychologists formulate hypotheses and collect data to test their validity. Research methods vary with the topic under study. Psychologists sometimes gather information through controlled laboratory experiments or by administering personality, performance, aptitude, or intelligence tests. Other methods include observation, interviews, questionnaires, clinical studies, and surveys.

Psychologists apply their knowledge to a wide range of endeavors, including health and human services, management, education, law, and sports. They usually specialize in one of a number of different areas.

Clinical psychologists—who constitute the largest specialty—work most often in counseling centers, independent or group practices, hospitals, or clinics. They help mentally and emotionally distressed clients adjust to life and may assist medical and surgical patients in dealing with illnesses or injuries. Some clinical psychologists work in physical rehabilitation settings, treating patients with spinal cord injuries, chronic pain or illness, stroke, arthritis, or neurological conditions. Others help people deal with personal crisis, such as divorce or the death of a loved one.

Clinical psychologists often interview patients and give diagnostic tests. They may provide individual, family, or group psychotherapy and may design and implement behavior modification programs. Some clinical psychologists collaborate with physicians and other specialists to develop and implement treatment and intervention programs that patients can understand and comply with. Other clinical psychologists work in universities and medical schools, where they train graduate students in the delivery of mental health and behavioral medicine services. Some administer community mental health programs.

Areas of specialization within clinical psychology include health psychology, neuropsychology, and geropsychology. *Health psychologists* study how biological, psychological, and social factors affect health and illness. They promote healthy living and disease prevention through counseling, and they focus on how patients adjust to illnesses and treatments and view their quality of life. *Neuropsychologists* study the relation between the brain and behavior. They often work in stroke and head injury programs. *Geropsychologists* deal with the special problems faced by the elderly. The emergence and growth of these specialties reflects the increasing participation of psychologists in direct services to special patient populations.

Often, clinical psychologists consult with other medical personnel regarding the best treatment for patients, especially treatment that includes medication. Clinical psychologists generally are not permitted to prescribe medication to treat patients; only psychiatrists and other medical doctors may prescribe most medications. (See the statement on physicians and surgeons elsewhere in the *Handbook*.) However, two States—Louisiana and New Mexico—currently allow appropriately trained clinical psychologists to prescribe medication with some limitations.

Counseling psychologists use various techniques, including interviewing and testing, to advise people on how to deal with problems of everyday living, including career or work problems and problems faced in different stages of life. They work in settings such as university counseling centers, hospitals, and individual or group practices. (See also the statements on counselors and social workers elsewhere in the *Handbook*.)

School psychologists work with students in early childhood and elementary and secondary schools. They collaborate with teachers, parents, and school personnel to create safe, healthy, and supportive learning environments for all students. School psychologists address students' learning and behavioral problems, suggest improvements to classroom management strategies or parenting techniques, and evaluate students with disabilities and gifted and talented students to help determine the best way to educate them.

They improve teaching, learning, and socialization strategies based on their understanding of the psychology of learning environments. They also may evaluate the effectiveness of academic programs, prevention programs, behavior management procedures, and other services provided in the school setting.

Industrial-organizational psychologists apply psychological principles and research methods to the workplace in the interest of improving productivity and the quality of worklife. They also are involved in research on management and marketing problems. They screen, train, and counsel applicants for jobs, as well as perform organizational development and analysis. An industrial psychologist might work with management to reorganize the work setting in order to improve productivity or quality of life in the workplace. Industrial psychologists frequently act as consultants, brought in by management to solve a particular problem.

Developmental psychologists study the physiological, cognitive, and social development that takes place throughout life. Some specialize in behavior during infancy, childhood, and adolescence, or changes that occur during maturity or old age. Developmental psychologists also may study developmental disabilities and their effects. Increasingly, research is developing ways to help elderly people remain independent as long as possible.

Social psychologists examine people's interactions with others and with the social environment. They work in organizational consultation, marketing research, systems design, or other applied psychology fields. Prominent areas of study include group behavior, leadership, attitudes, and perception.

Experimental or *research psychologists* work in university and private research centers and in business, nonprofit, and governmental organizations. They study the behavior of both human beings and animals, such as rats, monkeys, and pigeons. Prominent areas of study in experimental research include motivation, thought, attention, learning and memory, sensory and perceptual processes, effects of substance abuse, and genetic and neurological factors affecting behavior.

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Psychologists interact with people daily, and need good communication and personal skills.

Work environment. Psychologists' work environments vary by subfield and place of employment. For example, clinical, school, and counseling psychologists in private practice frequently have their own offices and set their own hours. However, they usually offer evening and weekend hours to accommodate their clients. Those employed in hospitals, nursing homes, and other health care facilities may work shifts that include evenings and weekends, and those who work in schools and clinics generally work regular daytime hours. Most psychologists in government and industry have structured schedules.

Psychologists employed as faculty by colleges and universities divide their time between teaching and research and also may have administrative responsibilities; many have part-time consulting practices.

Increasingly, many psychologists work as part of a team, consulting with other psychologists and professionals. Many experience pressures because of deadlines, tight schedules, and overtime. Their routine may be interrupted frequently. Travel may be required in order to attend conferences or conduct research.

Training, Other Qualifications, and Advancement

A master's or doctoral degree, and a license, are required for most psychologists.

Education and training. A doctoral degree usually is required for independent practice as a psychologist. Psychologists with a Ph.D. or Doctor of Psychology (Psy.D.) qualify for a wide range of teaching, research, clinical, and counseling positions in universities, health care services, elementary and secondary schools, private industry, and government. Psychologists with a doctoral degree often work in clinical positions or in private practices, but they also sometimes teach, conduct research, or carry out administrative responsibilities.

A doctoral degree generally requires 5 to 7 years of graduate study, culminating in a dissertation based on original research. Courses in quantitative research methods, which include the use of computer-based analysis, are an integral part of graduate study and are necessary to complete the dissertation. The Psy. D. degree may be based on practical work and examinations rather than a dissertation. In clinical, counseling, and school psychology, the requirements for the doctoral degree include at least a 1-year internship.

A specialist degree or its equivalent is required in most States for an individual to work as a school psychologist, although a few States still credential school psychologists with master's degrees. A specialist (Ed.S.) degree in school psychology requires a minimum of 3 years of full-time graduate study (at least 60 graduate semester hours) and a 1-year full-time internship. Because their professional practice addresses educational and mental health components of students' development, school psychologists' training includes coursework in both education and psychology.

People with a master's degree in psychology may work as industrial-organizational psychologists. They also may work as psychological assistants under the supervision of doctoral-level psychologists and may conduct research or psychological evaluations. A master's degree in psychology requires at least 2 years of full-time graduate study. Requirements usually include practical experience in an applied setting and a master's thesis based on an original research project.

Competition for admission to graduate psychology programs is keen. Some universities require applicants to have an undergraduate major in psychology. Others prefer only coursework in basic psychology with additional courses in the biological, physical, and social sciences and in statistics and mathematics.

A bachelor's degree in psychology qualifies a person to assist psychologists and other professionals in community mental health centers, vocational rehabilitation offices, and correctional programs. Bachelor's degree holders may also work as research or administrative assistants for psychologists. Some work as technicians in related fields, such as marketing research. Many find employment in other areas, such as sales, service, or business management.

In the Federal Government, candidates having at least 24 semester hours in psychology and one course in statistics qualify for entry-level positions. However, competition for these jobs is keen because this is one of the few ways in which one can work as a psychologist without an advanced degree.

The American Psychological Association (APA) presently accredits doctoral training programs in clinical, counseling, and school psychology, as well as institutions that provide internships for doctoral students in school, clinical, and counseling psychology. The National Association of School Psychologists, with the assistance of the National Council for Accreditation of Teacher Education, helps to approve advanced degree programs in school psychology.

Licensure. Psychologists in independent practice or those who offer any type of patient care—including clinical, counseling, and school psychologists—must meet certification or licensing requirements in all States and the District of Columbia. Licensing laws vary by State and by type of position and require licensed or certified psychologists to limit their practice to areas in which they have developed professional competence

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through training and experience. Clinical and counseling psychologists usually need a doctorate in psychology, an approved internship, and 1 to 2 years of professional experience. In addition, all States require that applicants pass an examination. Most State licensing boards administer a standardized test, and many supplement that with additional oral or essay questions. Some States require continuing education for renewal of the license.

The National Association of School Psychologists (NASP) awards the Nationally Certified School Psychologist (NCSP) designation, which recognizes professional competency in school psychology at a national, rather than State, level. Currently, 29 States recognize the NCSP and allow those with the certification to transfer credentials from one State to another without taking a new certification exam. In States that recognize the NCSP, the requirements for certification or licensure and those for the NCSP often are the same or similar. Requirements for the NCSP include the completion of 60 graduate semester hours in school psychology; a 1,200-hour internship, 600 hours of which must be completed in a school setting; and a passing score on the National School Psychology Examination.

Other qualifications. Aspiring psychologists who are interested in direct patient care must be emotionally stable, mature, and able to deal effectively with people. Sensitivity, compassion, good communication skills, and the ability to lead and inspire others are particularly important qualities for people wishing to do clinical work and counseling. Research psychologists should be able to do detailed work both independently and as part of a team. Patience and perseverance are vital qualities, because achieving results in the psychological treatment of patients or in research may take a long time.

Certification and advancement. The American Board of Professional Psychology (ABPP) recognizes professional achievement by awarding specialty certification in 13 different areas. Candidates for ABPP certification need a doctorate in psychology, postdoctoral training in their specialty, several years of experience, professional endorsements, and are required to pass the specialty board examination.

Psychologists can improve their advancement opportunities by earning an advanced degree and by participation in continuing education. Many psychologists opt to start their own practice after gaining experience working in the field.

Employment

Psychologists held about 166,000 jobs in 2006. Educational institutions employed about 29 percent of psychologists in positions other than teaching, such as counseling, testing, research, and administration. About 21 percent were employed in health care, primarily in offices of mental health practitioners, hospitals, physicians' offices, and outpatient mental health and substance abuse centers. Government agencies at the State and local levels employed psychologists in correctional facilities, law enforcement, and other settings.

After several years of experience, some psychologists—usually those with doctoral degrees—enter private practice or set up private research or consulting firms. About 34 percent of psychologists were self-employed in 2006, compared with only 8 percent of all professional workers.

In addition to the previously mentioned jobs, many psychologists held faculty positions at colleges and universities and as high school psychology teachers. (See the statements on teachers—postsecondary and teachers—preschool, kindergarten, elementary, middle, and secondary elsewhere in the *Handbook*.)

Job Outlook

Faster-than-average employment growth is expected for psychologists. Job prospects should be the best for people who have a doctoral degree from a leading university in an applied specialty, such as counseling or health, and those with a specialist or doctoral degree in school psychology. Master's degree holders in fields other than industrial-organizational psychology will face keen competition. Opportunities will be limited for bachelor's degree holders.

Employment change. Employment of psychologists is expected to grow 15 percent from 2006 to 2016, faster than the average for all occupations. Employment will grow because of increased demand for psychological services in schools, hospitals, social service agencies, mental health centers, substance abuse treatment clinics, consulting firms, and private companies.

Employment growth will vary by specialty. Growing awareness of how students' mental health and behavioral problems, such as bullying, affect learning will increase demand for school psychologists to offer student counseling and mental health services.

The rise in health care costs associated with unhealthy lifestyles, such as smoking, alcoholism, and obesity, has made prevention and treatment more critical. An increase in the number of employee assistance programs, which help workers deal with personal problems, also should lead to employment growth for clinical and counseling specialties. Clinical and counseling psychologists also will be needed to help people deal with depression and other mental disorders, marriage and family problems, job stress, and addiction. The growing number of elderly will increase the demand for psychologists trained in geropsychology to help people deal with the mental and physi-

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Psychologists	19-3030	166,000	191,000	25,000	15
Clinical, counseling, and school psychologists	19-3031	152,000	176,000	24,000	16
Industrial-organizational psychologists	19-3032	1,900	2,400	400	21
Psychologists, all other	19-3039	12,000	13,000	900	8

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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cal changes that occur as individuals grow older. There also will be increased need for psychologists to work with returning veterans.

Industrial-organizational psychologists also will be in demand to help to boost worker productivity and retention rates in a wide range of businesses. Industrial-organizational psychologists will help companies deal with issues such as workplace diversity and antidiscrimination policies. Companies also will use psychologists' expertise in survey design, analysis, and research to develop tools for marketing evaluation and statistical analysis.

Job prospects. Job prospects should be the best for people who have a doctoral degree from a leading university in an applied specialty, such as counseling or health, and those with a specialist or doctoral degree in school psychology. Psychologists with extensive training in quantitative research methods and computer science may have a competitive edge over applicants without such background.

Master's degree holders in fields other than industrial-organizational psychology will face keen competition for jobs because of the limited number of positions that require only a master's degree. Master's degree holders may find jobs as psychological assistants or counselors, providing mental health services under the direct supervision of a licensed psychologist. Still others may find jobs involving research and data collection and analysis in universities, government, or private companies.

Opportunities directly related to psychology will be limited for bachelor's degree holders. Some may find jobs as assistants in rehabilitation centers or in other jobs involving data collection and analysis. Those who meet State certification requirements may become high school psychology teachers.

Earnings

Median annual earnings of wage and salary clinical, counseling, and school psychologists in May 2006 were $59,440. The middle 50 percent earned between $45,300 and $77,750. The lowest 10 percent earned less than $35,280, and the highest 10 percent earned more than $102,730. Median annual earnings in the industries employing the largest numbers of clinical, counseling, and school psychologists were:

Offices of mental health practitioners	$69,510
Elementary and secondary schools	61,290
Local government	58,770
Individual and family services	50,780
Outpatient care centers	50,310

Median annual earnings of wage and salary industrial-organizational psychologists in May 2006 were $86,420. The middle 50 percent earned between $66,310 and $115,000. The lowest 10 percent earned less than $48,380, and the highest 10 percent earned more than $139,620.

Related Occupations

Psychologists work with people, developing relationships and comforting them. Other occupations with similar duties include counselors, social workers, clergy, sociologists, special education teachers, funeral directors, market and survey researchers, recreation workers, and human resources, training, and labor relations managers and specialists. Psychologists also sometimes diagnose and treat problems and help patients recover. These duties are similar to those for physicians and surgeons, radiation therapists, audiologists, dentists, optometrists, and speech-language pathologists.

Sources of Additional Information

For information on careers, educational requirements, financial assistance, and licensing in all fields of psychology, contact:

➤ American Psychological Association, Center for Psychology Workforce Analysis and Research and Education Directorate, 750 1st St.NE., Washington, DC 20002.
Internet: **http://www.apa.org/students**

For information on careers, educational requirements, certification, and licensing of school psychologists, contact:

➤ National Association of School Psychologists, 4340 East West Hwy., Suite 402, Bethesda, MD 20814.
Internet: **http://www.nasponline.org**

Information about State licensing requirements is available from:

➤ Association of State and Provincial Psychology Boards, P.O. Box 241245, Montgomery, AL 36124.
Internet: **http://www.asppb.org**

Information about psychology specialty certifications is available from:

➤ American Board of Professional Psychology, Inc., 300 Drayton St., 3rd Floor, Savannah, GA 31401.
Internet: **http://www.abpp.org**

Urban and Regional Planners

(O*NET 19-3051.00)

Significant Points

- Local governments employ about 68 percent of urban and regional planners.
- Most new jobs will be in affluent, rapidly growing communities.
- Job prospects will be best for those with a master's degree and strong computer skills; bachelor's degree holders may find positions, but advancement opportunities are limited.

Nature of the Work

Urban and regional planners develop long- and short-term plans for the use of land and the growth and revitalization of urban, suburban, and rural communities and the region in which they are located. They help local officials alleviate social, economic, and environmental problems by recommending locations for roads, schools, and other infrastructure and suggesting zoning regulations for private property. This work includes forecasting the future needs of the population. Because local governments employ the majority of urban and regional planners, they often are referred to as community or city planners.

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Planners promote the best use of a community's land and resources for residential, commercial, institutional, and recreational purposes. They address environmental, economic, and social health issues of a community as it grows and changes. They may formulate plans relating to the construction of new school buildings, public housing, or other kinds of infrastructure. Planners also may help to make decisions about developing resources and protecting ecologically sensitive regions. Some planners are involved in environmental issues including pollution control, wetland preservation, forest conservation, and the location of new landfills. Planners also may help to draft legislation on environmental, social, and economic issues, such as planning a new park, sheltering the homeless, or making the region more attractive to businesses.

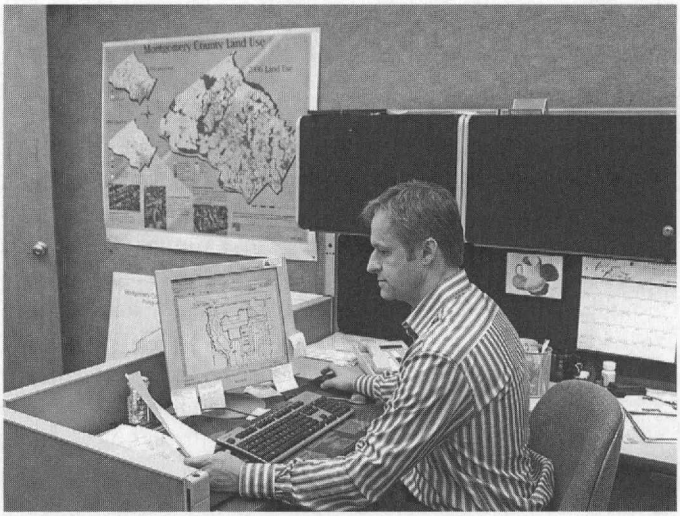
Before preparing plans for community development, planners study and report on the current use of land for residential, business, and community purposes. Their reports include information on the location and capacity of streets, highways, airports, water and sewer lines, schools, libraries, and cultural and recreational sites. They also provide data on the types of industries in the community, the characteristics of the population, and employment and economic trends. Using this information, along with input from citizens, planners try to optimize land use for buildings and other public facilities. Planners prepare reports showing how their programs can be carried out and what they will cost.

Planners examine proposed community facilities, such as schools, to be sure that these facilities will meet the needs of a growing or changing population. They keep abreast of economic and legal issues involved in zoning codes, building codes, and environmental regulations and ensure that builders and developers follow these codes and regulations. Planners also deal with land-use issues created by population movements. For example, as suburban growth and economic development create more jobs outside cities, the need for public transportation that gets workers to those jobs increases. In response, planners develop and model possible transportation systems and explain them to planning boards and the general public.

Planners use computers to record and analyze information and to prepare reports and recommendations for government executives and others. Computer databases, spreadsheets, and analytical techniques are used to project program costs and forecast future trends in employment, housing, transportation, or population. Computerized geographic information systems (GIS) enable planners to map land areas, to overlay maps with geographic variables such as population density, and to combine or manipulate geographic information to produce alternative plans for land use or development.

Urban and regional planners often confer with land developers, civic leaders, and public officials and may function as mediators in community disputes, presenting alternatives that are acceptable to opposing parties. Planners may prepare material for community relations programs, speak at civic meetings, and appear before legislative committees and elected officials to explain and defend their proposals.

Most urban and regional planners focus on one or more areas of specialization. Among the most common are community development and redevelopment and land-use or code enforcement. While planners may specialize in areas such as transportation planning or urban design, they are also required to keep the bigger picture in mind, and do what's best for the community as a whole.



Urban and regional planners develop plans for communities to best use land and other resources.

Work environment. Urban and regional planners often travel to inspect the features of land under consideration for development or regulation. Some local government planners involved in site development inspections spend most of their time in the field. Although most planners have a scheduled 40-hour workweek, they frequently attend evening or weekend meetings or public hearings with citizens' groups. Planners may experience the pressure of deadlines and tight work schedules, as well as political pressure generated by interest groups affected by proposals related to urban development and land use.

Training, Other Qualifications, and Advancement

A master's degree from an accredited planning program provides the best training for a wide range of planning positions. Experience and acquiring and maintaining certification lead to the best opportunities for advancement.

Education and training. Most entry-level jobs in Federal, State, and local governments require a master's degree from an accredited program in urban or regional planning or a related field, such as urban design or geography. Students are admitted to master's degree programs in planning with a wide range of undergraduate backgrounds; a bachelor's degree in economics, geography, political science, or environmental design is especially good preparation. A few schools offer a bachelor's degree in urban planning, and graduates from these programs qualify for some entry-level positions, but their advancement opportunities are often limited unless they acquire an advanced degree.

In 2007, 66 colleges and universities offered an accredited master's degree program, and 15 offered an accredited bachelor's degree program, in planning. Accreditation for these programs is from the Planning Accreditation Board, which consists of representatives of the American Institute of Certified Planners, the American Planning Association, and the Association of Collegiate Schools of Planning. Most graduate programs in planning require at least 2 years of study.

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Most college and university planning departments offer specialization in areas such as community development and redevelopment, land-use or code enforcement, transportation planning, environmental and natural resources planning, urban design, and economic planning and development.

Highly recommended also are courses in related disciplines, such as architecture, law, earth sciences, demography, economics, finance, health administration, and management, in addition to courses in planning. Because familiarity with computer models and statistical techniques is important, courses in statistics, computer science, and geographic information systems also are recommended or required.

Graduate students spend considerable time in studios, workshops, and laboratory courses, learning to analyze and solve planning problems. They often are required to work in a planning office part time or during the summer. Local government planning offices frequently offer students internships, providing experience that proves invaluable in obtaining a full-time planning position after graduation.

Licensure. As of 2007, New Jersey was the only State that required planners to be licensed, although Michigan required registration to use the title "community planner." Licensure in New Jersey is based on two examinations—one testing generalized knowledge of planning and another testing knowledge of New Jersey planning laws. Registration as a community planner in Michigan is based on professional experience and national and State examinations.

Other qualifications. Planners must be able to think in terms of spatial relationships and visualize the effects of their plans and designs. They should be flexible and be able to reconcile different viewpoints and make constructive policy recommendations. The ability to communicate effectively, both orally and in writing, is necessary for anyone interested in this field.

Certification and advancement. The American Institute of Certified Planners, a professional institute within the American Planning Association, grants certification to individuals who have the appropriate combination of education and professional experience and pass an examination. Professional development activities are required to maintain certification. Certification may be helpful for promotion.

After a few years of experience, planners may advance to assignments requiring a high degree of independent judgment, such as designing the physical layout of a large development or recommending policy and budget options. Some public sector planners are promoted to community planning director and spend a great deal of time meeting with officials, speaking to civic groups, and supervising a staff. Further advancement occurs through a transfer to a larger jurisdiction with more complex problems and greater responsibilities or into related occupations, such as director of community or economic development.

Employment

Urban and regional planners held about 34,000 jobs in 2006. About 68 percent were employed by local governments. Companies involved with architectural, engineering, and related services, as well as management, scientific, and technical consulting services, employ an increasing proportion of planners in the private sector. Others are employed in State government agencies dealing with housing, transportation, or environmental protection, and a small number work for the Federal Government.

Job Outlook

Faster than average employment growth is projected for urban and regional planners. Most new jobs will be in affluent, rapidly expanding communities. Job prospects will be best for those with a master's degree and strong computer skills.

Employment change. Employment of urban and regional planners is expected to grow 15 percent from 2006 to 2016, faster than the average for all occupations. Employment growth will be driven by the need for State and local governments to provide public services such as regulation of commercial development, the environment, transportation, housing, and land use and development for an expanding population. Nongovernmental initiatives dealing with historic preservation and redevelopment will also create employment growth.

Most new jobs for urban and regional planners will be in local government, as planners will be needed to address an array of problems associated with population growth, especially in affluent, rapidly expanding communities. For example, new housing developments require roads, sewer systems, fire stations, schools, libraries, and recreation facilities that must be planned for within budgetary constraints.

The fastest job growth for urban and regional planners will occur in the private sector, primarily in the professional, scientific, and technical services industries. For example, planners may be employed by firms to help design security measures for a building that are effective but also subtle and able to blend in with the surrounding area. However, because the private sector employs only 21 percent of urban and regional planners, not as many new jobs will be created in the private sector as in government.

Job prospects. In addition to those from employment growth, job openings will arise from the need to replace experienced planners who transfer to other occupations, retire, or leave the labor force for other reasons. Graduates with a master's degree from an accredited program should have better job opportunities than those with only a bachelor's degree. Also, computers and software—especially GIS software—are increasingly being used in planning, and those with strong computer skills and GIS experience will have an advantage in the job market.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Urban and regional planners	19-3051	34,000	39,000	4,900	15

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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Earnings

Median annual wage-and-salary earnings of urban and regional planners were $56,630 in May 2006. The middle 50 percent earned between $44,480 and $71,390. The lowest 10 percent earned less than $35,610, and the highest 10 percent earned more than $86,880. Median annual earnings in the industries employing the largest numbers of urban and regional planners in May 2006 were:

Engineering services	$63,840
Architectural, engineering, and related services	62,890
Architectural services	61,700
State government	57,490
Local government	54,550

Related Occupations

Urban and regional planners develop plans for the growth of urban, suburban, and rural communities. Others whose work is similar include architects; civil engineers; environmental engineers; landscape architects: geographers; property, real estate, and community association managers; surveyors, cartographers, photogrammetrists, and surveying technicians; and market and survey researchers.

Sources of Additional Information

Information on careers, salaries, and certification in urban and regional planning is available from:

➤ American Planning Association, 1776 Massachusetts Ave. N.W., Washington, DC 20036.
Internet: **http://www.planning.org**

Information on accredited urban and regional planning programs is available from:

➤ Association of Collegiate Schools of Planning, 6311 Mallard Trace, Tallahassee, FL 32312. Internet: **http://www.acsp.org**

For addition information on urban and regional planning and on related occupations, see "Geography jobs" in the Spring 2005 Occupational Outlook Quarterly. The article is online at: **http://www.bls.gov/opub/ooq/2005/spring/art01.pdf**

Social Scientists, Other

(O*NET 19-3041.00, 19-3091.01, 19-3091.02, 19-3092.00, 19-3093.00, 19-3094.00)

Significant Points

- About 41 percent of these workers are employed by governments, mostly by the Federal Government.
- The educational attainment of social scientists is among the highest of all occupations, with most positions requiring a master's or Ph.D. degree.
- Overall employment is projected to grow about as fast as the average for all occupations, but varies by specialty.
- Job seekers may face competition, and those with higher educational attainment will have the best prospects.

Nature of the Work

The major social science occupations covered in this statement are anthropologists, archaeologists, geographers, historians, political scientists, and sociologists. (Economists, market and survey researchers, psychologists, and urban and regional planners are covered elsewhere in the *Handbook*.)

Social scientists study all aspects of society—from past events and achievements to human behavior and relationships among groups. Their research provides insights into the different ways individuals, groups, and institutions make decisions, exercise power, and respond to change. Through their studies and analyses, social scientists suggest solutions to social, business, personal, governmental, and environmental problems. In fact, many work as policy analysts for government or private organizations.

Research is a major activity of many social scientists, who use a variety of methods to assemble facts and construct theories. Applied research usually is designed to produce information that will enable people to make better decisions or manage their affairs more effectively. Social scientists often begin by collecting existing information. Collecting information takes many forms, including conducting interviews and questionnaires to gather demographic and opinion data, living and working among the population being studied, performing other field investigations, and experimenting with human or animal subjects in a laboratory. Social scientists also look at data in detail, such as studying the data they've collected, reanalyzing already existing data, analyzing historical records and documents, and interpreting maps and the effect of location on culture and other aspects of society. Following are several major types of social scientists. Specialists in one field may find that their research overlaps work being conducted in another discipline.

Anthropologists study the origin and the physical, social, and cultural development and behavior of humans. They may examine the way of life, archaeological remains, language, or physical characteristics of people in various parts of the world. Some compare the customs, values, and social patterns of different cultures. Anthropologists usually concentrate in sociocultural anthropology, linguistics, biophysical, or physical anthropology. Sociocultural anthropologists study the customs, cultures, and social lives of groups in settings that range from unindustrialized societies to modern urban centers. Linguistic anthropologists investigate the role of, and changes to, language over time in various cultures. Biophysical anthropologists research the evolution of the human body, look for the earliest evidences of human life, and analyze how culture and biology influence one another. Physical anthropologists examine human remains found at archaeological sites in order to understand population demographics and factors, such as nutrition and disease, which affected these populations. *Archaeologists* examine and recover material evidence including the ruins of buildings, tools, pottery, and other objects remaining from past human cultures in order to determine the history, customs, and living habits of earlier civilizations. With continued technological advances making it increasingly possible to detect the presence of underground anomalies without digging, archaeologists will be able to better target excavation sites. Another technological advancement is the use of geographic information systems (GIS) for tasks such

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as analyzing how environmental factors near a site may have affected the development of a society. Most anthropologists and archaeologists specialize in a particular region of the world.

Political scientists study the origin, development, and operation of political systems and public policy. They conduct research on a wide range of subjects, such as relations between the United States and other countries, the institutions and political life of nations, the politics of small towns or major metropolises, and the decisions of the U.S. Supreme Court. Studying topics such as public opinion, political decision making, ideology, and public policy, they analyze the structure and operation of governments, as well as various political entities. Depending on the topic, a political scientist might conduct a public-opinion survey, analyze election results or public documents, or interview public officials.

Sociologists study society and social behavior by examining the groups, cultures, organizations, and social institutions people form. They also study the activities in which people participate, including social, religious, political, economic, and business organizations. They study the behavior of, and interaction among, groups, organizations, institutions, and nations and how they react to phenomena such as the spread of technology, health epidemics, crime, and social movements. They also trace the origin and growth of these groups and interactions. Sociologists analyze how social influences affect different individuals. They also are concerned with the ways organizations and institutions affect the daily lives of individuals and groups. To analyze social patterns, sociologists design research projects that use a variety of methods, including historical analysis, comparative analysis, and quantitative and qualitative techniques. The results of sociological research aid educators, lawmakers, administrators, and others who are interested in resolving social problems and formulating public policy. Most sociologists work in one or more specialties, such as social organization, stratification, and mobility; racial and ethnic relations; education; the family; social psychology; urban, rural, political, and comparative sociology; gender relations; demography; gerontology; criminology; and sociological practice.

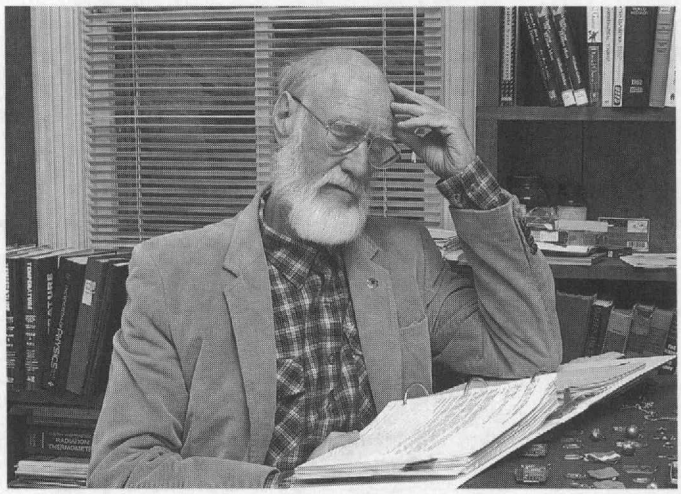
Geographers analyze distributions of physical and cultural phenomena on local, regional, continental, and global scales. Economic geographers study the distribution of resources and economic activities. Political geographers are concerned with the relationship of geography to political phenomena, and cultural geographers study the geography of cultural phenomena. Physical geographers examine variations in climate, vegetation, soil, and landforms and their implications for human activity. Urban and transportation geographers study cities and metropolitan areas. Regional geographers study the physical, economic, political, and cultural characteristics of regions ranging in size from a congressional district to entire continents. Medical geographers investigate health care delivery systems, epidemiology (the study of the causes and control of epidemics), and the effect of the environment on health. Most geographers use GIS technology to assist with their work. For example, they may use GIS to create computerized maps that can track information such as population growth, traffic patterns, environmental hazards, natural resources, and weather patterns, after which they use the information to advise governments on the development of houses, roads, or landfills. Many of the people who study geography and work with GIS technology are classified in other occupations, such as surveyors, cartographers, photogrammetrists, and survey technicians (who develop maps and other location-based information), urban and regional planners (who help to decide on and evaluate the locations of building and roads and other aspects of physical society), and geoscientists (who study earthquakes and other physical aspects of the Earth). (These occupations are described elsewhere in the *Handbook*.)

Historians research, analyze, and interpret the past. They use many sources of information in their research, including government and institutional records, newspapers and other periodicals, photographs, interviews, films, and unpublished manuscripts such as personal diaries and letters. Historians usually specialize in a country or region, a particular period, or a particular field, such as social, intellectual, cultural, political, or diplomatic history. Other historians help study and preserve archival materials, artifacts, and historic buildings and sites.

Work environment. Most social scientists have regular hours. Generally working behind a desk, either alone or in collaboration with other social scientists, they read and write research articles or reports. Many experience the pressures of writing and publishing, as well as those associated with deadlines and tight schedules. Sometimes they must work overtime, for which they usually are not compensated. Social scientists often work as an integral part of a research team. Travel may be necessary to collect information or attend meetings. Social scientists on foreign assignment must adjust to unfamiliar cultures, climates, and languages.

Some social scientists do fieldwork. For example, anthropologists, archaeologists, and geographers may travel to remote areas, live among the people they study, learn their languages, and stay for long periods at the site of their investigations. They may work under rugged conditions, and their work may involve strenuous physical exertion.

Social scientists employed by colleges and universities usually have flexible work schedules, often dividing their time among teaching, research, writing, consulting, and administra-



Social scientists need strong research, analytical, and writing skills.

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tive responsibilities. Those who teach in these settings are classified as postsecondary teachers.

Training, Other Qualifications, and Advancement

The educational attainment of social scientists is among the highest of all occupations, with most positions requiring a master's or Ph.D. degree.

Education and training. Graduates with master's degrees in applied specialties usually are qualified for positions outside of colleges and universities, although requirements vary by field. A Ph.D. degree may be required for higher-level positions. Bachelor's degree holders have limited opportunities and do not qualify for most of the occupations discussed above. A bachelor's degree does, however, provide a suitable background for many different kinds of entry-level jobs in related occupations, such as research assistant, writer, management trainee, or market analyst.

Training in statistics and mathematics is essential for many social scientists Geographers, political scientists, and those in other fields increasingly use mathematical and quantitative research methods. The ability to use computers for research purposes is mandatory in most disciplines. Social scientists also must keep up-to date on the latest technological advances that affect their discipline and research. For example, most geographers use GIS technology extensively, and GIS is also becoming more commonly used by archaeologists, sociologists, and other workers.

Many social science students also benefit from internships or field experience. Numerous local museums, historical societies, government agencies, non-profit and other organizations offer internships or volunteer research opportunities. Archaeological field schools instruct future anthropologists, archaeologists, and historians in how to excavate, record, and interpret historical sites.

Other qualifications. Social scientists need excellent written and oral communication skills to report research findings and to collaborate on research. Successful social scientists also need intellectual curiosity and creativity because they constantly seek new information about people, things, and ideas. The ability to think logically and methodically is also essential to analyze complicated issues, such as the relative merits of various forms of government. Objectivity, an open mind, and systematic work habits are important in all kinds of social science research. Perseverance, too, is often necessary, as when an anthropologist spends years studying artifacts from an ancient civilization before making a final analysis and interpretation.

Advancement. Some social scientists advance to top-level research and administrative positions. Advancement often depends on the number and quality of reports that social scientists publish or their ability to design studies.

Many social scientists choose to teach in their field, often while pursuing their own research. These workers are usually classified as postsecondary teachers. The minimum requirement for most positions in colleges and universities is a Ph.D. degree. Graduates with a master's degree in a social science may qualify for teaching positions in community colleges. Social science graduates with sufficient education courses can qualify for teaching positions in secondary and elementary schools.

Employment

Social scientists held about 18,000 jobs in 2006. Many worked as researchers, administrators, and counselors for a wide range of employers. About 41 percent worked for Federal, State, and local governments, mostly for the Federal Government. Other employers included scientific research and development services; management, scientific, and technical consulting services; business, professional, labor, political, and similar organizations; and architectural, engineering, and related firms.

Many individuals with training in a social science discipline teach in colleges and universities and in secondary and elementary schools. (For more information, see teachers—postsecondary and teachers—preschool, kindergarten, elementary, middle, and secondary elsewhere in the *Handbook*.) The proportion of social scientists who teach varies by specialty. For example, graduates in history are more likely to teach than are graduates in most other social science fields.

The following tabulation shows employment, by social science specialty.

Anthropologists and archeologists	5,500
Political scientists	4,700
Sociologists	3,700
Historians	3,400
Geographers	1,100

Job Outlook

Overall employment is projected to grow about as fast as average, but varies by detailed occupation. Job seekers may face competition, and those with higher educational attainment will have the best prospects.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Social scientists, other	—	18,000	20,000	1,800	10
Sociologists	19-3041	3,700	4,100	400	10
Anthropologists and archeologists	19-3091	5,500	6,400	800	15
Geographers	19-3092	1,100	1,200	100	6
Historians	19-3093	3,400	3,700	300	8
Political scientists	19-3094	4,700	4,900	300	5

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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Employment change. Overall employment of social scientists is expected to grow 10 percent from 2006 to 2016, about as fast as the average for all occupations. However, projected growth rates vary by specialty. Anthropologists and archaeologists, sociologists, and historians are projected to grow about as fast as average. Employment of geographers and political scientists is projected to grow more slowly than average, reflecting the relatively few opportunities outside of the Federal Government. Employment is projected to decline slowly in the Federal Government, a key employer of social scientists.

The following tabulation shows projected percent change in employment, by social science specialty.

	Percent
Anthropologists and archeologists	15
Sociologists	10
Historians	8
Geographers	6
Political scientists	5

Anthropologists and archaeologists will experience the majority of their job growth in the management, scientific, and technical consulting services industry. Anthropologists who work as consultants apply anthropological knowledge and methods to problems ranging from economic development issues to forensics. As construction projects increase, more archaeologists also will be needed to monitor the work, ensuring that historical sites and artifacts are preserved.

Political scientists, sociologists, and historians will mainly find jobs in policy or research. Demand for political science research is growing because of increasing interest about politics and foreign affairs, including social and environmental policy issues and immigration. Political scientists will use their knowledge of political institutions to further the interests of nonprofit, political lobbying, and social organizations. Likewise, the incorporation of sociology into research in other fields will continue to increase the need for sociologists. They may find work conducting policy research for consulting firms and nonprofit organizations, and their knowledge of society and social behavior may be used by a variety of companies in product development, marketing, and advertising. Historians may find opportunities with historic preservation societies or working as a consultant as public interest in preserving and restoring historical sites increases.

Geographers will work advising government, real estate developers, utilities, and telecommunications firms on where to build new roads, buildings, power plants, and cable lines. Geographers also will advise on environmental matters, such as where to build a landfill or preserve wetland habitats. Geographers with a background in GIS will find numerous job opportunities applying GIS technology in nontraditional areas, such as emergency assistance, where GIS can track locations of ambulances, police, and fire rescue units and their proximity to the emergency. Workers in these jobs may not necessarily be called "geographers," but instead may be referred to by a different title, such as "GIS analyst" or "GIS specialist."

Job prospects. In addition to opportunities from employment growth, some job openings for social scientists will come from the need to replace those who retire, enter teaching or other occupations, or leave their social science occupation for other reasons.

People seeking social science positions may face competition for jobs, and those with higher educational attainment will have the best prospects. Many jobs in policy, research, or marketing for which social scientists qualify are not advertised exclusively as social scientist positions. Because of the wide range of skills and knowledge possessed by these social scientists, many compete for jobs with other workers, such as market and survey researchers, psychologists, engineers, urban and regional planners, and statisticians.

Some people with social science degrees will find opportunities as university faculty rather than as applied social scientists. Although there will be keen competition for tenured positions, the number of faculty expected to retire over the decade and the increasing number of part-time or short-term faculty positions will lead to better opportunities in colleges and universities than in the past. The growing importance and popularity of social science subjects in secondary schools also is strengthening the demand for social science teachers at that level.

Earnings

In May 2006, anthropologists and archaeologists had median annual wage-and-salary earnings of $49,930; geographers, $62,990; historians, $48,520; political scientists, $90,140; and sociologists, $60,290.

In the Federal Government, social scientists with a bachelor's degree and no experience often started at a yearly salary of $28,862 or $35,572 in 2007, depending on their college records. Those with a master's degree could start at $43,731, and those with a Ph.D. degree could begin at $52,912, while some individuals with experience and an advanced degree could start at $63,417. Beginning salaries were higher in selected areas of the country where the prevailing local pay level was higher.

Related Occupations

The duties and training of these social scientists are similar to other social scientists, including economists, market and survey researchers, psychologists, and urban and regional planners. Many social scientists conduct surveys, study social problems, teach, and work in museums, performing tasks similar to those of statisticians; counselors; social workers; teachers—postsecondary; teachers—preschool, kindergarten, elementary, middle, and secondary; and archivists, curators, and museum technicians.

Political scientists often research the function of government, including the legal system, as do lawyers; paralegals and legal assistants; and judges, magistrates, and other judicial workers. Many political scientists analyze and report on current events, as do news analysts, reporters, and correspondents.

Geographers often study the Earth's environment and natural resources, as do conservation scientists and foresters, atmospheric scientists, and environmental scientists and hydrologists. Geographers also use GIS computer technology to make maps. Other occupations with similar duties include surveyors, cartographers, photogrammetrists, and surveying technicians; computer systems analysts; and computer scientists and database administrators.

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Sources of Additional Information

For information about careers in anthropology, contact:

➤ American Anthropological Association, 2200 Wilson Blvd., Suite 600, Arlington, VA 22201.
Internet: **http://www.aaanet.org**

For information about careers in archaeology, contact:

➤ Archaeological Institute of America, 656 Beacon St., 6th Floor, Boston, MA 02215. Internet: **http://www.archaeological.org**

➤ Society for American Archaeology, 900 2nd St.NE., Suite 12, Washington, DC 20002. Internet: **http://www.saa.org**

For information about careers in geography, contact:

➤ Association of American Geographers, 1710 16th St.NW., Washington, DC 20009. Internet: **http://www.aag.org**

Also see "Geography jobs," in the spring 2005 issue of the Occupational Outlook Quarterly and online at:
http://www.bls.gov/opub/ooq/2005/spring/art01.pdf

Information on careers for historians is available from:

➤ American Historical Association, 400 A St.SE., Washington, DC 20003. Internet: **http://www.historians.org**

For information about careers in political science, contact:

➤ American Political Science Association, 1527 New Hampshire Ave. NW., Washington, DC 20036.
Internet: **http://www.apsanet.org**

➤ National Association of Schools of Public Affairs and Administration, 1029 Vermont Ave. NW., Suite 1100, Washington, DC 20005. Internet: **http://www.naspaa.org**

Information about careers in sociology is available from:

➤ American Sociological Association, 1307 New York Ave. NW., Suite 700, Washington, DC 20005.
Internet: **http://www.asanet.org**

For information about careers in policy analysis, an important task for some social scientists, see "Policy analysts: Shaping society through research and problem-solving," online at **http://www.bls.gov/opub/ooq/2007/spring/art03.pdf** and in the spring 2007 issue of the Occupational Outlook Quarterly.

Science Technicians

(O*NET 19-4011.00, 19-4011.01, 19-4011.02, 19-4021.00, 19-4031.00, 19-4041.00, 19-4041.01, 19-4041.02, 19-4051.00, 19-4051.01, 19-4051.02, 19-4091.00, 19-4092.00, 19-4093.00, 19-4099.99)

Significant Points

- Science technicians in production jobs can be employed on day, evening, or night shifts; other technicians work outdoors, sometimes in remote locations.
- Most science technicians need an associate degree or a certificate in applied science or science-related technology; biological and forensic science technicians usually need a bachelor's degree.
- Projected job growth varies among occupational specialties; for example, forensic science technicians will grow much faster than average, while chemical technicians will grow more slowly than average.
- Job opportunities are expected to be best for graduates of applied science technology programs who are well trained on equipment used in laboratories or production facilities.

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. Those who perform production work monitor manufacturing processes and may ensure 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, the role of science technicians in research and development has expanded. In addition to performing routine tasks, many technicians, under the direction of scientists, now develop and adapt laboratory procedures to achieve the best results, interpret data, and devise solutions to problems. Technicians must develop expert knowledge of laboratory equipment so that they can adjust settings when necessary and recognize when equipment is malfunctioning.

Most science technicians specialize, learning their 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 and food science technicians work with related scientists to conduct research, development, and testing on food and other agricultural products. Agricultural technicians are involved 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 breed animals for the purpose of investigating nutrition. 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 compliance with Food and Drug Administration regulations regarding color, texture, and nutrients. These technicians analyze, record, and compile test results; order supplies to maintain laboratory inventory; and clean and sterilize laboratory equipment.

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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 medicine. Those working in the field of microbiology generally work as laboratory assistants, studying living organisms and infectious agents. Biological technicians also analyze organic substances, such as blood, food, and drugs. Biological technicians working in biotechnology apply knowledge and techniques gained from basic research, including gene splicing and recombinant DNA, and apply them to 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 technicians who work in experimental laboratories and process control technicians who work in manufacturing or other industrial plants. Many chemical technicians working in research and development 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 they may produce compounds through complex organic synthesis. Most *process technicians* work in manufacturing, testing packaging for design, integrity of materials, and environmental acceptability. Often, process technicians who work in plants focus on quality assurance, monitoring product quality or production processes and developing new production techniques. A few work in shipping to provide technical support and expertise.

Environmental science and protection technicians perform laboratory and field tests to monitor environmental resources and determine the contaminants and sources of pollution in the environment. They may collect samples for testing or be involved in abating and controlling sources of environmental pollution. Some are responsible for waste management operations, control and management of hazardous materials inventory, or general activities involving regulatory compliance. Many environmental science technicians employed at private consulting firms work directly under the supervision of an environmental scientist.

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 on substances such as fiber, glass, hair, tissue, and body fluids to determine their significance to the investigation. Proper collection and storage methods are important to protect the evidence. Forensic science technicians also prepare reports to document their findings and the laboratory techniques used, and they may provide information and expert opinions to investigators. When criminal cases come to trial, forensic science technicians often give testimony as expert witnesses on laboratory findings by identifying and classifying substances, materials, and other evidence collected at the scene of a crime. Some forensic science technicians work closely with other experts or technicians. For example, a forensic science technician may consult either a medical expert about the exact time and cause of a death or another technician who specializes in DNA typing in hopes of matching a DNA type to a suspect.

Forest and conservation technicians compile data on the size, content, and condition of forest land. These workers usually work in a forest under the supervision of a forester, doing 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 data on populations of trees, disease and insect damage, tree seedling mortality, and conditions that may pose a fire hazard. In addition, forest and conservation technicians train and lead forest and conservation workers in seasonal activities, such as planting tree seedlings, and maintaining recreational facilities. Increasing numbers of forest and conservation technicians work in urban forestry—the study of individual trees in cities—and other nontraditional specialties, rather than in forests or rural areas.

Geological and petroleum technicians measure and record physical and geologic conditions in oil or gas wells, using advanced instruments lowered into the wells or analyzing the mud from the wells. In oil and gas exploration, technicians collect and examine geological data or test geological samples to determine their petroleum content and their mineral and element composition. Some petroleum technicians, called scouts, collect information about oil well 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 controlled equipment to manipulate radioactive materials or materials exposed to radioactivity. Workers who control nuclear reactors are classified as *nuclear power reactor operators*, and are not included in this statement. (See the statement on power plant operators, distributors, and dispatchers elsewhere in the *Handbook*.)

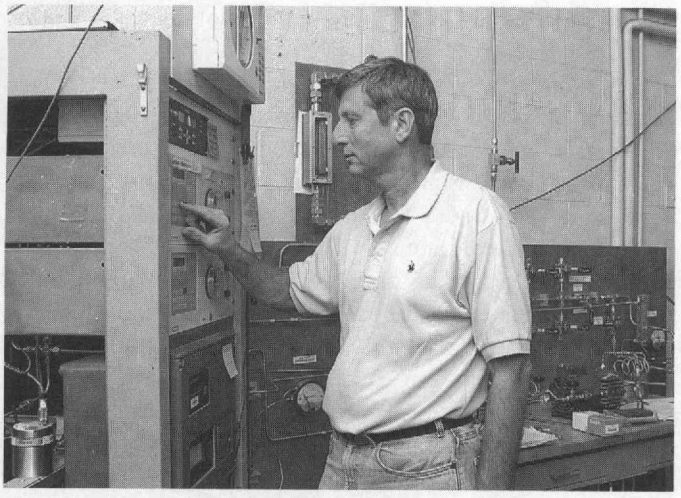
Other science technicians perform a wide range of activities. Some collect weather information or assist oceanographers; others work as laser technicians or radiographers.

Work environment. 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.

Advances in automation and information technology require technicians to operate more sophisticated laboratory equipment. Science technicians make extensive use of computers, electronic measuring equipment, and traditional experimental apparatus.

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

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Job opportunities will be best for graduates who are trained on equipment used in labratories or production facilities.

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.

Training, Other Qualifications, and Advancement

Most science technicians need an associate degree or a certificate in applied science or science-related technology. Biological and forensic science technicians usually need a bachelor's degree. Science technicians with a high school diploma and no college degree typically begin work as trainees under the direct supervision of a more experienced technician, and eventually earn a 2-year degree in science technology.

Education and training. 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 completed several science and math courses at a 4-year college.

Most biological technician jobs, for example, require a bachelor's degree in biology or a closely related field. Forensic science positions also typically require a bachelor's degree to work in the field. Knowledge and understanding of legal procedures also can be helpful. Chemical technician positions in research and development also often have a bachelor's degree, but most chemical process technicians have a 2-year degree instead, usually an associate degree in process technology. In some cases, a high school diploma is sufficient. These workers 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 generally require less on-the-job training.

Whatever their degree, science technicians usually need hands-on training either in school or on the job. Most can get 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 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.

Job candidates, who have 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. Those with a high school diploma and no college degree typically begin work as trainees under the direct supervision of a more experienced technician. Many with a high school diploma eventually earn a 2-year degree in science technology, often paid for by their employer.

Many technical and community colleges offer associate degrees in a specific technology or more general education in science and mathematics. A number of associate degree programs are designed to provide easy transfer to bachelor's degree programs at colleges or universities. Technical institutes usually offer technician training, but they provide less theory and general education than do community colleges. The length of programs at technical institutes varies, although 1-year certificate programs and 2-year associate degree programs are common. Prospective forestry and conservation technicians can choose from more than 20 associate degree programs in forest technology accredited by the Society of American Foresters.

Approximately 30 colleges and universities offer a bachelor's degree program in forensic science; about another 25 schools offer a bachelor's degree in a natural science with an emphasis on forensic science or criminology; a few additional schools offer a bachelor's degree with an emphasis in a specialty area, such as criminology, pathology, jurisprudence, investigation, odontology, toxicology, or forensic accounting.

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

People 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 chemistry, physics, and math is vital.

Other qualifications. Communication skills are important because technicians are often required to report their findings both orally and in writing. In addition, technicians should be able to work well with others. Because computers often are used in research and development laboratories, technicians should also have strong computer skills, especially in computer modeling. Organizational ability, an eye for detail, and skill in interpreting scientific results are important as well, as are a high mechanical aptitude, attention to detail, and analytical thinking.

Advancement. Technicians usually begin work as trainees in routine positions under the direct supervision of a scientist or a more experienced technician. As they gain experience, techni-

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cians take on more responsibility and carry out assignments under only general supervision, and some eventually become supervisors. However, technicians employed at universities often have job prospects tied to those of particular professors; when those professors retire or leave, these technicians face uncertain employment prospects.

Employment

Science technicians held about 267,000 jobs in 2006. As indicated by the following tabulation, chemical and biological technicians accounted for 52 percent of all jobs:

Biological technicians	79,000
Chemical technicians	61,000
Environmental science and protection technicians, including health	37,000
Forest and conservation technicians	34,000
Agricultural and food science technicians	26,000
Forensic science technicians	13,000
Geological and petroleum technicians	12,000
Nuclear technicians	6,500

About 30 percent of biological technicians worked in professional, scientific, or technical services firms; most other biological technicians worked in educational services, Federal, State, and local governments, or pharmaceutical and medicine manufacturing. Chemical technicians held jobs in a wide range of manufacturing and service-providing industries. About 39 percent worked in chemical manufacturing and another 30 percent worked in professional, scientific, or technical services firms. Most environmental science and protection technicians worked for State and local governments and professional, scientific, and technical services firms. About 76 percent of forest and conservation technicians held jobs in the Federal Government, mostly in the Forest Service; another 17 percent worked for State governments. Around 32 percent of agricultural and food science technicians worked in educational services and 20 percent worked for food processing companies; most of the rest were employed in agriculture. Forensic science technicians worked primarily for State and local governments. Approximately 37 percent of all geological and petroleum technicians worked for oil and gas extraction companies and 49 percent of nuclear technicians worked for utilities.

Job Outlook

Employment of science technicians is projected to grow about as fast as the average, although employment change will vary by specialty. Job opportunities are expected to be best for graduates of applied science technology programs who are well trained on equipment used in laboratories or production facilities.

Employment change. Overall employment of science technicians is expected to grow 12 percent during the 2006-16 decade, about as fast as the average for all occupations. The continued growth of scientific and medical research—particularly research related to biotechnology—will be the primary driver of employment growth, but the development and production of technical products should also stimulate demand for science technicians in many industries.

Employment of biological technicians should increase faster than the average, as the growing number of agricultural and medicinal products developed with the use of biotechnology techniques boosts demand for these workers. Also, an aging population and stronger competition among pharmaceutical companies are expected to contribute to the need for innovative and improved drugs, further spurring demand. Most growth in employment will be in professional, scientific, and technical services and in educational services.

Job growth for chemical technicians is projected to grow more slowly than the average. The chemical manufacturing industry, except pharmaceutical and medicine manufacturing, is anticipated to experience a decline in overall employment as companies downsize and turn to outside contractors to provide specialized services. Some of these contractors will be in other countries with lower average wages, further limiting employment growth. An increasing focus on quality assurance will require a greater number of process technicians, however, stimulating demand for these workers.

Employment of environmental science and protection technicians is expected to grow much faster than the average; these workers will be needed to help regulate waste products; to collect air, water, and soil samples for measuring levels of pollutants; to monitor compliance with environmental regulations;

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Science technicians	—	267,000	300,000	33,000	12
Agricultural and food science technicians	19-4011	26,000	28,000	1,700	7
Biological technicians	19-4021	79,000	91,000	13,000	16
Chemical technicians	19-4031	61,000	65,000	3,600	6
Geological and petroleum technicians	19-4041	12,000	13,000	1,000	9
Nuclear technicians	19-4051	6,500	6,900	400	7
Environmental science and protection technicians, including health	19-4091	37,000	47,000	10,000	28
Forensic science technicians	19-4092	13,000	17,000	4,000	31
Forest and conservation technicians	19-4093	34,000	33,000	-700	-2

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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and to clean up contaminated sites. Over 80 percent of this growth is expected to be in professional, scientific, and technical services as environmental monitoring, management, and regulatory compliance increase.

An expected decline in employment of forest and conservation technicians within the Federal Government will lead to little or no change in employment in this specialty, due to budgetary constraints and continued reductions in demand for timber management on Federal lands. However, opportunities at State and local governments within specialties such as urban forestry may provide some new jobs. In addition, an increased emphasis on specific conservation issues, such as environmental protection, preservation of water resources, and control of exotic and invasive pests, may provide some employment opportunities.

Employment of agricultural and food science technicians is projected to grow about as fast as the average. Research in biotechnology and other areas of agricultural science will increase as it becomes more important to balance greater agricultural output with protection and preservation of soil, water, and the ecosystem. In particular, research will be needed to combat insects and diseases as they adapt to pesticides and as soil fertility and water quality continue to need improvement.

Jobs for forensic science technicians are expected to increase much faster than the average. Employment growth in State and local government should be driven by the increasing application of forensic science to examine, solve, and prevent crime. Crime scene technicians who work for State and county crime labs should experience favorable employment prospects resulting from strong job growth.

Average employment growth is expected for geological and petroleum technicians. Job growth should be strongest in professional, scientific, and technical services firms because geological and petroleum technicians will be needed to assist environmental scientists and geoscientists as they provide consultation services for companies regarding environmental policy and Federal Government mandates, such as those requiring lower sulfur emissions.

Nuclear technicians should grow about as fast as the average as more are needed to monitor the Nation's aging fleet of nuclear reactors and research future advances in nuclear power. Although no new nuclear powerplants have been built for decades in the United States, energy demand has recently renewed interest in this form of electricity generation and may lead to future construction. Technicians also will be needed to work in defense-related areas, to develop nuclear medical technology, and to improve and enforce waste management and safety standards.

Job prospects. In addition to job openings created by growth, many openings should arise from the need to replace technicians who retire or leave the labor force for other reasons. Job opportunities are expected to be best for graduates of applied science technology programs who are well trained on equipment used in laboratories or production facilities. As the instrumentation and techniques used in industrial research, development, and production become increasingly more complex, employers will seek individuals with highly developed technical skills. Good communication skills are also increasingly sought by employers.

Job opportunities vary by specialty. The best opportunities for agricultural and food science technicians will be in agricultural biotechnology, specifically in research and development on biofuels. Geological and petroleum technicians should experience little competition for positions because of the relatively small number of new entrants. Forensic science technicians with a bachelor's degree in a forensic science will enjoy much better opportunities than those with an associate degree. During periods of economic recession, science technicians may be laid off.

Earnings

Median hourly earnings of science technicians in May 2006 were as follows:

Nuclear technicians	$31.49
Geological and petroleum technicians	22.19
Forensic science technicians	21.79
Chemical technicians	18.87
Environmental science and protection technicians, including health	18.31
Biological technicians	17.17
Agricultural and food science technicians	15.26
Forest and conservation technicians	14.84

In 2007, the average annual salary in the Federal Government was $40,629 for biological science technicians; $53,026 for physical science technicians; $40,534 for forestry technicians; $54,081 for geodetic technicians; $50,337 for hydrologic technicians; and $63,396 for meteorological technicians.

Related Occupations

Other technicians who apply scientific principles and who usually have a 2-year associate degree include engineering technicians, broadcast and sound engineering technicians and radio operators, drafters, and health technologists and technicians—especially clinical laboratory technologists and technicians, diagnostic medical sonographers, and radiologic technologists and technicians.

Sources of Additional Information

For information about a career as a chemical technician, contact:

➤ American Chemical Society, Education Division, Career Publications, 1155 16th St.NW., Washington, DC 20036. Internet: **http://www.acs.org**

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

➤ American Academy of Forensic Sciences, P.O. Box 669, Colorado Springs, CO, 80901. Internet: **http://www.aafs.org**

For general information on forestry technicians and a list 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**

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Community and Social Services Occupations

Counselors

(O*NET 21-1011.00, 21-1012.00, 21-1013.00, 21-1014.00, 21-1015.00, 21-1019.99)

Significant Points

- A master's degree generally is required to become a licensed counselor.
- Job opportunities for counselors should be very good because job openings are expected to exceed the number of graduates from counseling programs.
- The health care and social assistance industry employs about 47 percent of counselors, and state and local government employ about 11 percent.

Nature of the Work

Counselors assist people with personal, family, educational, mental health, and career problems. Their duties vary greatly depending on their occupational specialty, which is determined by the setting in which they work and the population they serve.

Educational, vocational, and school counselors provide individuals and groups with career and educational counseling. School counselors assist students of all levels, from elementary school to postsecondary education. They advocate for students and work with other individuals and organizations to promote the academic, career, personal, and social development of children and youth. School counselors help students evaluate their abilities, interests, talents, and personalities to develop realistic academic and career goals. Counselors use interviews, counseling sessions, interest and aptitude assessment tests, and other methods to evaluate and advise students. They also operate career information centers and career education programs. Often, counselors work with students who have academic and social development problems or other special needs.

Elementary school counselors observe children during classroom and play activities and confer with their teachers and parents to evaluate the children's strengths, problems, or special needs. In conjunction with teachers and administrators, they make sure that the curriculum addresses both the academic and the developmental needs of students. Elementary school counselors do less vocational and academic counseling than high school counselors.

High school counselors advise students regarding college majors, admission requirements, entrance exams, financial aid, trade or technical schools, and apprenticeship programs. They help students develop job search skills, such as resume writing and interviewing techniques. College career planning and placement counselors assist alumni or students with career development and job-hunting techniques.

School counselors at all levels help students to understand and deal with social, behavioral, and personal problems. These counselors emphasize preventive and developmental counseling to provide students with the life skills needed to deal with problems before they worsen and to enhance students' personal, social, and academic growth. Counselors provide special services, including alcohol and drug prevention programs and conflict resolution classes. They also try to identify cases of domestic abuse and other family problems that can affect a student's development.

Counselors interact with students individually, in small groups, or as an entire class. They consult and collaborate with parents, teachers, school administrators, school psychologists, medical professionals, and social workers to develop and implement strategies to help students succeed.

Vocational counselors, also called *employment* or *career counselors*, provide mainly career counseling outside the school setting. Their chief focus is helping individuals with career decisions. Vocational counselors explore and evaluate the client's education, training, work history, interests, skills, and personality traits. They may arrange for aptitude and achievement tests to help the client make career decisions. They also work with individuals to develop their job-search skills and assist clients in locating and applying for jobs. In addition, career counselors provide support to people experiencing job loss, job stress, or other career transition issues.

Rehabilitation counselors help people deal with the personal, social, and vocational effects of disabilities. They counsel people with disabilities resulting from birth defects, illness or disease, accidents, or other causes. They evaluate the strengths and limitations of individuals, provide personal and vocational counseling, and arrange for medical care, vocational training, and job placement. Rehabilitation counselors interview both individuals with disabilities and their families, evaluate school and medical reports, and confer with physicians, psychologists, occupational therapists, and employers to determine the capabilities and skills of the individual. They develop rehabilitation programs by conferring with clients; these programs often include training to help clients develop job skills. Rehabilitation counselors also work toward increasing the client's capacity to live independently.

Mental health counselors work with individuals, families, and groups to address and treat mental and emotional disorders and to promote mental health. They are trained in a variety of therapeutic techniques used to address issues, including depression, addiction and substance abuse, suicidal impulses, stress, problems with self-esteem, and grief. They also help with job and career concerns, educational decisions, issues related to mental and emotional health, and family, parenting, marital, or other relationship problems. Mental health counselors often work closely with other mental health specialists, such as psychiatrists, psychologists, clinical social workers, psychiatric nurses, and school counselors. (Information on psychologists, registered nurses, social workers and physicians and surgeons,

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which includes psychiatrists, appears elsewhere in the *Handbook*.)

Substance abuse and behavioral disorder counselors help people who have problems with alcohol, drugs, gambling, and eating disorders. They counsel individuals who are addicted to drugs, helping them to identify behaviors and problems related to their addiction. Counseling can be done on an individual basis, but is frequently done in a group setting. These counselors will often also work with family members who are affected by the addictions of their loved ones. Counselors also conduct programs aimed at preventing addictions.

Marriage and family therapists apply family systems theory, principals and techniques to individuals, families, and couples to resolve emotional conflicts. In doing so, they modify people's perceptions and behaviors, enhance communication and understanding among family members, and help to prevent family and individual crises. Marriage and family therapists also may engage in psychotherapy of a non-medical nature, make appropriate referrals to psychiatric resources, perform research, and teach courses about human development and interpersonal relationships.

Other counseling specialties include gerontological, multicultural, and genetic counseling. A gerontological counselor provides services to elderly people and their families as they face changing lifestyles. Genetic counselors provide information and support to families who have members with birth defects or genetic disorders and to families who may be at risk for a variety of inherited conditions. These counselors identify families at risk, interpret information about the disorder, analyze inheritance patterns and risks of recurrence, and review available options with the family.

Work environment. Work environment can vary greatly depending on occupational specialty. School counselors work predominantly in schools, where they usually have an office but also may work in classrooms. Other counselors may work in a private practice, community health organization, or hospital. Many counselors work in an office where they see clients throughout the day. Because privacy is essential for confidential and frank discussions with clients, counselors usually have private offices.



Counselors often work with clients one-on-one to assist with personal, family, educational, and career problems and decisions.

The work schedules of counselors depend on occupational specialty and work setting. Some school counselors work the traditional 9- to 10-month school year with a 2- to 3-month vacation, but increasing numbers, are employed on 11-month or full-year contracts, particularly those working in middle and high schools. They usually work the same hours as teachers, but they may travel more frequently to attend conferences and conventions. College career planning and placement counselors work long and irregular hours during student recruiting periods.

Rehabilitation counselors usually work a standard 40-hour week. Self-employed counselors and those working in mental health and community agencies, such as substance abuse and behavioral disorder counselors, frequently work evenings to counsel clients who work during the day. Both mental health counselors and marriage and family therapists also often work flexible hours to accommodate families in crisis or working couples who must have evening or weekend appointments.

Training, Other Qualifications, and Advancement

Education and training requirements for counselors are often very detailed and vary by State and specialty. Prospective counselors should check with State and local governments, employers, and national voluntary certification organizations to determine which requirements apply.

Education and training. Education requirements vary based on occupational specialty and State licensure and certification requirements. A master's degree is usually required to be licensed as a counselor. Some States require counselors in public employment to have a master's degree; others accept a bachelor's degree with appropriate counseling courses. Counselor education programs in colleges and universities are often found in departments of education or psychology. Fields of study include college student affairs, elementary or secondary school counseling, education, gerontological counseling, marriage and family therapy, substance abuse counseling, rehabilitation counseling, agency or community counseling, clinical mental health counseling, career counseling, and related fields. Courses are often grouped into eight core areas: human growth and development, social and cultural diversity, relationships, group work, career development, assessment, research and program evaluation, and professional identity. In an accredited master's degree program, 48 to 60 semester hours of graduate study, including a period of supervised clinical experience in counseling, are required.

Some employers provide training for newly hired counselors. Others may offer time off or tuition assistance to complete a graduate degree. Often counselors must participate in graduate studies, workshops, and personal studies to maintain their certificates and licenses.

Licensure. Licensure requirements differ greatly by State, occupational specialty, and work setting. Many States require school counselors to hold a State school counseling certification and to have completed at least some graduate course work; most require the completion of a master's degree. Some States require school counselors to be licensed, which generally requires continuing education credits. Some States require public school counselors to have both counseling and teaching certificates and to have had some teaching experience.

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For counselors based outside of schools, 49 States and the District of Columbia have some form of counselor licensure that governs the practice of counseling. Requirements typically include the completion of a master's degree in counseling, the accumulation of 2 years or 3,000 hours of supervised clinical experience beyond the master's degree level, the passage of a State-recognized exam, adherence to ethical codes and standards, and the completion of annual continuing education requirements. However, counselors working in certain settings or in a particular specialty may face different licensure requirements. For example, a career counselor working in private practice may need a license, but a counselor working for a college career center may not. In addition, substance abuse and behavior disorder counselors are generally governed by a different State agency or board than other counselors. The criteria for their licensure vary greatly and in some cases, these counselors may only need a high school diploma and certification. Those interested in entering the field must research State and specialty requirements to determine what qualifications they must have.

Other qualifications. People interested in counseling should have a strong desire to help others and should be able to inspire respect, trust, and confidence. They should be able to work independently or as part of a team. Counselors must follow the code of ethics associated with their respective certifications and licenses.

Counselors must possess high physical and emotional energy to handle the array of problems that they address. Dealing daily with these problems can cause stress.

Certification and advancement. Some counselors elect to be certified by the National Board for Certified Counselors, Inc., which grants a general practice credential of National Certified Counselor. To be certified, a counselor must hold a master's degree with a concentration in counseling from a regionally accredited college or university; have at least 2 years of supervised field experience in a counseling setting (graduates from counselor education programs accredited by the Council for Accreditation of Counseling and Related Educational Programs are exempted); provide two professional endorsements, one of which must be from a recent supervisor; and must have a passing score on the board's examination. This national certification is voluntary and is distinct from State licensing. However, in some States, those who pass the national exam are exempted from taking a State certification exam. The board also offers specialty certifications in school, clinical mental health, and addiction counseling. These specialty certifications require passage of a supplemental exam. To maintain their certifications, counselors retake and pass the exam or complete 100 credit hours of acceptable continuing education every 5 years.

The Commission on Rehabilitation Counselor Certification offers voluntary national certification for rehabilitation counselors. Many State and local governments and other employers require rehabilitation counselors to have this certification. To become certified, rehabilitation counselors usually must graduate from an accredited educational program, complete an internship, and pass a written examination. Certification requirements vary, however, according to an applicant's educational history. Employment experience, for example, is required for those with a counseling degree in a specialty other than rehabilitation. To maintain their certification, counselors must successfully retake the certification exam or complete 100 credit hours of acceptable continuing education every 5 years.

Other counseling organizations also offer certification in particular counseling specialties. Usually, becoming certified is voluntary, but having certification may enhance job prospects.

Prospects for advancement vary by counseling field. School counselors can become directors or supervisors of counseling, guidance, or pupil personnel services; or, usually with further graduate education, become counselor educators, counseling psychologists, or school administrators. (Psychologists and education administrators are covered elsewhere in the *Handbook*.) Some counselors choose to work for a State's department of education.

Some marriage and family therapists, especially those with doctorates in family therapy, become supervisors, teachers, researchers, or advanced clinicians in the discipline. Counselors may also become supervisors or administrators in their agencies. Some counselors move into research, consulting, or college teaching or go into private or group practice. Some may choose to pursue a doctoral degree to improve their chances for advancement.

Employment

Counselors held about 635,000 jobs in 2006. Employment was distributed among the counseling specialties as follows:

Educational, vocational, and school counselors	260,000
Rehabilitation counselors	141,000
Mental health counselors	100,000
Substance abuse and behavioral disorder counselors	83,000
Marriage and family therapists	25,000
Counselors, all other	27,000

Educational, vocational, and school counselors work primarily in elementary and secondary schools and colleges and universities. Other types of counselors work in a wide variety of public and private establishments, including healthcare facilities; job training, career development, and vocational rehabilitation centers; social agencies; correctional institutions; and residential care facilities, such as halfway houses for criminal offenders and group homes for children, the elderly, and the disabled. Some substance abuse and behavioral disorder counselors work in therapeutic communities where people with addictions live while undergoing treatment. Counselors also work in organizations engaged in community improvement and social change, drug and alcohol rehabilitation programs, and State and local government agencies.

A growing number of counselors are self-employed and work in group practices or private practice, due in part to new laws allowing counselors to be paid for their services by insurance companies and to the growing recognition that counselors are well-trained, effective professionals.

Job Outlook

Employment for counselors is expected to grow much faster than the average for all occupations through 2016. However, job growth will vary by location and occupational specialty.

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Counselors	21-1010	635,000	771,000	136,000	21
Substance abuse and behavioral disorder counselors	21-1011	83,000	112,000	29,000	34
Educational, vocational, and school counselors	21-1012	260,000	292,000	33,000	13
Marriage and family therapists	21-1013	25,000	32,000	7,400	30
Mental health counselors	21-1014	100,000	130,000	30,000	30
Rehabilitation counselors	21-1015	141,000	173,000	32,000	23
Counselors, all other	21-1019	27,000	32,000	4,500	17

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

Job prospects should be good due to growth and the need to replace people leaving the field.

Employment change. Overall employment of counselors is expected to increase by 21 percent between 2006 and 2016, which is much faster than the average for all occupations. However, growth is expected to vary by specialty.

Employment of substance abuse and behavioral disorder counselors is expected to grow 34 percent, which is much faster than the average for all occupations. As society becomes more knowledgeable about addiction, it is increasingly common for people to seek treatment. Furthermore, drug offenders are increasingly being sent to treatment programs rather than jail.

Employment for educational, vocational and school counselors is expected to grow 13 percent, which is about as fast as the average for all occupations. Demand for vocational or career counselors should grow as multiple job and career changes become common and as workers become increasingly aware of counseling services. In addition, State and local governments will employ growing numbers of counselors to assist beneficiaries of welfare programs who exhaust their eligibility and must find jobs. Other opportunities for employment of counselors will arise in private job-training centers that provide training and other services to laid-off workers and others seeking to acquire new skills or careers. Demand for school counselors may increase due in large part to increases in student enrollments at postsecondary schools and colleges and as more States require elementary schools to employ counselors. Expansion of the responsibilities of school counselors should also lead to increases in their employment. For example, counselors are becoming more involved in crisis and preventive counseling, helping students deal with issues ranging from drug and alcohol abuse to death and suicide. Although schools and governments realize the value of counselors in helping their students to achieve academic success, budget constraints at every school level will dampen job growth of school counselors. Federal grants and subsidies may help to offset tight budgets and allow the reduction in student-to-counselor ratios to continue.

Employment of mental health counselors is expected to grow by 30 percent, which is much faster than the average for all occupations. Mental health counselors will be needed to staff statewide networks that are being established to improve services for children and adolescents with serious emotional disturbances and for their families. Under managed care systems, insurance companies are increasingly providing for reimbursement of counselors as a less costly alternative to psychiatrists and psychologists.

Jobs for rehabilitation counselors are expected to grow by 23 percent, which is much faster than the average for all occupations. The number of people who will need rehabilitation counseling is expected to grow as advances in medical technology allow more people to survive injury or illness and live independently again. In addition, legislation requiring equal employment rights for people with disabilities will spur demand for counselors, who not only help these people make a transition to the workforce but also help companies to comply with the law.

Marriage and family therapists will experience growth of 30 percent, which is much faster than the average for all occupations. This is due in part to an increased recognition of the field. It is more common for people to seek help for their marital and family problems than it was in the past.

Job prospects. Job prospects vary greatly based on the occupational specialty. Prospects for rehabilitation counselors are excellent because many people are leaving the field or retiring. Furthermore, opportunities are very good in substance abuse and behavioral disorder counseling because relatively low wages and long hours make recruiting new entrants difficult. For school counselors, job prospects should be good because many people are leaving the occupation to retire; however, opportunities may be more favorable in rural and urban areas, rather than the suburbs, because it is often difficult to recruit people to these areas.

Earnings

Median annual earnings of wage and salary educational, vocational, and school counselors in May 2006 were $47,530. The middle 50 percent earned between $36,120 and $60,990. The lowest 10 percent earned less than $27,240, and the highest 10 percent earned more than $75,920. School counselors can earn additional income working summers in the school system or in other jobs. Median annual earnings in the industries employing the largest numbers of educational, vocational, and school counselors were as follows:

Elementary and secondary schools	$53,750
Junior colleges	48,240
Colleges, universities, and professional schools	41,780
Individual and family services	32,370
Vocational rehabilitation services	31,340

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Median annual earnings of wage and salary substance abuse and behavioral disorder counselors in May 2006 were $34,040. The middle 50 percent earned between $27,330 and $42,650. The lowest 10 percent earned less than $22,600, and the highest 10 percent earned more than $52,340.

Median annual earnings of wage and salary mental health counselors in May 2006 were $34,380. The middle 50 percent earned between $26,780 and $45,610. The lowest 10 percent earned less than $21,890, and the highest 10 percent earned more than $59,700.

Median annual earnings of wage and salary rehabilitation counselors in May 2006 were $29,200. The middle 50 percent earned between $22,980 and $39,000. The lowest 10 percent earned less than $19,260, and the highest 10 percent earned more than $53,170.

For substance abuse, mental health, and rehabilitation counselors, government employers generally pay the highest wages, followed by hospitals and social service agencies. Residential care facilities often pay the lowest wages.

Median annual earnings of wage and salary marriage and family therapists in May 2006 were $43,210. The middle 50 percent earned between $32,950 and $54,150. The lowest 10 percent earned less than $25,280, and the highest 10 percent earned more than $69,050. Median annual earnings were $36,020 in individual and family social services, the industry employing the largest number of marriage and family therapists.

Self-employed counselors who have well-established practices, as well as counselors employed in group practices, usually have the highest earnings.

Related Occupations

Counselors help people evaluate their interests, abilities, and disabilities and deal with personal, social, academic, and career problems. Others who help people in similar ways include teachers, social and human service assistants, social workers, psychologists, physicians and surgeons, registered nurses, occupational therapists, and human resources, training, and labor relations managers and specialists.

Sources of Additional Information

For general information about counseling, as well as information on specialties such as college, mental health, rehabilitation, multicultural, career, marriage and family, and gerontological counseling, contact:

➤ American Counseling Association, 5999 Stevenson Ave., Alexandria, VA 22304. Internet: **http://www.counseling.org**

For information on school counselors, contact:

➤ American School Counselors Association, 1101 King St., Suite 625, Alexandria, VA 22314.
Internet: **http://www.schoolcounselor.org**

For information on mental health counselors, contact:

➤ American Mental Health Counselors Association, 801 N. Fairfax Street, Suite 304, Alexandria, VA 22314.
Internet: **http://www.amhca.org**

For information on marriage and family therapists, contact:

➤ American Association for Marriage and Family Therapy, 112 South Alfred Street, Alexandria, VA 22314
Internet: **http://www.aamft.org**

For information on accredited counseling and related training programs, contact:

➤ Council for Accreditation of Counseling and Related Educational Programs, American Counseling Association, 5999 Stevenson Ave., 4th floor, Alexandria, VA 22304.
Internet: **http://www.cacrep.org**

For information on national certification requirements for counselors, contact:

➤ National Board for Certified Counselors, Inc, 3 Terrace Way, Suite D, Greensboro, NC 27403.
Internet: **http://www.nbcc.org**

State departments of education can supply information on colleges and universities offering guidance and counseling training that meets State certification and licensure requirements.

State employment service offices have information about job opportunities and entrance requirements for counselors.

Health Educators

(O*NET 21-1091.00)

Significant Points

- 5 out of 10 health educators work in health care and social assistance and an additional 2 out of 10 work in State and local government.
- A bachelor's degree is the minimum requirement for entry level jobs, but many employers prefer to hire workers with a master's degree.
- Rapid job growth is expected, but the relatively small number of jobs in this occupation will limit the number of job openings.

Nature of the Work

Health educators work to encourage healthy lifestyles and wellness through educating individuals and communities about behaviors that promote healthy living and prevent diseases and other health problems.

They attempt to prevent illnesses by informing and educating individuals and communities about health-related topics, such as proper nutrition, the importance of exercise, how to avoid sexually transmitted diseases, and the habits and behaviors necessary to avoid illness. They begin by assessing the needs of their audience, which includes determining which topics to cover and how to best present the information. For example, they may hold programs on self-examinations for breast cancer to women who are at higher risk or may teach classes on the effects of binge drinking to college students. Health educators must take the cultural norms of their audience into account. For example, programs targeted at the elderly need to be drastically different from those aimed at a college-aged population.

After assessing their audiences' needs, health educators must decide how to meet those needs. Health educators have a lot of options in putting together programs to that end. They may organize a lecture, class, demonstration or health screening, or create a video, pamphlet or brochure. Often, planning a pro-

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gram requires working with other people in a team or on a committee within the organization that employs them. Also, health educators must plan programs that are consistent with the goals and objectives of their employers. For example, many nonprofit organizations educate the public about just one disease or health issue and, therefore, limit their programs to cover topics related to that disease or issue.

Next, health educators need to implement their proposed plan. This may require finding funding by applying for grants, writing curriculums for classes, or creating written materials that would be made available to the public. Also, programs may require dealing with basic logistics problems, such as finding speakers or locations for the event.

Generally, after a program is presented, health educators evaluate its success. This could include tracking the absentee rate of employees from work and students from school, surveying participants on their opinions about the program, or other methods of collecting evidence that suggests whether the programs were effective. Through evaluation, they can improve plans for the future by learning from mistakes and capitalizing on strengths.

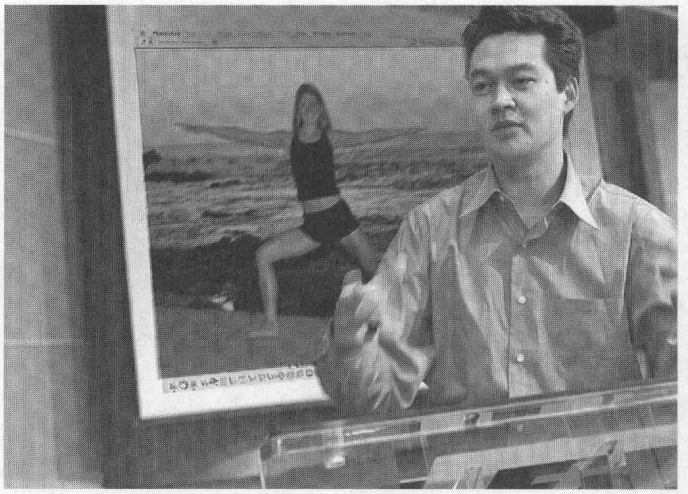
Although programming is a large part of their job, health educators also serve as a resource on health topics. This may include locating services, reference material and other resources that may be useful to the community they serve and referring individuals or groups to organizations or medical professionals.

The basic goals and duties of health educators are the same but their jobs vary greatly depending on the type of organization in which they work. Most health educators work in medical care settings, colleges and universities, schools, public health departments, nonprofit organizations, and private business.

Within medical care facilities, health educators tend to work one-on-one with patients and their families. Their goal in this setting is to educate individual patients on their diagnosis and how that may change or affect their lifestyle. Often, this includes explaining the necessary procedures or surgeries as well as how patients will need to change their lifestyles in order to manage their illness or return to full health. This may include directing patients to outside resources that may be useful in their transition, such as support groups, home health agencies or social services. Often, health educators work closely with physicians, nurses, and other staff to create educational programs or materials, such as brochures, Web sites, and classes, for other departments. In some cases, health educators train hospital staff about how to better interact with patients.

Health educators in colleges and universities work primarily with the student population. Generally, they create programs on topics that affect young adults, like sexual activity, smoking, and nutrition. They may need to alter their teaching methods to attract audiences to their events. For example, they might show a popular movies followed by a discussion or hold programs in dormitories or cafeterias. They may teach courses for credit or give lectures on health-related topics. Often they train students as peer educators, who then lead their own programs.

Health educators in schools are typically found in secondary schools, where they generally teach health class. They develop lesson plans that are relevant and age appropriate to their students. They may need to cover sensitive topics, like sexually transmitted diseases, alcohol and drugs. They may be required to be able to also teach another subject such as science or physical education. Sometimes they may develop the health education curriculum for the school or the entire school district. (For more information see the statement on secondary school teachers elsewhere in the *Handbook*.)



Health educators teach individuals and groups about topics related to a healthy lifestyle.

Heath educators in public health are employed primarily by State and local departments of public health and, therefore, administer State-mandated programs. They often serve as members of statewide councils or national committees on topics like aging. As part of this work, they inform other professionals in changes to health policy. They work closely with nonprofit organizations to help them get the resources they need, such as grants, to continue serving the community.

Health educators in nonprofits strive to get information out to the public on various health problems and make people aware of the resources their programs have to help people to the community. While some organizations target a particular audience, others educate the community regarding one disease or health issue. Therefore, in this setting, health educators may be limited in the topics they cover or the population they serve. Work in this setting may include creating print-based material for distribution to the community, often in conjunction with organizing lectures, health screenings, and activities related to increasing awareness.

In private industry, health educators create programs to inform the employees of an entire firm or organization. They organize programs that fit into workers' schedules by arranging lunchtime speakers or daylong health screenings so that workers may come when it is most convenient. Educators in this setting must align their work with the overall goals of their employers. For example, a health educator working for a medical supply company may hold a program related to the company's newest product.

Work environment. Health educators work in various environments based on the industry in which they work. In public health, nonprofit organizations, business work sites, colleges and universities, and medical care settings they work primarily in offices. However, they may spend a lot of time away

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from the office implementing and attending programs, meeting with community organizers, speaking with patients, or teaching classes. Health educators in schools spend the majority of their day in classrooms.

Health educators generally work 40 hour weeks. However, when programs, events, or meetings are scheduled they may need to work evening or weekends.

Training, Other Qualifications, and Advancement

A bachelor's degree is generally required for entry level health educator positions, but some employers prefer a bachelor's degree and some related experience gained through an internship or volunteer work. A master's degree may be required for some positions and is usually required for advancement. In addition, some employers may require candidates to be Certified Health Education Specialists.

Education and training. Entry level health educator positions generally require a bachelor's degree in health education. Over 250 colleges and universities offer bachelor's programs in health education or a similarly titled major. These programs teach students the theories of health education and develop the skills necessary to implement health education programs. Courses in psychology, human development, and a foreign language are helpful, and experience gained through an internship or other volunteer opportunities can make graduates more appealing to employers.

Graduate health education programs are often offered under titles such as community health education, school health education, or health promotion and lead to a Master of Arts, Master of Science, Master of Education, or a Master of Public Health degree. Many students pursue their master's in health education after majoring or working in another related field, such as nursing or psychology. A master's degree is required for most health educator positions in public health.

Once hired, on-the-job training for health educators varies greatly depending on the type and size of employer. State and local public health departments and other larger offices may have a formal training program, while smaller health education offices and departments may train new employees through less formal means, such as mentoring or working with more experienced staff. Some employers may require and pay for educators to take continuing education courses to keep their skills up-to-date.

Other qualifications. Health educators spend much of their time working with people and must be comfortable working with both individuals and large groups. They need to be good communicators and comfortable speaking in public as they may need to teach classes or give presentations. Health educators often work with a very diverse population so they must be sensitive to cultural differences and open to working with people of varied backgrounds. Health educators often create new programs or materials so they should be creative and skilled writers.

Certification and advancement. Health educators may choose to become a Certified Health Education Specialist, a credential offered by the National Commission of Health Education Credentialing, Inc. The certification is awarded after passing an examination on the basic areas of responsibility for a health educator. The exam is aimed at entry level educators who have already completed a degree in health education or are within 3 months of completion. In addition, to maintain certification, health educators must complete 75 hours of approved continuing education courses or seminars over a 5-year period. Some employers prefer to hire applicants who are certified and some States require health educators certification to work in a public health department.

A graduate degree is usually required to advance past an entry level position to jobs such as executive director, supervisor, or senior health educator. These positions may spend more time on planning and evaluating programs than on their implementation, but may require supervising other health educators who implement the programs. Health educators at this level may also work with other administrators of related programs. Some health educators pursue a doctoral degree in health education and may transfer to research positions or become professors of health education (see the statement on postsecondary teachers elsewhere in the *Handbook*)

Employment

Health educators held about 62,000 jobs in 2006. They work primarily in two industries with 20 percent working in State and local government and 53 percent working in health care and social assistance. In addition, a small percent of health educators work in grant-making services and social advocacy organizations.

Job Outlook

Employment of health educators is expected to grow much faster than the average for all occupations and job prospects are expected to be favorable.

Employment change. Employment of health educators is expected to grow by 26 percent, which is much faster than the average for all occupations. Growth will result from the rising cost of health care and the increased recognition of the need for qualified health educators.

The rising cost of healthcare has increased the need for health educators. As health care costs continue to rise, insurance companies, employers and governments are attempting to find ways to curb the cost. One of the more cost effective ways is to employ health educators to teach people how to live healthy lives and avoid costly treatments for illnesses. Awareness of the number of illnesses, such as lung cancer, HIV, heart disease

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Health educators	21-1091	62,000	78,000	16,000	26

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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and skin cancer, that may be avoided with lifestyle changes has increased. These diseases may be avoidable if the public better understands the effects of their behavior on their health. In addition, many illnesses, such as breast and testicular cancer are best treated with early detection so it is important for people to understand how to detect possible problems on their own. The need to provide the public with this information will result in State and local governments, hospitals, and businesses employing a growing number of health educators.

The emphasis on health education has been coupled with a growing demand for qualified health educators. In the past, it was thought that anyone could do the job of a health educator and the duties were often given to nurses or other healthcare professionals. However, in recent years, employers have recognized that those trained specifically in health education are better qualified to perform those duties. Therefore, demand for health professionals with a background specifically in health education has increased.

Demand for health educators will increase in most industries, but their employment may decrease in secondary schools. Many schools, facing budget cuts, ask teachers trained in other fields, like science or physical education, to teach the subject of health education.

Job prospects. Job prospects for health educators with bachelor's degrees will be favorable, but better for those who have acquired experience through internships or volunteer jobs. A graduate degree is preferred by many employers.

Earnings

Median annual earnings of health educators was $41,330 in May 2006; the middle 50 percent earned between $31,300 and $56,580. The lowest 10 percent earned less than $24,750, and the highest 10 percent earned more than $72,500.

Median annual earnings in the industries employing the largest numbers of health educators in May 2006 were as follows:

General medical and surgical hospitals	$40,890
State government	33,100
Local government	32,420
Outpatient care centers	27,530
Individual and family services	25,760

Related Occupations

Health educators work closely with people to alter their behavior. Other professions with similar skills include counselors, social workers, psychologists, teachers, social and human service assistances, and nurses.

Sources of Additional Information

For further information about health educators, contact:

➤ American Association for Health Education, 1900 Association Drive, Reston, VA 20191
Internet: **http://www.aahperd.org/aahe/**

For information on voluntary credentialing and job opportunities, contact:

➤ The National Commission for Health Education Credentialing, Inc. 1541 Alta Drive, Suite 303, Whitehall, PA 18052-5642 Internet: **http://www.nchec.org**

Probation Officers and Correctional Treatment Specialists

(O*NET 21-1092.00)

Significant Points

- State and local governments employ most of these workers.
- A bachelor's degree in social work, criminal justice, or a related field usually is required.
- Employment growth, which is projected to be as fast as the average, depends on government funding.
- Job opportunities are expected to be excellent.

Nature of the Work

Many people who are convicted of crimes are placed on probation instead of being sent to prison. People who have served time in prison are often released on parole. During probation and parole, offenders must stay out of trouble and meet various other requirements. Probation officers, parole officers, and correctional treatment specialists work with and monitor offenders to prevent them from committing new crimes.

Probation officers, who are called community supervision officers in some States, supervise people who have been placed on probation. *Correctional treatment specialists*, who may also be known as case managers, counsel offenders and create rehabilitation plans for them to follow when they are no longer in prison or on parole. *Parole officers* perform many of the same duties that probation officers perform. The difference is that parole officers supervise offenders who have been released from prison, whereas probation officers work with those who are sentenced to probation instead of prison. *Pretrial services officers* conduct pretrial investigations, the findings of which help determine whether suspects should be released before their trial.

Probation and parole officers supervise offenders on probation or parole through personal contact with the offenders and their families. Instead of requiring offenders to meet officers in their offices, many officers meet offenders in their homes and at their places of employment or therapy. Probation and parole agencies also seek the assistance of community organizations, such as religious institutions, neighborhood groups, and local residents, to monitor the behavior of many offenders. Some offenders are required to wear an electronic device so that probation officers can monitor their location and movements. Probation and parole officers may arrange for offenders to get substance abuse rehabilitation or job training. Probation officers usually work with either adults or juveniles exclusively. Only in small, usually rural, jurisdictions do probation officers counsel both adults and juveniles. In some States, the jobs of parole and probation officers are combined.

Probation officers also spend much of their time working for the courts. They investigate the backgrounds of the accused, write presentence reports, and recommend sentences. They review sentencing recommendations with offenders and their

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families before submitting them to the court. Probation officers may be required to testify in court as to their findings and recommendations. They also attend hearings to update the court on offenders' efforts at rehabilitation and compliance with the terms of their sentences.

Correctional treatment specialists work in jails, prisons, or parole or probation agencies. In jails and prisons, they evaluate the progress of inmates. They may evaluate inmates using questionnaires and psychological tests. They also work with inmates, probation officers, and other agencies to develop parole and release plans. Their case reports, which discuss the inmate's history and likelihood of committing another crime, are provided to the appropriate parole board when their clients are eligible for release. In addition, they plan education and training programs to improve offenders' job skills and provide them with coping, anger management, and drug and sexual abuse counseling either individually or in groups. They usually write treatment plans and summaries for each client. Correctional treatment specialists working in parole and probation agencies perform many of the same duties as their counterparts who work in correctional institutions.

The number of cases a probation officer or correctional treatment specialist handles at one time depends on the needs of offenders and the risks they pose. Higher risk offenders and those who need more counseling usually command more of the officer's time and resources. Caseload size also varies by agency jurisdiction. Consequently, officers may handle from 20 to more than 100 active cases at a time.

Computers, telephones, and fax machines enable the officers to handle the caseload. Probation officers may telecommute from their homes. Other technological advancements, such as electronic monitoring devices and drug screening, also have assisted probation officers and correctional treatment specialists in supervising and counseling offenders.

Pretrial services officers conduct pretrial investigations, the findings of which help determine whether suspects should be released before their trial. When suspects are released before their trial, pretrial services officers supervise them to make sure they adhere to the terms of their release and that they show up for trial. In the Federal courts system, probation officers perform the functions of pretrial services officers.

Work environment. Probation officers and correctional treatment specialists work with criminal offenders, some of whom may be dangerous. In the course of supervising offenders, they usually interact with many other individuals, such as family members and friends of their clients, who may be angry, upset, or difficult to work with. Workers may be assigned to fieldwork in high-crime areas or in institutions where there is a risk of violence or communicable disease.

Probation officers and correctional treatment specialists are required to meet many court-imposed deadlines, which contribute to heavy workloads. In addition, extensive travel and fieldwork may be required to meet with offenders who are on probation or parole. Workers may be required to carry a firearm or other weapon for protection. They also may be required to collect and transport urine samples of offenders for drug testing. All of these factors make for a stressful work environment. Although the high stress levels can make these jobs very difficult at times, this work also can be very rewarding. Many workers obtain personal satisfaction from counseling members of their community and helping them become productive citizens.



Most probation officers and correctional treatment specialists work in State or local government.

Probation officers and correctional treatment specialists generally work a 40-hour week, but some may work longer. They may be on call 24 hours a day to supervise and assist offenders at any time.

Training, Other Qualifications, and Advancement

Qualifications vary by agency, but a bachelor's degree is usually required. Most employers require candidates to pass oral, written, and psychological examinations.

Education and training. A bachelor's degree in social work, criminal justice, psychology, or a related field is usually required. Some employers require a master's degree in criminal justice, social work, psychology, or a related field for candidates who do not have previous related experience. Different employers have different requirements for what counts as related experience. It may include work in probation, pretrial services, parole, corrections, criminal investigations, substance abuse treatment, social work, or counseling.

Most probation officers and some correctional treatment specialists are required to complete a training program sponsored by their State government or the Federal Government, after which a certification test may be required. Most probation officers and correctional treatment specialists work as trainees or on a probationary period for up to a year before being offered a permanent position.

Other qualifications. Applicants usually take written, oral, psychological, and physical examinations. Prospective probation officers or correctional treatment specialists should be in good physical and emotional condition. Most agencies require applicants to be at least 21 years old and, for Federal employment, not older than 37. Those convicted of felonies may not be eligible for employment in this occupation.

Familiarity with the use of computers often is required due to the increasing use of computer technology in probation and parole work. Candidates also should be knowledgeable about laws and regulations pertaining to corrections. Probation officers and correctional treatment specialists should have strong writing skills because they are required to prepare many reports.

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Probation officers and correctional treatment specialists	21-1092	94,000	105,000	10,000	11

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

They should also have excellent listening and interpersonal skills to work effectively with offenders.

Advancement. A typical agency has several levels of probation and parole officers and correctional treatment specialists, as well as supervisors. Advancement is primarily based on length of experience and performance. A graduate degree, such as a master's degree in criminal justice, social work, or psychology, may be helpful for advancement.

Employment

Probation officers and correctional treatment specialists held about 94,000 jobs in 2006. Most jobs are in State or local governments. In some States, the State government employs all probation officers and correctional treatment specialists; in other States, local governments are the only employers. In still other States, both levels of government employ these workers. Jobs are more plentiful in urban areas. In the Federal Government, probation officers are employed by the U.S. courts, and correctional treatment specialists are employed by the U.S. Department of Justice's Bureau of Prisons.

Job Outlook

Employment of probation officers and correctional treatment specialists is projected to grow as fast as the average for all occupations through 2016. Job opportunities are expected to be excellent.

Employment change. Employment of probation officers and correctional treatment specialists is projected to grow 11 percent between 2006 and 2016, as fast as the average for all occupations. Mandatory sentencing guidelines calling for longer sentences and reduced parole for inmates have resulted in a large increase in the prison population. However, mandatory sentencing guidelines are being reconsidered in many States because of budgetary constraints, court decisions, and doubts about the guidelines' effectiveness. Instead, there may be more emphasis in many States on rehabilitation and alternate forms of punishment, such as probation, spurring demand for probation and parole officers and correctional treatment specialists. Additionally, there will be a need for parole officers to supervise the large numbers of people who are currently incarcerated and will be released from prison.

However, the job outlook depends primarily on the amount of government funding that is allocated to corrections, and especially to probation systems. Although community supervision is far less expensive than keeping offenders in prison, a change in political trends toward more imprisonment and away from community supervision could result in reduced employment opportunities.

Job prospects. In addition to openings due to growth, many openings will be created by replacement needs, especially openings due to the large number of these workers who are expected to retire. This occupation is not attractive to some potential entrants due to relatively low earnings, heavy workloads, and high stress. For these reasons, job opportunities are expected to be excellent.

Earnings

Median annual earnings of probation officers and correctional treatment specialists in May 2006 were $42,500. The middle 50 percent earned between $33,880 and $56,280. The lowest 10 percent earned less than $28,000, and the highest 10 percent earned more than $71,160. In May 2006, median annual earnings for probation officers and correctional treatment specialists employed in State government were $42,970; those employed in local government earned $43,100. Higher wages tend to be found in urban areas.

Related Occupations

Probation officers and correctional treatment specialists counsel criminal offenders while they are in prison or on parole. Other occupations that involve similar responsibilities include social workers, social and human service assistants, and counselors.

Probation officers and correctional treatment specialists also play a major role in maintaining public safety. Other occupations related to corrections and law enforcement include police and detectives, correctional officers, and firefighting occupations.

Sources of Additional Information

For information about criminal justice job opportunities in your area, contact your State's department of corrections, criminal justice, or probation.

Further information about probation officers and correctional treatment specialists is available from:

➤ American Probation and Parole Association, P.O. Box 11910, Lexington, KY 40578. Internet: **http://www.appa-net.org**

Social and Human Service Assistants

(O*NET 21-1093.00)

Significant Points

- A bachelor's degree usually is not required for these jobs, but employers increasingly seek individuals with relevant work experience or education beyond high school.
- Employment is projected to grow much faster than average for all occupations.
- Job opportunities should be excellent, particularly for applicants with appropriate postsecondary education, but wages remain low.

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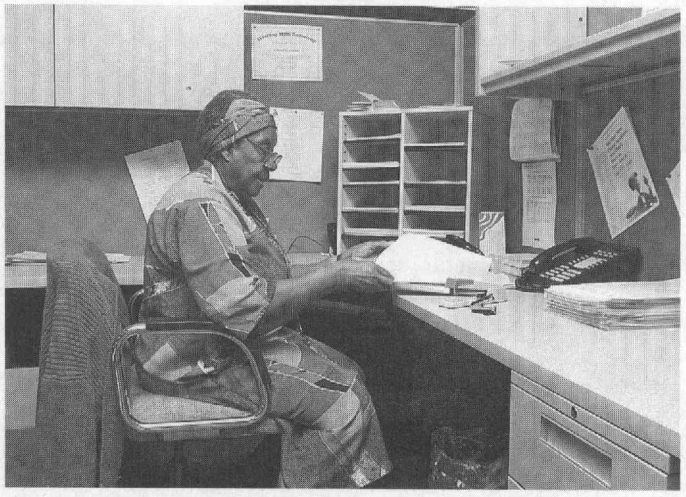
Nature of the Work

Social and human service assistants help social workers, health care workers, and other professionals to provide services to people. Social and human service assistant is a generic term for workers with a wide array of job titles, including human service worker, case management aide, social work assistant, community support worker, mental health aide, community outreach worker, life skills counselor, or gerontology aide. They usually work under the direction of workers from a variety of fields, such as nursing, psychiatry, psychology, rehabilitative or physical therapy, or social work. The amount of responsibility and supervision they are given varies a great deal. Some have little direct supervision—they may run a group home, for example. Others work under close direction.

Social and human service assistants provide services to clients to help them improve their quality of life. They assess clients' needs, investigate their eligibility for benefits and services such as food stamps, Medicaid, or welfare, and help to obtain them. They also arrange for transportation and escorts, if necessary, and provide emotional support. Social and human service assistants monitor and keep case records on clients and report progress to supervisors and case managers.

Social and human service assistants play a variety of roles in a community. They may organize and lead group activities, assist clients in need of counseling or crisis intervention, or administer food banks or emergency fuel programs, for example. In halfway houses, group homes, and government-supported housing programs, they assist adults who need supervision with personal hygiene and daily living skills. They review clients' records, ensure that they take their medication, talk with family members, and confer with medical personnel and other caregivers to provide insight into clients' needs. Social and human service assistants also give emotional support and help clients become involved in community recreation programs and other activities.

In psychiatric hospitals, rehabilitation programs, and outpatient clinics, social and human service assistants work with psychiatrists, psychologists, social workers, and others to help clients master everyday living skills, communicate more effectively, and live well with others. They support the client's participation in a treatment plan, such as individual or group counseling or occupational therapy.



Social and human service assistants help clients apply for benefits and services, like food stamps or welfare.

The work, while satisfying, can be emotionally draining. Understaffing and relatively low pay may add to the pressure.

Work environment. Working conditions of social and human service assistants vary. Some work in offices, clinics, and hospitals, while others work in group homes, shelters, sheltered workshops, and day programs. Traveling to see clients is also required for some jobs. Sometimes working with clients can be dangerous even though most agencies do everything they can to ensure their workers' safety. Most assistants work 40 hours a week; some work in the evening and on weekends.

Training, Other Qualifications, and Advancement

A bachelor's degree is not required for most jobs in this occupation, but employers increasingly seek individuals with relevant work experience or education beyond high school.

Education and training. Many employers prefer to hire people with some education beyond high school. Certificates or associate degrees in subjects such as human services, gerontology or one of the social or behavioral sciences meet many employers' requirements. Some jobs may require a bachelor's or master's degree in human services or a related field, such as counseling, rehabilitation, or social work.

Human services degree programs have a core curriculum that trains students to observe patients and record information, conduct patient interviews, implement treatment plans, employ problem-solving techniques, handle crisis intervention matters, and use proper case management and referral procedures. Many programs utilize field work to give students hands-on experience. General education courses in liberal arts, sciences, and the humanities also are part of most curriculums. Most programs also offer specialized courses related to addictions, gerontology, child protection, and other areas. Many degree programs require completion of a supervised internship.

The level of education workers have often influenced the kind of work they are assigned and the degree of responsibility that is given to them. For example, workers with no more than a high school education are likely to receive extensive on-the-job training to work in direct-care services, helping clients to fill out paperwork, for example. Workers with a college degree, however, might do supportive counseling, coordinate program activities, or manage a group home. Social and human service assistants with proven leadership ability, especially from paid or volunteer experience in social services, often have greater autonomy in their work. Regardless of the academic or work background of employees, most employers provide some form of in-service training to their employees such as seminars and workshops.

Other qualifications. These workers should have a strong desire to help others, effective communication skills, a sense of responsibility, and the ability to manage time effectively. Many human services jobs involve direct contact with people who are vulnerable to exploitation or mistreatment; so patience and understanding are also highly valued characteristics.

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Social and human service assistants	21-1093	339,000	453,000	114,000	34

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

It is becoming more common for employers to require a criminal background check, and in some settings, workers may be required to have a valid driver's license.

Advancement. Formal education is almost always necessary for advancement. In general, advancement to case management, rehabilitation, or social work jobs requires a bachelor's or master's degree in human services, counseling, rehabilitation, social work, or a related field.

Employment

Social and human service assistants held about 339,000 jobs in 2006. Over 60 percent were employed in the health care and social assistance industries. Nearly 3 in 10 were employed by State and local governments, primarily in public welfare agencies and facilities for mentally disabled and developmentally challenged individuals.

Job Outlook

Employment of social and human service assistants is expected to grow by nearly 34 percent through 2016. Job prospects are expected to be excellent, particularly for applicants with appropriate postsecondary education.

Employment change. The number of social and human service assistants is projected to grow by nearly 34 percent between 2006 and 2016, which is much faster than the average for all occupations. This occupation will have a very large number of new jobs arise, about 114,000 over the projections decade. Faced with rapid growth in the demand for social and human services, many employers increasingly rely on social and human service assistants.

Demand for social services will expand with the growing elderly population, who are more likely to need adult day care, meal delivery programs, support during medical crises, and other services. In addition, more social and human service assistants will be needed to provide services to pregnant teenagers, people who are homeless, people who are mentally disabled or developmentally challenged, and people who are substance abusers.

Job training programs are also expected to require additional social and human service assistants. As social welfare policies shift focus from benefit-based programs to work-based initiatives, there will be more demand for people to teach job skills to the people who are new to, or returning to, the workforce.

Residential care establishments should face increased pressures to respond to the needs of the mentally and physically disabled. The number of people who are disabled is increasing, and many need help to care for themselves. More community-based programs and supportive independent-living sites are expected to be established to house and assist the homeless and the mentally and physically disabled. Furthermore, as substance abusers are increasingly being sent to treatment programs instead of prison, employment of social and human service assistants in substance abuse treatment programs also will grow.

Opportunities are expected to be good in private social service agencies. Employment in private agencies will grow as State and local governments continue to contract out services to the private sector in an effort to cut costs. Also, some private agencies have been employing more social and human service assistants in place of social workers, who are more educated and more highly paid.

The number of jobs for social and human service assistants in local governments will grow but not as fast as employment for social and human service assistants in other industries. Employment in the public sector may fluctuate with the level of funding provided by State and local governments and with the number of services contracted out to private organizations.

Job prospects. Job prospects for social and human service assistants are expected to be excellent, particularly for individuals with appropriate education after high school. Job openings will come from job growth, but also from the need to replace workers who advance into new positions, retire, or leave the workforce for other reasons. There will be more competition for jobs in urban areas than in rural ones, but qualified applicants should have little difficulty finding employment.

Earnings

Median annual earnings of social and human service assistants were $25,580 in May 2006. The middle 50 percent earned between $20,350 and $32,440. The top 10 percent earned more than $40,780, while the lowest 10 percent earned less than $16,180.

Median annual earnings in the industries employing the largest numbers of social and human service assistants in May 2006 were:

Local government	$30,510
State government	29,810
Individual and family services	24,490
Vocational rehabilitation services	22,530
Residential mental retardation, mental health and substance abuse facilities	22,380

Related Occupations

Workers in other occupations that require skills similar to those of social and human service assistants include social workers, clergy, counselors, child care workers; occupational therapist assistants and aides, physical therapist assistants and aides, and nursing, psychiatric, and home health aides.

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Sources of Additional Information

For information on programs and careers in human services, contact:

➤ Council for Standards in Human Services Education, PMB 703, 1050 Larrabee Avenue, Suite 104, Bellingham, WA 98225-7367. Internet: **http://www.cshse.org**

➤ National Organization for Human Services, 90 Madison Street, Suite 206, Denver, CO 80206.
Internet: **http://www.nationalhumanservices.org**

Information on job openings may be available from State employment service offices or directly from city, county, or State departments of health, mental health and mental retardation, and human resources.

Social Workers

(O*NET 21-1021.00, 21-1022.00, 21-1023.00, 21-1029.99)

Significant Points

- Employment is projected to grow much faster than average.
- About 5 out of 10 jobs were in health care and social assistance industries and 3 in 10 work for State and local government agencies.
- While a bachelor's degree is the minimum requirement, a master's degree in social work or a related field has become the standard for many positions.
- Competition for jobs is expected in cities, but opportunities should be good in rural areas.

Nature of the Work

Social work is a profession for those with a strong desire to help improve people's lives. Social workers assist people by helping them cope with issues in their everyday lives, deal with their relationships, and solve personal and family problems. Some social workers help clients who face a disability or a life-threatening disease or a social problem, such as inadequate housing, unemployment, or substance abuse. Social workers also assist families that have serious domestic conflicts, sometimes involving child or spousal abuse. Some social workers conduct research, advocate for improved services, engage in systems design or are involved in planning or policy development. Many social workers specialize in serving a particular population or working in a specific setting.

Child, family, and school social workers provide social services and assistance to improve the social and psychological functioning of children and their families and to maximize the well-being of families and the academic functioning of children. They may assist single parents, arrange adoptions, or help find foster homes for neglected, abandoned, or abused children. Some specialize in services for senior citizens. These social workers may run support groups for the children of aging parents; advise elderly people or family members about housing, transportation, long-term care, and other services; and coordinate and monitore these services. Through employee assistance programs, social workers may help people cope with job-related pressures or with personal problems that affect the quality of their work.

In schools, social workers often serve as the link between students' families and the school, working with parents, guardians, teachers, and other school officials to ensure students reach their academic and personal potential. In addition, they address problems such as misbehavior, truancy, and teenage pregnancy and advise teachers on how to cope with difficult students. Increasingly, school social workers teach workshops to entire classes.

Child, family, and school social workers may also be known as child welfare social workers, family services social workers, child protective services social workers, occupational social workers, or gerontology social workers. They often work for individual and family services agencies, schools, or State or local governments.

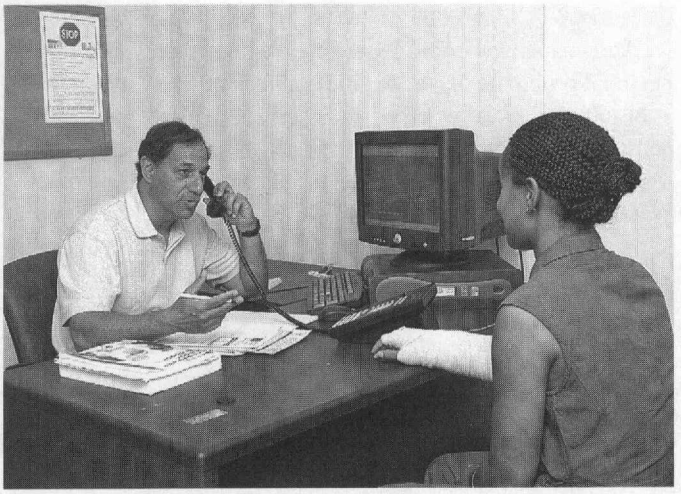
Medical and public health social workers provide psychosocial support to people, families, or vulnerable populations so they can cope with chronic, acute, or terminal illnesses, such as Alzheimer's disease, cancer, or AIDS. They also advise family caregivers, counsel patients, and help plan for patients' needs after discharge from hospitals. They may arrange for at-home services, such as meals-on-wheels or home care. Some work on interdisciplinary teams that evaluate certain kinds of patients—geriatric or organ transplant patients, for example. Medical and public health social workers may work for hospitals, nursing and personal care facilities, individual and family services agencies, or local governments.

Mental health and substance abuse social workers assess and treat individuals with mental illness or substance abuse problems, including abuse of alcohol, tobacco, or other drugs. Such services include individual and group therapy, outreach, crisis intervention, social rehabilitation, and teaching skills needed for everyday living. They also may help plan for supportive services to ease clients' return to the community. Mental health and substance abuse social workers are likely to work in hospitals, substance abuse treatment centers, individual and family services agencies, or local governments. These social workers may be known as clinical social workers. (Counselors and psychologists, who may provide similar services, are discussed elsewhere in the *Handbook*.)

Other types of social workers include social work administrators, planners and policymakers, who develop and implement programs to address issues such as child abuse, homelessness, substance abuse, poverty, and violence. These workers research and analyze policies, programs, and regulations. They identify social problems and suggest legislative and other solutions. They may help raise funds or write grants to support these programs.

Work environment. Social workers usually spend most of their time in an office or residential facility, but they also may travel locally to visit clients, meet with service providers, or attend meetings. Some may meet with clients in one of several offices within a local area. Social work, while satisfying, can be challenging. Understaffing and large caseloads add to the pressure in some agencies. To tend to patient care or client needs, many hospitals and long-term care facilities employ social workers on teams with a broad mix of occupations, including clinical specialists, registered nurses, and health aides. Full-time social

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Social workers help clients with problems such as unemployment, life-threatening illnesses, or substance abuse.

workers usually work a standard 40-hour week, but some occasionally work evenings and weekends to meet with clients, attend community meetings, and handle emergencies. Some work part time, particularly in voluntary nonprofit agencies.

Training, Other Qualifications, and Advancement

A bachelor's degree is the minimum requirement for entry into the occupation, but many positions require an advanced degree. All States and the District of Columbia have some licensure, certification, or registration requirement, but the regulations vary.

Education and training. A bachelor's degree in social work (BSW) is the most common minimum requirement to qualify for a job as a social worker; however, majors in psychology, sociology, and related fields may qualify for some entry-level jobs, especially in small community agencies. Although a bachelor's degree is sufficient for entry into the field, an advanced degree has become the standard for many positions. A master's degree in social work (MSW) is typically required for positions in health settings and is required for clinical work as well. Some jobs in public and private agencies also may require an advanced degree, such as a master's degree in social services policy or administration. Supervisory, administrative, and staff training positions usually require an advanced degree. College and university teaching positions and most research appointments normally require a doctorate in social work (DSW or Ph.D.).

As of 2006, the Council on Social Work Education accredited 458 bachelor's programs and 181 master's programs. The Group for the Advancement of Doctoral Education listed 74 doctoral programs in social work (DSW or Ph.D.) in the United States. Bachelor's degree programs prepare graduates for direct service positions, such as caseworker, and include courses in social work values and ethics, dealing with a culturally diverse clientele and at-risk populations, promotion of social and economic justice, human behavior and the social environment, social welfare policy and services, social work practice, social research methods, and field education. Accredited programs require a minimum of 400 hours of supervised field experience.

Master's degree programs prepare graduates for work in their chosen field of concentration and continue to develop the skills required to perform clinical assessments, manage large caseloads, take on supervisory roles, and explore new ways of drawing upon social services to meet the needs of clients. Master's programs last 2 years and include a minimum of 900 hours of supervised field instruction or internship. A part-time program may take 4 years. Entry into a master's program does not require a bachelor's degree in social work, but courses in psychology, biology, sociology, economics, political science, and social work are recommended. In addition, a second language can be very helpful. Most master's programs offer advanced standing for those with a bachelor's degree from an accredited social work program.

Licensure. All States and the District of Columbia have licensing, certification, or registration requirements regarding social work practice and the use of professional titles. Although standards for licensing vary by State, a growing number of States are placing greater emphasis on communications skills, professional ethics, and sensitivity to cultural diversity issues. Most States require 2 years (3,000 hours) of supervised clinical experience for licensure of clinical social workers.

Other qualifications. Social workers should be emotionally mature, objective, and sensitive to people and their problems. They must be able to handle responsibility, work independently, and maintain good working relationships with clients and coworkers. Volunteer or paid jobs as a social work aide can help people test their interest in this field.

Certification and advancement. The National Association of Social Workers offers voluntary credentials. Social workers with a master's degree in social work may be eligible for the Academy of Certified Social Workers (ACSW), the Qualified Clinical Social Worker (QCSW), or the Diplomate in Clinical Social Work (DCSW) credential, based on their professional experience. Credentials are particularly important for those in private practice; some health insurance providers require social workers to have them in order to be reimbursed for services.

Advancement to supervisor, program manager, assistant director, or executive director of a social service agency or department usually requires an advanced degree and related work experience. Other career options for social workers include teaching, research, and consulting. Some of these workers also help formulate government policies by analyzing and advocating policy positions in government agencies, in research institutions, and on legislators' staffs.

Some social workers go into private practice. Most private practitioners are clinical social workers who provide psychotherapy, usually paid for through health insurance or by the client themselves. Private practitioners must have at least a master's degree and a period of supervised work experience. A network of contacts for referrals also is essential. Many private practitioners split their time between working for an agency or hospital and working in their private practice. They may continue to hold a position at a hospital or agency in order to receive health and life insurance.

Employment

Social workers held about 595,000 jobs in 2006. About 5 out of 10 jobs were in health care and social assistance industries and 3 out of 10 are employed by State and local government agencies. Although most social workers are employed in cities or suburbs,

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some work in rural areas. Employment by type of social worker in 2006, follows:

Child, family, and school social workers	282,000
Medical and public health social workers	124,000
Mental health and substance abuse social workers	122,000
Social workers, all other	66,000

Job Outlook

Employment for social workers is expected grow much faster than the average for all occupations through 2016. Job prospects are expected to be favorable, particularly for social workers who specialize in the aging population or work in rural areas.

Employment change. Employment of social workers is expected to increase by 22 percent during the 2006-16 decade, which is much faster than the average for all occupations. The growing elderly population and the aging baby boom generation will create greater demand for health and social services, resulting in rapid job growth among gerontology social workers. Employment of social workers in private social service agencies also will increase. However, agencies increasingly will restructure services and hire more social and human service assistants, who are paid less, instead of social workers. Employment in State and local government agencies may grow somewhat in response to growing needs for public welfare, family services, and child protective services, but many of these services will be contracted out to private agencies. Employment levels in public and private social services agencies may fluctuate, depending on need and government funding levels.

Opportunities for social workers in private practice will expand, but growth may be somewhat hindered by restrictions that managed care organizations put on mental health services. The growing popularity of employee assistance programs is expected to spur demand for private practitioners, some of whom provide social work services to corporations on a contractual basis. However, the popularity of employee assistance programs will fluctuate with the business cycle because businesses are not likely to offer these services during recessions.

Employment of child, family and school social workers is expected to grow by 19 percent, which is faster than the average for all occupations. One of the major contributing factors is the rise in the elderly population. Social workers, particularly family social workers, will be needed to assist in finding the best care for the aging and to support their families. Furthermore, demand for school social workers will increase and lead to more jobs as efforts are expanded to respond to rising student enrollments as well as the continued emphasis on integrating disabled children into the general school population. There could be competition for school social work jobs in some areas because of the limited number of openings. The availability of Federal, State, and local funding will be a major factor in determining the actual job growth in schools. The demand for child and family social workers may also be tied to the availability of government funding.

Mental health and substance abuse social workers will grow by 29 percent, which is much faster than the average, over the 2006-16 decade. In particular, social workers specializing in substance abuse will experience strong demand. Substance abusers are increasingly being placed into treatment programs instead of being sentenced to prison. Also, growing numbers of the substance abusers sentenced to prison or probation are, increasingly being required by correctional systems to have substance abuse treatment added as a condition to their sentence or probation. As this trend grows, demand will strengthen for treatment programs and social workers to assist abusers on the road to recovery.

Growth of medical and public health social workers is expected to be 24 percent, which is much faster than the average for all occupations. Hospitals continue to limit the length of patient stays, so the demand for social workers in hospitals will grow more slowly than in other areas. But hospitals are releasing patients earlier than in the past, so social worker employment in home health care services is growing. However, the expanding senior population is an even larger factor. Employment opportunities for social workers with backgrounds in gerontology should be good in the growing numbers of assisted-living and senior-living communities. The expanding senior population also will spur demand for social workers in nursing homes, long-term care facilities, and hospices. However, in these settings other types of workers are often being given tasks that were previously done by social workers.

Job prospects. Job prospects are generally expected to be favorable. Many job openings will stem from growth and the need to replace social workers who leave the occupation. However, competition for social worker jobs is expected in cities, where training programs for social workers are prevalent. Opportunities should be good in rural areas, which often find it difficult to attract and retain qualified staff. By specialty, job prospects may be best for those social workers with a background in gerontology and substance abuse treatment.

Earnings

Median annual earnings of child, family, and school social workers were $37,480 in May 2006. The middle 50 percent earned between $29,590 and $49,060. The lowest 10 percent earned

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Social workers	21-1020	595,000	727,000	132,000	22
Child, family, and school social workers	21-1021	282,000	336,000	54,000	19
Medical and public health social workers	21-1022	124,000	154,000	30,000	24
Mental health and substance abuse social workers	21-1023	122,000	159,000	37,000	30
Social workers, all other	21-1029	66,000	78,000	12,000	18

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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less than $24,480, and the top 10 percent earned more than $62,530. Median annual earnings in the industries employing the largest numbers of child, family, and school social workers in May 2006 were:

Elementary and secondary schools	$48,360
Local government	43,500
State government	39,000
Individual and family services	32,680
Other residential care facilities	32,590

Median annual earnings of medical and public health social workers were $43,040 in May 2006. The middle 50 percent earned between $34,110 and $53,740. The lowest 10 percent earned less than $27,280, and the top 10 percent earned more than $64,070. Median annual earnings in the industries employing the largest numbers of medical and public health social workers in May 2006 were:

General medical and surgical hospitals	$48,420
Home health care services	44,470
Local government	41,590
Nursing care facilities	38,550
Individual and family services	35,510

Median annual earnings of mental health and substance abuse social workers were $35,410 in May 2006. The middle 50 percent earned between $27,940 and $45,720. The lowest 10 percent earned less than $22,490, and the top 10 percent earned more than $57,630. Median annual earnings in the industries employing the largest numbers of mental health and substance abuse social workers in May 2006 were:

Local government	$39,550
Psychiatric and substance abuse hospitals	39,240
Individual and family services	34,920
Residential mental retardation, mental health and substance abuse facilities	30,590
Outpatient mental health and substance abuse centers	34,290

Median annual earnings of social workers, all other were $43,580 in May 2006. The middle 50 percent earned between $32,530 and $56,420. The lowest 10 percent earned less than $25,540, and the top 10 percent earned more than $68,500. Median annual earnings in the industries employing the largest numbers of social workers, all other in May 2006 were:

Local government	$46,330
State government	45,070
Individual and family services	35,150

About 20 percent of social workers are members of a union. Many belong to the union that represents workers in other occupations at their place of employment.

Related Occupations

Through direct counseling or referral to other services, social workers help people solve a range of personal problems. Workers in occupations with similar duties include the clergy, counselors, probation officers and correctional treatment specialists, psychologists, and social and human services assistants.

Sources of Additional Information

For information about career opportunities in social work and voluntary credentials for social workers, contact:

➤ National Association of Social Workers, 750 First St.N.E., Suite 700, Washington, DC 20002-4241. Internet: **http://www.socialworkers.org**

For a listing of accredited social work programs, contact:

➤ Council on Social Work Education, 1725 Duke St., Suite 500, Alexandria, VA 22314-3457. Internet: **http://www.cswe.org**

Information on licensing requirements and testing procedures for each State may be obtained from State licensing authorities, or from:

➤ Association of Social Work Boards, 400 South Ridge Pkwy., Suite B, Culpeper, VA 22701. Internet: **http://www.aswb.org**

Legal Occupations

Court Reporters

(O*NET 23-2091.00)

Significant Points

- Job prospects are expected to be excellent, especially for those with certification.
- Demand for real-time broadcast captioning and translating will spur employment growth.
- The amount of training required to become a court reporter varies by specialization; licensure requirements vary by State.

Nature of the Work

Court reporters usually create verbatim transcripts of speeches, conversations, legal proceedings, meetings, and other events. Sometimes written accounts of spoken words are necessary for correspondence, records, or legal proof, and court reporters provide those accounts. They play a critical role not only in judicial proceedings, but also 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

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reporters provide closed-captioning and real-time translating services to the deaf and hard-of-hearing community.

There are several methods of court reporting. The most common method is called stenographic. Using a stenotype machine, stenotypists document all statements made in official proceedings. The machine allows them to press multiple keys at once to record combinations of letters representing sounds, words, or phrases. These symbols are electronically recorded and then translated and displayed as text in a process called computer-aided transcription (CAT). In real-time court reporting, the stenotype machine is linked to computers for real-time captioning, often of television programs. As the reporter keys in the symbols, the spoken word instantly appear as text on the screen.

Another method of court reporting is electronic reporting. This method uses audio equipment to record court proceedings. The court reporter monitors the process, takes notes to identify speakers, and listens to the recording to ensure clarity and quality. The equipment used may include analog tape recorders or digital equipment. Electronic reporters and transcribers often are responsible for producing a written transcript of the recorded proceeding.

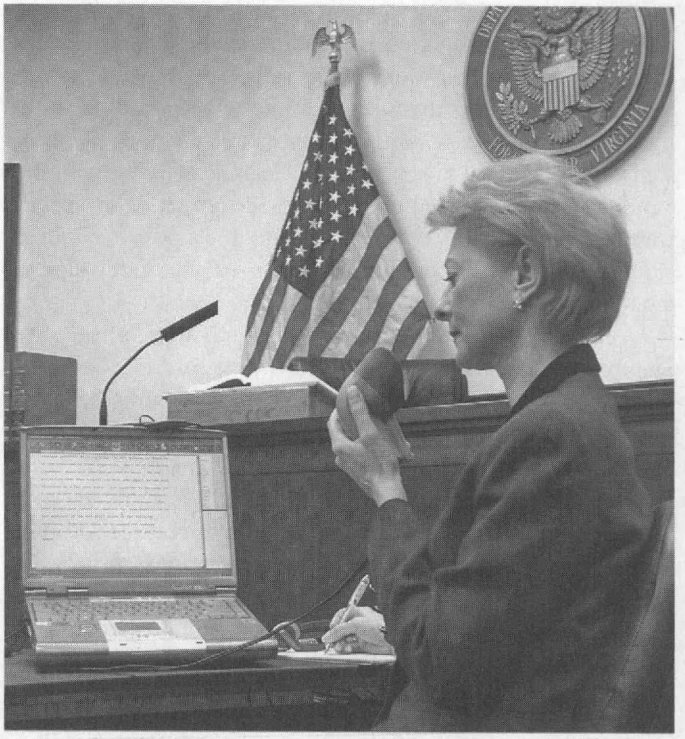
Yet another method of court reporting is voice writing. Using the voice-writing method, a court reporter speaks directly into a voice silencer—a hand-held mask containing a microphone. As the reporter repeats the testimony into the recorder, the mask prevents the reporter from being heard during testimony.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

Court reporters are responsible for a number of duties both before and after transcribing events. Stenographic or voice writing reporters must create and maintain the computer dictionary that they use to translate their keystroke codes or voice 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, stenographic reporters must edit the computer-generated translation for correct grammar. All reporters are responsible for accurate identification of proper names and places. Electronic reporters ensure that the record or testimony is discernible. Reporters usually prepare written transcripts, make copies, and provide information from the transcript to courts, counsels, parties, and the public on request. Court reporters also develop procedures for easy storage and retrieval of all stenographic notes, voice files, commonly referred to as "stenograms", or audio recordings in paper or digital format.

Although many court reporters record official proceedings in the courtroom, others work outside the courts. For example, court reporters—called webcasters—capture sales meetings, press conferences, product introductions, and technical training seminars and instantly transmit them to all parties involved via computers. As participants speak into telephones or microphones, the words appear on all of the participants' computer monitors simultaneously. 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 who specialize in captioning live television programming for people with hearing loss are commonly known as broadcast captioners. They work for television networks or cable stations, captioning news, emergency broadcasts, sporting events, and other programming.

A version of the captioning process that allows reporters to provide more personalized services for deaf and hard-of-hearing people is Communication Access Real-time Translation (CART). CART reporters often work with hard-of-hearing students and people who are learning English as a second language, captioning high school and college classes and providing transcripts at the end of the sessions. CART reporters also accompany deaf clients to events, including conventions, doctor appointments, or wherever communication access is needed. CART providers increasingly furnish this service remotely, as an Internet or phone connection allows for immediate communication access regardless of location. With CART and broadcast captioning, the level of understanding gained by a person with hearing loss depends entirely on the skill of the court reporter. In an emergency, such as a tornado or a hurricane, people's safety may depend on the accuracy of information provided in the form of captioning.

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-enabled voice writers pursue not only court reporting careers, but also careers as closed captioners, CART reporters for hearing-impaired individuals, and Internet streaming text providers or caption providers.



Stenographic or voice writing reporters create and maintain the computer dictionary that they use to translate their keystroke codes or voice files into written text.

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Work environment. 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 strain. Workers also risk repetitive stress 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, and they often work additional hours at home preparing transcripts. Self-employed court reporters, or freelancers, usually work flexible hours, including part time, evenings, and weekends, or they may be on call.

Training, Other Qualifications, and Advancement

The amount of training required to become a court reporter varies by specialization. Licensure requirements vary by State.

Education and training. 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 novice voice writer, although it takes at least two years to become proficient at realtime voice writing. Electronic reporters and transcribers learn their skills on the job. The average length of time it takes to become a realtime stenotypist is 33 months. Training is offered by about 130 postsecondary vocational and technical schools and colleges. The National Court Reporters Association (NCRA) has certified about 70 programs, all of which offer courses in stenotype computer-aided transcription and real-time reporting. NCRA-certified programs require students to capture a minimum of 225 words per minute, a requirement for Federal Government employment as well.

Electronic court reporters use audio-capture technology and, therefore, usually learn their skills on the job. Students read manuals, review them with their trainers, and observe skilled electronic transcribers perform procedures. Court electronic transcribers generally obtain initial technical training from a vendor when it is placed in service, with further court-specific training provided on the job. If working for a private company or organization, hands-on training occurs under direct supervision of an established practitioner or firm.

Licensure. Some States require voice writers to pass a test and to earn State licensure. As a substitute for State licensure, the National Verbatim Reporters Association offers three national certifications to voice writers: Certified Verbatim Reporter (CVR), Certificate of Merit (CM), and Real-Time Verbatim Reporter (RVR). Earning these certifications is sufficient to be licensed in States where the voice method of court reporting is permitted. Candidates for the first certification—the CVR—must pass a written test of spelling, punctuation, vocabulary, legal and medical terminology and three 5-minute dictation and transcription examinations that test for speed, accuracy, and silence. The second certification, the CM, requires additional levels of speed, knowledge, and accuracy. The RVR certification measures the candidate's skill at real-time transcription, judicial reporting, CART provision, and captioning, including Webcasting. 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.

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 test administered by a board of examiners.

Other qualifications. In addition to possessing speed and accuracy, court reporters must have excellent listening skills and hearing, good English grammar and vocabulary, and punctuation skills. 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. Voice writers must learn to listen and speak simultaneously and very quickly and quietly, while also identifying speakers and describing peripheral activities in the courtroom or deposition room.

Certification and advancement. Certifications can help court reporters get jobs and advance in their careers. Several associations offer certifications for different types of reporters.

The National Court Reporters Association 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 court reporter may obtain additional certifications that demonstrate higher levels of experience and competency, such as Registered Merit Reporter (RMR) or Registered Diplomate Reporter (RDR). The NCRA also offers the designations Certified Realtime Reporter (CRR), Certified Broadcast Captioner (CBC), and Certified CART Provider (CCP), designed primarily for those who caption media programs or assist people who are deaf.

With experience and education, court reporters can also receive certification in administrative and management, consulting, or teaching positions.

The United States Court Reporters Association offers another voluntary certification designation, the Federal Certified Realtime Reporter (FCRR), for court reporters working in Federal courts. The exam is designed to test the basic real-time skills of Federal court reporters and is recognized by the Administrative Office for the United States District Courts for purposes of real-time certification.

The American Association of Electronic Reporters and Transcribers (AAERT) certifies electronic court reporters. Certification is voluntary and includes a written and a practical examination. To be eligible to take the exams, candidates must have at least 2 years of court reporting or transcribing experience, must be eligible for notary public commissions in their States, and must have completed high school. AAERT offers three types of certificates—Certified Electronic Court Reporter (CER), Certified Electronic Court Transcriber (CET), and Certified Electronic Court Reporter and Transcriber (CERT). Some employ-

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ers may require electronic court reporters and transcribers to obtain certificates once they are eligible.

Employment

Court reporters held about 19,000 jobs in 2006. More than half 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 were employed by court reporting agencies. Around 8 percent of court reporters were self-employed.

Job Outlook

Employment is projected to grow much faster than the average, reflecting the demand for real-time broadcast captioning and translating. Job opportunities should be excellent, especially for those with certification.

Employment change. Employment of court reporters is projected to grow 25 percent, much faster than the average for all occupations between 2006 and 2016. Demand for court reporter services will be spurred by the continuing need for accurate transcription of proceedings in courts and in pretrial depositions, by the growing need to create captions for live television, and by the need to provide other real-time broadcast captioning and translating services for the deaf and hard-of-hearing.

Increasing numbers of civil and criminal cases are expected to create new jobs for court reporters, but budget constraints are expected to limit the ability of Federal, State, and local courts to expand, and thereby also limit the demand for traditional court reporting services in courtrooms and other legal venues. Further, because of the difficulty in attracting court reporters and in efforts to control costs, many courtrooms have installed tape recorders that are maintained by electronic court reporters and transcribers to record court proceedings. However, because courts use electronic reporters and transcribers only in a limited capacity traditional stenographic court reporters will continue to be used in felony trials and other proceedings. Despite the use of audiotape and videotape technology, court reporters can quickly turn spoken words into readable, searchable, permanent text, and they will continue to be needed to produce written legal transcripts and proceedings for publication.

Voice writers have become more widely accepted as the accuracy of speech recognition technology improves. Still, many courts allow only stenotypists to perform court reporting duties.

In addition, more court reporters will be needed to caption outside of legal proceedings. Not only is there Federal legislation mandating that all new television programming be captioned for the deaf and hard-of-hearing, all new Spanish-language programming likewise must be captioned by 2010. 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. These factors are expected to continue to increase the demand for court reporters who provide CART services. Although these services forgo transcripts and differ from traditional court reporting, they require the same skills that court reporters learn in their training.

Job prospects. Job opportunities for court reporters are expected to be excellent as job openings continue to outnumber jobseekers in some areas. Court reporters with certification and those who choose to specialize in providing CART, broadcast captioning, and or webcasting services should have the best job opportunities. The favorable job market reflects the fact that fewer people are entering this profession, particularly as stenographic typists.

Earnings

Wage and salary court reporters had median annual earnings of $45,610 in May 2006. The middle 50 percent earned between $33,160 and $61,530. The lowest paid 10 percent earned less than $23,430, and the highest paid 10 percent earned more than $77,770. Median annual earnings in May 2006 were $45,080 for court reporters working in local government and $41,720 for those working in business support services.

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. Official court reporters earn a salary and a per-page fee for transcripts. Many salaried court reporters supplement their income by doing freelance work. Freelance court reporters are paid per job and receive a per-page fee for transcripts. CART providers are paid by the hour. Captioners receive a salary and benefits if they work as employees of a captioning company; Captioners working as independent contractors are paid by the hour.

Related Occupations

Workers in several other occupations also type, record information, and process paperwork. Among these are secretaries and administrative assistants; medical transcriptionists; data entry and information processing workers; receptionists and information clerks; and human resources assistants, except payroll and timekeeping. Other workers who provide legal support include paralegals and legal assistants.

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:

➤ American Association of Electronic Reporters and Transcribers, 23812 Rock Circle, Bothell, WA 98021. Internet: **http://www.aaert.org**

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Court reporters	23-2091	19,000	24,000	4,700	25

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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➤ National Court Reporters Association, 8224 Old Courthouse Rd., Vienna, VA 22182.
Internet: **http://www.ncraonline.org**
➤ National Verbatim Reporters Association, 207 Third Ave., Hattiesburg, MS 39401. Internet: **http://www.nvra.org**
➤ United States Court Reporters Association, 4731 N. Western Ave., Chicago, IL 60625-2012.
Internet: **http://www.uscra.org**

Judges, Magistrates, and Other Judicial Workers

(O*NET 23-1021.00, 23-1022.00, 23-1023.00)

Significant Points

- A bachelor's degree and work experience are the minimum requirements for a judgeship or magistrate position, but most workers have law degrees, and some are elected.
- Overall employment is projected to grow more slowly than average, but varies by occupational specialty.
- Judges and magistrates are expected encounter competition for jobs because of the prestige associated with serving on the bench.

Nature of the Work

Judges, magistrates, and other judicial workers apply the law and oversee the legal process in courts. They preside over cases concerning every aspect of society, from traffic offenses to disputes over the management of professional sports to issues concerning the rights of huge corporations. All judicial workers must ensure that trials and hearings are conducted fairly and that the court safeguards the legal rights of all parties involved.

The most visible responsibility of judges is presiding over trials or hearings and listening as attorneys represent their clients. Judges rule on the admissibility of evidence and the methods of conducting testimony, and they may be called on to settle disputes between opposing attorneys. Also, they ensure that rules and procedures are followed, and if unusual circumstances arise for which standard procedures have not been established, judges interpret the law to determine how the trial will proceed.

Judges often hold pretrial hearings for cases. They listen to allegations and determine whether the evidence presented merits a trial. In criminal cases, judges may decide that people charged with crimes should be held in jail pending trial, or they may set conditions for their release. In civil cases, judges and magistrates occasionally impose restrictions on the parties until a trial is held.

In many trials, juries are selected to decide guilt or innocence in criminal cases or liability and compensation in civil cases. Judges instruct juries on applicable laws, direct them to deduce the facts from the evidence presented, and hear their verdict. When the law does not require a jury trial or when the parties waive their right to a jury, judges decide cases. In such instances, the judge determines guilt in criminal cases and imposes sentences on the guilty; in civil cases, the judge awards relief—such as compensation for damages—to the winning parties to the lawsuit.

Judges also work outside the courtroom in their chambers or private offices. There, judges read documents on pleadings and motions, research legal issues, write opinions, and oversee the court's operations. In some jurisdictions, judges also manage the courts' administrative and clerical staff.

Judges' duties vary according to the extent of their jurisdictions and powers. *General trial court judges* of the Federal and State court systems have jurisdiction over any case in their system. They usually try civil cases transcending the jurisdiction of lower courts and all cases involving felony offenses. Federal and State *appellate court judges*, although few in number, have the power to overrule decisions made by trial court or *administrative law judges*. Appellate court judges overrule decisions if they determine that legal errors were made in a case or if legal precedent does not support the judgment of the lower court. Appellate court judges rule on a small number of cases and rarely have direct contact with litigants—the people who bring the case or who are on trial. Instead, they usually base their decisions on the lower court's records and on lawyers' written and oral arguments.

Many State court judges only hear certain types of cases. A variety of titles are assigned to these judges; among the most common are *municipal court judge, county court judge, magistrate*, and *justice of the peace*. Traffic violations, misdemeanors, small-claims cases, and pretrial hearings constitute the bulk of the work of these judges, but some States allow them to handle cases involving domestic relations, probate, contracts, and other selected areas of the law.

Administrative law judges, sometimes called *hearing officers or adjudicators*, are employed by government agencies to make determinations for administrative agencies. These judges make decisions, for example, on a person's eligibility for various Social Security or workers' compensation benefits, on protection of the environment, on the enforcement of health and safety regulations, on employment discrimination, and on compliance with economic regulatory requirements.

Some people work as arbitrators, mediators, or conciliators instead of as judges or magistrates. They assist with alternative dispute resolution—processes used to settle disputes outside of court. All hearings are private and confidential, and the processes are less formal than a court trial. If no settlement is reached, no statements made during the proceedings are admissible as evidence in any subsequent litigation.

There are two types of arbitration—compulsory and voluntary. During compulsory arbitration, opposing parties submit their dispute to one or more impartial persons, called arbitrators, for a final and nonbinding decision. Either party may reject the ruling and request a trial in court. Voluntary arbitration is a process in which opposing parties choose one or more arbitrators to hear their dispute and submit a final, binding decision.

Arbitrators usually are attorneys or business people with expertise in a particular field. The parties identify, in advance,

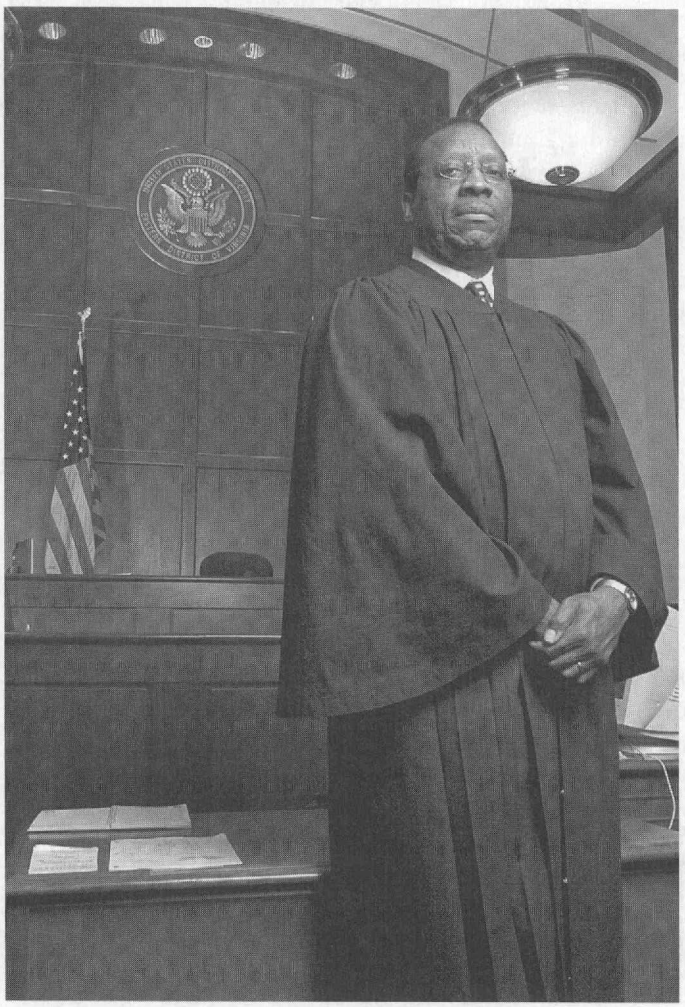
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the issues to be resolved by arbitration, the scope of the relief to be awarded, and many of the procedural aspects of the process.

Mediators are neutral parties who help people to resolve their disputes outside of court. People often use mediators when they wish to preserve their relationship. A mediator may offer suggestions, but resolution of the dispute rests with the parties themselves. Mediation proceedings also are confidential and private. If the parties are unable to reach a settlement, they are free to pursue other options. The parties usually decide in advance how they will share the cost of mediation. However, many mediators volunteer their services, or they may be court staff. Courts ask that mediators provide their services at the lowest possible rate and that parties split the cost.

Conciliation, or facilitation, is similar to mediation. The conciliator's role is to guide the parties to a settlement. The parties must decide in advance whether they will be bound by the conciliator's recommendations.

Work environment. Judges, magistrates, and other judicial workers do most of their work in offices, law libraries, and courtrooms. Work in these occupations presents few hazards, although sitting in the same position in the courtroom for long periods can be tiring. Most judges wear robes when they are in a courtroom. Judges typically work a standard 40-hour week, but many work more than 50 hours per week. Some judges with limited jurisdiction are employed part time and divide their time between their judicial responsibilities and other careers.



Judges preside over cases concerning every aspect of society, from traffic offenses to disputes over the management of professional sports.

Arbitrators, mediators, and conciliators usually work in private offices or meeting rooms; no public record is made of the proceedings. Arbitrators, mediators, and conciliators often travel to a site chosen for negotiations, but some work from their home. Arbitrators, mediators, and conciliators usually work a standard 35- to 40-hour week. However, longer hours might be necessary when contract agreements are being prepared and negotiated.

Training, Other Qualifications, and Advancement

A bachelor's degree and work experience usually constitute the minimum requirements for judges and magistrates, but most workers have law degrees, and some are elected. Training requirements for arbitrators, mediators, and conciliators vary.

Education and training. Most judges have first been lawyers. In fact, Federal and State judges usually are required to be lawyers, which means that they have attended law school and passed an examination. About 40 States allow nonlawyers to hold limited-jurisdiction judgeships, but opportunities are better for those with law experience.

Federal administrative law judges must be lawyers and pass a competitive examination administered by the U.S. Office of Personnel Management. Some State administrative law judges and other hearing officials are not required to be lawyers.

All States have some type of orientation for newly elected or appointed judges. The Federal Judicial Center, American Bar Association, National Judicial College, and National Center for State Courts provide judicial education and training for judges and other judicial-branch personnel. General and continuing education courses usually last from a few days to 3 weeks. More than half of all States, as well as Puerto Rico, require judges to take continuing education courses while serving on the bench.

Training for arbitrators, mediators, and conciliators is available through independent mediation programs, national and local mediation membership organizations, and postsecondary schools. To practice in State-funded or court-funded mediation programs, mediators usually must meet specific training or experience standards, which vary by State and court. Most mediators complete a 40-hour basic course and a 20-hour advanced training course. Some people receive training by volunteering at a community mediation center or co-mediating cases with an experienced mediator. Others go on to complete an advanced degree or certificate program in conflict resolution at a college or university. Degrees in public policy, law, and related fields also provide good background for prospective arbitrators, mediators, and conciliators.

Licensure. There are no national credentials or licensure requirements for arbitrators, mediators, and conciliators. In fact, State regulatory requirements vary widely. Some States require arbitrators to be experienced lawyers. Some States "license" mediators while other States "register" or "certify." Currently, only four States—Florida, New Hampshire, Texas,

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and Virginia—have certification programs. Increasingly, credentialing programs are being offered through professional organizations. For example, the American Arbitration Association requires mediators listed on its mediation panel to complete their training course, receive recommendations from the trainers, and complete an apprenticeship.

Other qualifications. Judges and magistrates must be appointed or elected. That often takes political support. Federal administrative law judges are appointed by various Federal agencies, with virtually lifetime tenure. Federal magistrate judges are appointed by district judges—the life-tenured Federal judges of district courts—to serve in a U.S. district court for 8 years. A part-time Federal magistrate judge's term of office is 4 years. Some State judges are appointed, but the remainder are elected in partisan or nonpartisan State elections. Many State and local judges serve fixed renewable terms ranging from 4 or 6 years for some trial court judgeships to as long as 14 years or even life for other trial or appellate court judgeships. Judicial nominating commissions, composed of members of the bar and the public, are used to screen candidates for judgeships in many States and for some Federal judgeships.

Advancement. Some judicial workers move to higher courts or courts with broader jurisdiction. Advancement for alternative dispute workers includes taking on more complex cases or starting a business.

Employment

Judges, magistrates, and other judicial workers held 51,000 jobs in 2006. Judges, magistrates, and magistrate judges held 27,000 jobs, all in State and local governments. Administrative law judges, adjudicators, and hearing officers held 15,000 jobs, with 59 percent in State governments, 22 percent in the Federal Government, and 19 percent in local governments. Arbitrators, mediators, and conciliators held another 8,500 jobs. Approximately 29 percent worked for State and local governments. The remainder worked for labor organizations, law offices, insurance carriers, and other private companies and for organizations that specialize in providing dispute resolution services.

Job Outlook

Overall employment is projected to grow more slowly than average, but varies by specialty. Judges and magistrates are expected encounter competition for jobs because of the prestige associated with serving on the bench.

Employment change. Overall employment of judges, magistrates, and other judicial workers is expected to grow 4 percent over the 2006-16 projection decade, slower than the average for all occupations. Budgetary pressures at all levels of government are expected to hold down the hiring of judges, despite rising caseloads, particularly in Federal courts. However, the continued need to cope with crime and settle disputes, as well as the public's willingness to go to court to settle disputes, should spur demand for judges. Also, economic growth is expected to lead to more business contracts and transactions and, thus, more legal disputes.

Demographic shifts in the population will also spur demand for judges. For instance, the number of immigrants migrating to the U.S. will continue to rise, thereby increasing the demand for judges to handle the complex issues of immigrant legal status. Demand for judges will also increase because as the American population ages, the courts are expected to reform guardianship policies and practices and develop new strategies to address elder abuse. Both the quantity and the complexity of judges' work have increased because of developments in information technology, medical science, electronic commerce, and globalization.

Employment of arbitrators, mediators, and conciliators is expected to grow about as fast as the average for all occupations through 2016. Many individuals and businesses try to avoid litigation, which can involve lengthy delays, high costs, unwanted publicity, and ill will. Arbitration and other alternatives to litigation usually are faster, less expensive, and more conclusive, spurring demand for the services of arbitrators, mediators, and conciliators. Demand also will continue to increase for arbitrators, mediators, and conciliators as all jurisdictions now have some type of alternative dispute resolution program. Some jurisdictions have programs requiring disputants to meet with a mediator, in certain circumstances, such as when attempting to resolve child custody issues.

Job prospects. The prestige associated with serving on the bench will ensure continued competition for judge and magistrate positions. However, a growing number of candidates choose to forgo the bench and work in the private sector, where pay may be significantly higher. This movement may lessen the competition somewhat. Most job openings will arise as judges retire. However, additional openings will occur when new judgeships are authorized by law or when judges are elevated to higher judicial offices.

Earnings

Judges, magistrate judges, and magistrates had median annual earnings of $101,690 in May 2006. The middle 50 percent earned between $53,920 and $135,010. The top 10 percent earned more than $145,600, while the bottom 10 percent

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Judges, magistrates, and other judicial workers	23-1020	51,000	53,000	2,300	4
Administrative law judges, adjudicators, and hearing officers	23-1021	15,000	15,000	0	0
Arbitrators, mediators, and conciliators	23-1022	8,500	9,400	900	11
Judges, magistrate judges, and magistrates	23-1023	27,000	29,000	1,400	5

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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earned less than $29,540. Median annual earnings in the industries employing the largest numbers of judges, magistrate judges, and magistrates in May 2006 were $117,760 in State government and $74,630 in local government. Administrative law judges, adjudicators, and hearing officers earned a median of $72,600, and arbitrators, mediators, and conciliators earned a median of $49,490.

In the Federal court system, the Chief Justice of the U.S. Supreme Court earned $212,100 in 2006, and the Associate Justices earned $203,000. Federal court of appeals judges earned $175,100 a year, while district court judges had salaries of $165,200, as did judges in the Court of Federal Claims and the Court of International Trade. Federal judges with limited jurisdiction, such as magistrates and bankruptcy judges, had salaries of $151,984.

According to a 2006 survey by the National Center for State Courts, salaries of chief justices of State high courts averaged $142,264 and ranged from $102,466 to $200,613. Annual salaries of associate justices of the State highest courts averaged $136,810 and ranged from $100,884 to $184,300. Salaries of State intermediate appellate court judges averaged $132,102 and ranged from $101,612 to $172,452. Salaries of State judges of general jurisdiction trial courts averaged $122,559 and ranged from $94,093 to $168,100.

Most salaried judges are provided health, life, and dental insurance; pension plans; judicial immunity protection; expense accounts; vacation, holiday, and sick leave; and contributions to retirement plans made on their behalf. In many States, judicial compensation committees, which make recommendations on the amount of salary increases, determine judicial salaries. States without commissions have statutes that regulate judicial salaries, link judicial salaries to the increases in pay for Federal judges, or adjust annual pay according to the change in the Consumer Price Index, calculated by the U.S. Bureau of Labor Statistics.

Related Occupations

Legal training and mediation skills are useful to those in many other occupations, including counselors; lawyers; paralegals and legal assistants; title examiners, abstractors, and searchers; law clerks; and detectives and criminal investigators.

Sources of Additional Information

Information on judges, magistrates, and other judicial workers may be obtained from:

➤ National Center for State Courts, 300 Newport Ave., Williamsburg, VA 23185-4147.
Internet: **http://www.ncsconline.org**

Information on arbitrators, mediators, and conciliators may be obtained from:

➤ American Arbitration Association, 1633 Broadway, Floor 10, New York, NY 10019. Internet: **http://www.adr.org**

Information on Federal judges can be found at:

➤ Administrative Office of the United States Courts, One Columbus Circle, NE., Washington, DC 20544.
Internet: **http://www.uscourts.gov**

Lawyers

(O*NET 23-1011.00)

Significant Points

- About 27 percent of lawyers are self-employed, either as partners in law firms or in solo practices.
- Formal requirements to become a lawyer usually include a 4-year college degree, 3 years of law school, and passing a written bar examination; however, some requirements may vary by State.
- Competition for admission to most law schools is intense.
- Competition for job openings should be keen because of the large number of students graduating from law school each year.

Nature of the Work

The legal system affects nearly every aspect of our society, from buying a home to crossing the street. Lawyers form the backbone of this system, linking it to society in numerous ways. They hold positions of great responsibility and are obligated to adhere to a strict code of ethics.

Lawyers, also called *attorneys*, act as both advocates and advisors in our society. As advocates, they represent one of the parties in criminal and civil trials by presenting evidence and arguing in court to support their client. As advisors, lawyers counsel their clients about their legal rights and obligations and suggest particular courses of action in business and personal matters. Whether acting as an advocate or an advisor, all attorneys research the intent of laws and judicial decisions and apply the law to the specific circumstances faced by their clients.

The more detailed aspects of a lawyer's job depend upon his or her field of specialization and position. Although all lawyers are licensed to represent parties in court, some appear in court more frequently than others. Trial lawyers, who specialize in trial work, must be able to think quickly and speak with ease and authority. In addition, familiarity with courtroom rules and strategy is particularly important in trial work. Still, trial lawyers spend the majority of their time outside the courtroom, conducting research, interviewing clients and witnesses, and handling other details in preparation for a trial.

Lawyers may specialize in a number of areas, such as bankruptcy, probate, international, elder, or environmental law. Those specializing in environmental law, for example, may represent interest groups, waste disposal companies, or construction firms in their dealings with the U.S. Environmental Protection Agency and other Federal and State agencies. These lawyers help clients prepare and file for licenses and applications for approval before certain activities may occur. Some lawyers specialize in the growing field of intellectual property, helping to protect clients' claims to copyrights, artwork under contract, product designs, and computer programs. Other lawyers advise insurance companies about the legality of insurance transactions, guiding

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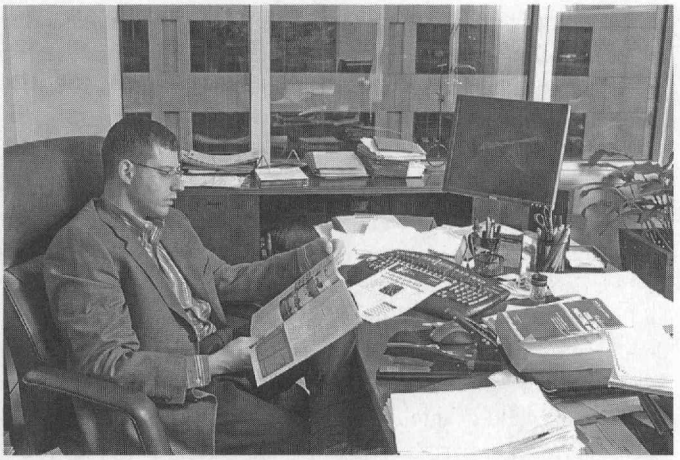
the company in writing insurance policies to conform to the law and to protect the companies from unwarranted claims. When claims are filed against insurance companies, these attorneys review the claims and represent the companies in court.

Most lawyers are in private practice, concentrating on criminal or civil law. In criminal law, lawyers represent individuals who have been charged with crimes and argue their cases in courts of law. Attorneys dealing with civil law assist clients with litigation, wills, trusts, contracts, mortgages, titles, and leases. Other lawyers handle only public-interest cases—civil or criminal—concentrating on particular causes and choosing cases that might have an impact on the way law is applied. Lawyers are sometimes employed full time by a single client. If the client is a corporation, the lawyer is known as "house counsel" and usually advises the company concerning legal issues related to its business activities. These issues might involve patents, government regulations, contracts with other companies, property interests, or collective bargaining agreements with unions.

A significant number of attorneys are employed at the various levels of government. Some work for State attorneys general, prosecutors, and public defenders in criminal courts. At the Federal level, attorneys investigate cases for the U.S. Department of Justice and other agencies. Government lawyers also help develop programs, draft and interpret laws and legislation, establish enforcement procedures, and argue civil and criminal cases on behalf of the government.

Other lawyers work for legal aid societies—private, nonprofit organizations established to serve disadvantaged people. These lawyers generally handle civil, rather than criminal, cases.

Lawyers increasingly use various forms of technology to perform more efficiently. Although all lawyers continue to use law libraries to prepare cases, most supplement conventional printed sources with computer sources, such as the Internet and legal databases. Software is used to search this legal literature automatically and to identify legal texts relevant to a specific case. In litigation involving many supporting documents, lawyers may use computers to organize and index material. Lawyers must be geographically mobile and able to reach their clients in a timely matter, so they might use electronic filing, web and videoconferencing, and voice-recognition technology to share information more effectively.



Lawyers use law libraries and other sources, such as the Internet and legal databases, to prepare cases.

Work environment. Lawyers do most of their work in offices, law libraries, and courtrooms. They sometimes meet in clients' homes or places of business and, when necessary, in hospitals or prisons. They may travel to attend meetings, gather evidence, and appear before courts, legislative bodies, and other authorities. They may also face particularly heavy pressure when a case is being tried. Preparation for court includes understanding the latest laws and judicial decisions.

Salaried lawyers usually have structured work schedules. Lawyers who are in private practice may work irregular hours while conducting research, conferring with clients, or preparing briefs during nonoffice hours. Lawyers often work long hours; of those who work full time, about 37 percent work 50 hours or more per week.

Training, Other Qualifications, and Advancement

Formal requirements to become a lawyer usually include a 4-year college degree, 3 years of law school, and passing a written bar examination; however, some requirements may vary by State. Competition for admission to most law schools is intense. Federal courts and agencies set their own qualifications for those practicing before or in them.

Education and training. Becoming a lawyer usually takes 7 years of full-time study after high school—4 years of undergraduate study, followed by 3 years of law school. Law school applicants must have a bachelor's degree to qualify for admission. To meet the needs of students who can attend only part time, a number of law schools have night or part-time divisions.

Although there is no recommended "prelaw" undergraduate major, prospective lawyers should develop proficiency in writing and speaking, reading, researching, analyzing, and thinking logically—skills needed to succeed both in law school and in the law. Regardless of major, a multidisciplinary background is recommended. Courses in English, foreign languages, public speaking, government, philosophy, history, economics, mathematics, and computer science, among others, are useful. Students interested in a particular aspect of law may find related courses helpful. For example, prospective patent lawyers need a strong background in engineering or science, and future tax lawyers must have extensive knowledge of accounting.

Acceptance by most law schools depends on the applicant's ability to demonstrate an aptitude for the study of law, usually through undergraduate grades, the Law School Admission Test (LSAT), the quality of the applicant's undergraduate school, any prior work experience, and sometimes, a personal interview. However, law schools vary in the weight they place on each of these and other factors.

All law schools approved by the American Bar Association require applicants to take the LSAT. As of 2006, there were 195 ABA-accredited law schools; others were approved by State authorities only. Nearly all law schools require applicants to have certified transcripts sent to the Law School Data Assembly Service, which then submits the applicants' LSAT scores and their standardized records of college grades to the law schools of their choice. The Law School Admission Council administers both this service and the LSAT. Competition for admission to many law schools—especially the most prestigious ones—is

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usually intense, with the number of applicants greatly exceeding the number that can be admitted.

During the first year or year and a half of law school, students usually study core courses, such as constitutional law, contracts, property law, torts, civil procedure, and legal writing. In the remaining time, they may choose specialized courses in fields such as tax, labor, or corporate law. Law students often gain practical experience by participating in school-sponsored legal clinics; in the school's moot court competitions, in which students conduct appellate arguments; in practice trials under the supervision of experienced lawyers and judges; and through research and writing on legal issues for the school's law journals.

A number of law schools have clinical programs in which students gain legal experience through practice trials and projects under the supervision of lawyers and law school faculty. Law school clinical programs might include work in legal aid offices, for example, or on legislative committees. Part-time or summer clerkships in law firms, government agencies, and corporate legal departments also provide valuable experience. Such training can lead directly to a job after graduation and can help students decide what kind of practice best suits them. Law school graduates receive the degree of *juris doctor* (J.D.), a first professional degree.

Advanced law degrees may be desirable for those planning to specialize, research, or teach. Some law students pursue joint degree programs, which usually require an additional semester or year of study. Joint degree programs are offered in a number of areas, including business administration or public administration.

After graduation, lawyers must keep informed about legal and nonlegal developments that affect their practices. In 2006, 43 States and jurisdictions required lawyers to participate in mandatory continuing legal education. Many law schools and State and local bar associations provide continuing education courses that help lawyers stay abreast of recent developments. Some States allow continuing education credits to be obtained through participation in seminars on the Internet.

Licensure. To practice law in the courts of any State or other jurisdiction, a person must be licensed, or admitted to its bar, under rules established by the jurisdiction's highest court. All States require that applicants for admission to the bar pass a written bar examination; most States also require applicants to pass a separate written ethics examination. Lawyers who have been admitted to the bar in one State occasionally may be admitted to the bar in another without taking another examination if they meet the latter jurisdiction's standards of good moral character and a specified period of legal experience. In most cases, however, lawyers must pass the bar examination in each State in which they plan to practice. Federal courts and agencies set their own qualifications for those practicing before or in them.

To qualify for the bar examination in most States, an applicant must earn a college degree and graduate from a law school accredited by the American Bar Association (ABA) or the proper State authorities. ABA accreditation signifies that the law school, particularly its library and faculty, meets certain standards. With certain exceptions, graduates of schools not approved by the ABA are restricted to taking the bar examination and practicing in the State or other jurisdiction in which the school is located; most of these schools are in California.

Although there is no nationwide bar examination, 48 States, the District of Columbia, Guam, the Northern Mariana Islands, Puerto Rico, and the Virgin Islands require the 6-hour Multistate Bar Examination (MBE) as part of their overall bar examination; the MBE is not required in Louisiana or Washington. The MBE covers a broad range of issues, and sometimes a locally prepared State bar examination is given in addition to it. The 3-hour Multistate Essay Examination (MEE) is used as part of the bar examination in several States. States vary in their use of MBE and MEE scores.

Many States also require Multistate Performance Testing to test the practical skills of beginning lawyers. Requirements vary by State, although the test usually is taken at the same time as the bar exam and is a one-time requirement.

In 2007, law school graduates in 52 jurisdictions were required to pass the Multistate Professional Responsibility Examination (MPRE), which tests their knowledge of the ABA codes on professional responsibility and judicial conduct. In some States, the MPRE may be taken during law school, usually after completing a course on legal ethics.

Other qualifications. The practice of law involves a great deal of responsibility. Individuals planning careers in law should like to work with people and be able to win the respect and confidence of their clients, associates, and the public. Perseverance, creativity, and reasoning ability also are essential to lawyers, who often analyze complex cases and handle new and unique legal problems.

Advancement. Most beginning lawyers start in salaried positions. Newly hired attorneys usually start as associates and work with more experienced lawyers or judges. After several years, some lawyers are admitted to partnership in their firm, which means they are partial owners of the firm, or go into practice for themselves. Some experienced lawyers are nominated or elected to judgeships. (See the section on judges, magistrates, and other judicial workers elsewhere in the *Handbook*.) Others become full-time law school faculty or administrators; a growing number of these lawyers have advanced degrees in other fields as well.

Some attorneys use their legal training in administrative or managerial positions in various departments of large corporations. A transfer from a corporation's legal department to another department often is viewed as a way to gain administrative experience and rise in the ranks of management.

Employment

Lawyers held about 761,000 jobs in 2006. Approximately 27 percent of lawyers were self-employed, practicing either as partners in law firms or in solo practices. Most salaried lawyers held positions in government, in law firms or other corporations, or in nonprofit organizations. Most government-employed lawyers worked at the local level. In the Federal Government, lawyers worked for many different agencies but were concentrated in the Departments of Justice, Treasury, and Defense. Many salaried lawyers working outside of government were employed as house counsel by public utilities, banks, insurance companies, real estate agencies, manufacturing firms, and other business firms and

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nonprofit organizations. Some also had part-time independent practices, while others worked part time as lawyers and full time in another occupation.

A relatively small number of trained attorneys work in law schools, and are not included in the employment estimate for lawyers. Most are faculty members who specialize in one or more subjects; however, some serve as administrators. Others work full time in nonacademic settings and teach part time. (For additional information, see the *Handbook* section on teachers—postsecondary.)

Job Outlook

Average employment growth is projected, but job competition is expected to be keen.

Employment change. Employment of lawyers is expected to grow 11 percent during the 2006-16 decade, about as fast as the average for all occupations. The growth in the population and in the level of business activity is expected create more legal transactions, civil disputes, and criminal cases. Job growth among lawyers also will result from increasing demand for legal services in such areas as health care, intellectual property, venture capital, energy, elder, antitrust, and environmental law. In addition, the wider availability and affordability of legal clinics should result in increased use of legal services by middle-income people. However, growth in demand for lawyers will be constrained as businesses increasingly use large accounting firms and paralegals to perform some of the same functions that lawyers do. For example, accounting firms may provide employee-benefit counseling, process documents, or handle various other services previously performed by a law firm. Also, mediation and dispute resolution increasingly are being used as alternatives to litigation.

Job growth for lawyers will continue to be concentrated in salaried jobs, as businesses and all levels of government employ a growing number of staff attorneys. Most salaried positions are in urban areas where government agencies, law firms, and big corporations are concentrated. The number of self-employed lawyers is expected to grow slowly, reflecting the difficulty of establishing a profitable new practice in the face of competition from larger, established law firms. Moreover, the growing complexity of law, which encourages specialization, along with the cost of maintaining up-to-date legal research materials, favors larger firms.

Job prospects. Competition for job openings should continue to be keen because of the large number of students graduating from law school each year. Graduates with superior academic records from highly regarded law schools will have the best job opportunities. Perhaps as a result of competition for attorney positions, lawyers are increasingly finding work in less traditional areas for which legal training is an asset, but not normally a requirement—for example, administrative, managerial, and business positions in banks, insurance firms, real estate companies, government agencies, and other organizations. Employment opportunities are expected to continue to arise in these organizations at a growing rate.

As in the past, some graduates may have to accept positions outside of their field of interest or for which they feel overqualified. Some recent law school graduates who have been unable to find permanent positions are turning to the growing number of temporary staffing firms that place attorneys in short-term jobs. This service allows companies to hire lawyers on an "as-needed" basis and permits beginning lawyers to develop practical skills.

Because of the keen competition for jobs, a law graduate's geographic mobility and work experience assume greater importance. The willingness to relocate may be an advantage in getting a job, but to be licensed in another State, a lawyer may have to take an additional State bar examination. In addition, employers increasingly seek graduates who have advanced law degrees and experience in a specialty, such as tax, patent, or admiralty law.

Job opportunities often are adversely affected by cyclical swings in the economy. During recessions, demand declines for some discretionary legal services, such as planning estates, drafting wills, and handling real estate transactions. Also, corporations are less likely to litigate cases when declining sales and profits restrict their budgets. Some corporations and law firms will not hire new attorneys until business improves, and these establishments may even cut staff to contain costs. Several factors, however, mitigate the overall impact of recessions on lawyers; during recessions, for example, individuals and corporations face other legal problems, such as bankruptcies, foreclosures, and divorces requiring legal action.

For lawyers who wish to work independently, establishing a new practice will probably be easiest in small towns and expanding suburban areas. In such communities, competition from larger, established law firms is likely to be less than in big cities, and new lawyers may find it easier to establish a reputation among potential clients.

Earnings

In May 2006, the median annual earnings of all wage-and-salaried lawyers were $102,470. The middle half of the occupation earned between $69,910 and $145,600. Median annual earnings in the industries employing the largest numbers of lawyers in May 2006 were:

Management of companies and enterprises	$128,610
Federal Government	119,240
Legal services	108,100
Local government	78,810
State government	75,840

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Lawyers	23-1011	761,000	844,000	84,000	11

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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Table 1. Median salaries of lawyers 9 months after graduation, 2005

All graduates	$60,000
Type of work	
Private practice	$85,000
Business	60,000
Government	46,158
Academic/judicial clerkships	45,000

Source: National Association of Law Placement

Salaries of experienced attorneys vary widely according to the type, size, and location of their employer. Lawyers who own their own practices usually earn less than those who are partners in law firms. Lawyers starting their own practice may need to work part time in other occupations to supplement their income until their practice is well established.

Median salaries of lawyers 9 months after graduation from law school in 2005 varied by type of work, as indicated in table 1.

Most salaried lawyers are provided health and life insurance, and contributions are made to retirement plans on their behalf. Lawyers who practice independently are covered only if they arrange and pay for such benefits themselves.

Related Occupations

Legal training is necessary in many other occupations, including paralegals and legal assistants; law clerks; title examiners, abstractors, and searchers; and judges, magistrates, and other judicial workers.

Sources of Additional Information

Information on law schools and a career in law may be obtained from the following organizations:

➤ American Bar Association, 321 North Clark St., Chicago, IL 60610. Internet: **http://www.abanet.org**

➤ National Association for Law Placement, 1025 Connecticut Ave. NW., Suite 1110, Washington, DC 20036. Internet: **http://www.nalp.org**

Information on the LSAT, the Law School Data Assembly Service, the law school application process, and financial aid available to law students may be obtained from:

➤ Law School Admission Council, P.O. Box 40, Newtown, PA 18940. Internet: **http://www.lsac.org**

Information on obtaining positions as lawyers with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result. For advice on how to find and apply for Federal jobs, see the Occupational Outlook Quarterly article "How to get a job in the Federal Government," online at: **http://www.bls.gov/opub/ooq/2004/summer/art01.pdf**.

The requirements for admission to the bar in a particular State or other jurisdiction may be obtained at the State capital, from the clerk of the Supreme Court, or from the administrator of the State Board of Bar Examiners.

Paralegals and Legal Assistants

(O*NET 23-2011.00)

Significant Points

- Most entrants have an associate degree in paralegal studies, or a bachelor's degree coupled with a certificate in paralegal studies.
- About 7 out of 10 work for law firms; others work for corporate legal departments and government agencies.
- Employment is projected to grow much faster than average, as employers try to reduce costs by hiring paralegals to perform tasks once done by lawyers.
- Competition for jobs should continue; experienced, formally trained paralegals should have the best employment opportunities.

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—are continuing to assume a growing range of tasks in legal offices and perform many of the same tasks as lawyers. Nevertheless, they are explicitly prohibited from carrying out duties 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 might 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. If 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 perform a number of other functions. For example, they help draft contracts, mortgages, and separation agreements. They also may assist in preparing tax returns, establishing trust funds, and planning estates. Some paralegals coordinate the activities of other law office employees and maintain financial office records.

Computer software packages and the Internet are used to search legal literature stored in computer databases and on CD-ROM. In litigation involving many supporting documents, paralegals usually use computer databases to retrieve, organize, and index various materials. Imaging software al-

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lows paralegals to scan documents directly into a database, while billing programs help them to track hours billed to clients. Computer software packages also are used to perform tax computations and explore the consequences of various tax strategies for clients.

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 becomes more complex, paralegals become more specialized. Within specialties, functions are often broken down further. For example, paralegals specializing in labor law may concentrate exclusively on employee benefits. In small and medium-size law firms, duties are often more general.

The tasks of paralegals differ widely according to the type of organization for which they work. A corporate paralegal often assists 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 minutes' record resolutions, and prepare forms to secure loans for the corporation. Corporate paralegals often monitor and review government regulations to ensure that the corporation is aware of new requirements and is operating within the law. Increasingly, experienced corporate paralegals or paralegal managers are assuming additional supervisory responsibilities such as overseeing team projects.

The duties of paralegals who work in the public sector usually vary by agency. In general, litigation paralegals analyze legal material for internal use, maintain reference files, conduct research for attorneys, and collect and analyze evidence for agency hearings. They may 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 who are in need of legal assistance. They file forms, conduct research, prepare documents, and, when authorized by law, may represent clients at administrative hearings.



In addition to investigating the facts of cases, paralegals identify relevant laws, judicial decisions, legal articles, and other materials.

Work environment. Paralegals 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 in offices and law libraries. Occasionally, they travel to gather information and perform other duties.

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. Paralegals who work for law firms sometimes work very long hours when under pressure to meet deadlines.

Training, Other Qualifications, and Advancement

Most entrants have an associate degree in paralegal studies, or a bachelor's degree coupled with a certificate in paralegal studies. Some employers train paralegals on the job.

Education and training. There are several ways to become a paralegal. The most common is through a community college paralegal program that leads to an associate degree. Another common method of entry, mainly for those who already have a college degree, is earning a certificate in paralegal studies. A small number of schools offer a bachelor's and master's degree in paralegal studies. Finally, some employers train paralegals on the job.

Associate and bachelor's degree programs usually combine paralegal training with courses in other academic subjects. Certificate programs vary significantly, with some only taking a few months to complete. Most certificate programs provide intensive paralegal training for individuals who already hold college degrees.

About 1,000 colleges and universities, law schools, and proprietary schools offer formal paralegal training programs. Approximately 260 paralegal programs are approved by the American Bar Association (ABA). Although many employers do not require such approval, graduation from an ABA-approved program can enhance employment opportunities. Admission requirements vary. Some require certain college courses or a bachelor's degree, while others accept high school graduates or those with legal experience. A few schools require standardized tests and personal interviews.

The quality of paralegal training programs varies; some programs may include job placement services. If possible, prospective students should examine the experiences of recent graduates before enrolling in a paralegal program. Any training program usually includes courses in legal research and the legal applications of computers. Many paralegal training programs also offer an internship in which students gain practical experience by working for several months in a private law firm, the office of a public defender or attorney general, a corporate legal department, a legal aid organization, a bank, or a government agency. Internship experience is an asset when one is seeking a job after graduation.

Some employers train paralegals on the job, hiring college graduates with no legal experience or promoting experienced

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legal secretaries. Other entrants have experience in a technical field that is useful to law firms, such as a background in tax preparation or criminal justice. Nursing or health administration experience is valuable in personal injury law practices.

Certification and other qualifications. Although most employers do not require certification, earning a voluntary certification from a professional society may offer advantages in the labor market. The National Association of Legal Assistants (NALA), 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. Those who pass the exam may use the Certified Legal Assistant (CLA) or Certified Paralegal (CP) credential. The NALA also offers the Advanced Paralegal Certification for experienced paralegals who want to specialize. The Advanced Paralegal Certification program is a curriculum based program offered on the Internet.

The American Alliance of Paralegals, Inc. offers the American Alliance Certified Paralegal (AACP) credential, a voluntary certification program. Paralegals seeking the AACP certification must possess at least five years of paralegal experience and meet one of the three educational criteria. Certification must be renewed every two years, including the completion 18 hours of continuing education.

In addition, the National Federation of Paralegal Association offers the Registered Paralegal (RP) designation to paralegals with a bachelor's degree and at least 2 years of experience who pass an exam. To maintain the credential, workers must complete 12 hours of continuing education every 2 years. The National Association for Legal Professionals offers the Professional Paralegal (PP) certification to those who pass a four-part exam. Recertification requires 75 hours of continuing education.

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 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 knowledge of the law. In fact, all paralegals in California must complete 4 hours of mandatory continuing education in either general law or in a specialized area of law.

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.

Advancement. Paralegals usually are given more responsibilities and require less supervision as they gain work experience. Experienced paralegals who work in large law firms, corporate legal departments, or 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.

Employment

Paralegals and legal assistants held about 238,000 jobs in 2006. 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 the 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.

Job Outlook

Despite projected rapid employment growth, competition for jobs is expected to continue as many people seek to go into this profession; experienced, formally trained paralegals should have the best employment opportunities.

Employment change. Employment of paralegals and legal assistants is projected to grow 22 percent between 2006 and 2016, much faster than the average for all occupations. Employers are trying to reduce costs and increase the availability and efficiency of legal services by hiring paralegals to perform tasks once done by lawyers. Paralegals are performing a wider variety of duties, making them more useful to businesses.

Demand for paralegals also is expected to grow as an expanding population increasingly requires legal services, especially in areas such as intellectual property, health care, international law, elder issues, criminal law, and environmental law. The growth of prepaid legal plans also should contribute to the demand for legal services.

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 also hire paralegals. Corporations in particular are expected to increase their in-house legal departments to cut costs. In part because of the

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Paralegals and legal assistants	23-2011	238,000	291,000	53,000	22

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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range of tasks they can perform, paralegals are also increasingly employed in small and medium-size establishments of all types.

Job prospects. In addition to new jobs created by employment growth, more job openings will arise as people leave the occupation. There will be demand for paralegals who specialize in areas such as real estate, bankruptcy, medical malpractice, and product liability. Community legal service programs, which provide assistance to the poor, elderly, minorities, and middle-income families, will employ additional paralegals to minimize expenses and serve the most people. Job opportunities also are expected in Federal, State, and local government agencies, consumer organizations, and the courts. However, this occupation attracts many applicants, creating competition for jobs. Experienced, formally trained paralegals should have the best job prospects.

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. However, during recessions, corporations and individuals are more likely to face 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, the type and size of employer, and the 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 May 2006, full-time wage-and-salary paralegals and legal assistants had median annual earnings, including bonuses, of $43,040. The middle 50 percent earned between $33,920 and $54,690. The top 10 percent earned more than $67,540, and the bottom 10 percent earned less than $27,450. Median annual earnings in the industries employing the largest numbers of paralegals were:

Federal Government	$56,080
Management of companies and enterprises	52,220
Local government	42,170
Legal services	41,460
State government	38,020

In addition to earning a salary, many paralegals receive bonuses, in part, to compensate them for sometimes having to work long hours. Paralegals also receive vacation, paid sick leave, a 401 savings plan, life insurance, personal paid time off, dental insurance, and reimbursement for continuing legal education.

Related Occupations

Among the other occupations that call for a specialized understanding of the law but do not require the extensive training of a lawyer, are law clerks; title examiners, abstractors, and searchers; claims adjusters, appraisers, examiners, and investigators; and occupational health and safety specialists and technicians.

Sources of Additional Information

General information on a career as a paralegal can be obtained from:

➤ Standing Committee on Paralegals, American Bar Association, 321 North Clark St., Chicago, IL 60610. Internet: **http://www.abanet.org/legalservices/paralegals**

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 the Paralegal Advanced Competency Exam, paralegal careers, paralegal training programs, job postings, and local associations is available from:

➤ National Federation of Paralegal Associations, PO Box 2016, Edmonds, WA 98020. 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, 19 Mantua Rd., Mt. Royal, NJ 08061. Internet: **http://www.aafpe.org**

Information on paralegal careers, certification, and job postings is available from:

➤ American Alliance of Paralegals, Inc., 16815 East Shea Boulevard, Suite 110, No. 101, Fountain Hills, Arizona, 85268. Internet: **http://www.aapipara.org**

For information on the Professional Paralegal exam, schools that offer training programs in a specific State, and standards and guidelines for paralegals, contact:

➤ NALS, 314 E. 3rd St., Suite 210, Tulsa, OK 74120. Internet: **http://www.nals.org**

Information on obtaining positions as a paralegal or legal assistant with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result. For advice on how to find and apply for Federal jobs, see the Occupational Outlook Quarterly article "How to get a job in the Federal Government," online at: **http://www.bls.gov/opub/ooq/2004/summer/art01.pdf**.

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Education, Training, Library, and Museum Occupations

Archivists, Curators, and Museum Technicians

(O*NET 25-4011.00, 25-4012.00, 25-4013.00)

Significant Points

- Most worked in museums, historical sites, and similar venues; in educational institutions; or in Federal, State, or local government.
- A graduate degree and related work experience are required for most positions; museum technicians may enter with a bachelor's degree.
- Keen competition is expected for most jobs because qualified applicants generally outnumber job openings.

Nature of the Work

Archivists, curators, and museum technicians work for museums, governments, zoos, colleges and universities, corporations, and other institutions that require experts to preserve important records and artifacts. These workers preserve important objects and documents, including works of art, transcripts of meetings, photographs, coins and stamps, living and preserved plants and animals, and historic objects, including, for example, turn-of-the-century immigration records, buildings, and sites.

Archivists and curators plan and oversee the arrangement, cataloguing, and exhibition of collections and, along with technicians and conservators, maintain collections. They acquire and preserve important documents and other valuable items for permanent storage or display. They also describe, catalogue, and analyze, valuable objects for the benefit of researchers and the public.

Archivists and curators may coordinate educational and public outreach programs, such as tours, workshops, lectures, and classes, and may work with the boards of institutions to administer plans and policies. They also may research topics or items relevant to their collections.

Although some duties of archivists and curators are similar, the types of items they deal with differ: curators usually handle objects with cultural, biological, or historical significance, such as sculptures, textiles, and paintings, while archivists handle mainly records and documents that are retained because of their importance and potential value in the future.

Archivists collect, organize, and maintain control over a wide range of information deemed important enough for permanent safekeeping. This information takes many forms: photographs, films, video and sound recordings, and electronic data files in a wide variety of formats, as well as more traditional paper records, letters, and documents.

Archivists maintain records in accordance with accepted standards and practices that ensure the long-term preservation and easy retrieval of the documents. Records may be saved on any medium, including paper, film, videotape, audiotape, computer disk, or DVD. They also may be copied onto some other format to protect the original and to make the records more accessible to researchers who use them. As various storage media evolve, archivists must keep abreast of technological advances in electronic information storage.

Archivists often specialize in an area of history so they can more accurately determine which records in that area qualify for retention and should become part of the archives. Archivists also may work with specialized forms of records, such as manuscripts, electronic records, photographs, cartographic records, motion pictures, and sound recordings.

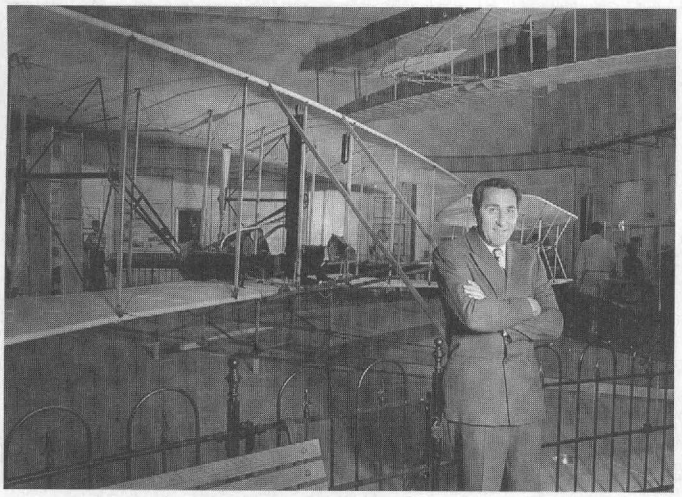
Computers are increasingly being used to generate and maintain archival records. Professional standards for the use of computers in handling archival records are still evolving. Expanding computer capabilities that allow more records to be stored and exhibited electronically have transformed, and are expected to continue to transform, many aspects of archival collections.

Curators administer museums, zoos, aquariums, botanical gardens, nature centers, and historic sites. The head curator of the museum is usually called the *museum director*. Curators direct the acquisition, storage, and exhibition of collections, including negotiating and authorizing the purchase, sale, exchange, or loan of collections. They are also responsible for authenticating, evaluating, and categorizing the specimens in a collection. Curators oversee and help conduct the institution's research projects and related educational programs. Today, an increasing part of a curator's duties involves fundraising and promotion, which may include the writing and reviewing of grant proposals, journal articles, and publicity materials, as well as attendance at meetings, conventions, and civic events.

Most curators specialize in a particular field, such as botany, art, paleontology, or history. Those working in large institutions may be highly specialized. A large natural history museum, for example, would employ separate curators for its collections of birds, fishes, insects, and mammals. Some curators maintain their collections, others do research, and others perform administrative tasks. In small institutions with only one or a few curators, one curator may be responsible for a number of tasks, from maintaining collections to directing the affairs of the museum.

Conservators manage, care for, preserve, treat, and document works of art, artifacts, and specimens—work that may require substantial historical, scientific, and archaeological research. They use x-rays, chemical testing, microscopes, special lights, and other laboratory equipment and techniques to examine objects and determine their condition and the appropriate method for preserving them. Conservators document their findings and treat items to minimize their deterioration or to restore them to their original state. Conservators usually specialize in a particular material or group of objects, such as documents and books, paintings, decorative arts, textiles, metals, or architectural material. In addition to their conservation work, conservators par-

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Keen competition is expected for most jobs because qualified applicants generally outnumber job openings.

ticipate in outreach programs, research topics in their area of specialty, and write articles for scholarly journals.

Museum technicians assist curators by performing various preparatory and maintenance tasks on museum items. They also answer public inquiries and assist curators and outside scholars in using collections. Archives technicians help archivists organize, maintain, and provide access to historical documentary materials.

Work environment. The working conditions of archivists and curators vary. Some spend most of their time working with the public, providing reference assistance and educational services. Others perform research or process records, which often means working alone or in offices with only a few people. Those who restore and install exhibits or work with bulky, heavy record containers may lift objects, climb, or stretch. Those in zoos, botanical gardens, and other outdoor museums and historic sites frequently walk great distances. Conservators work in conservation laboratories. The size of the objects in the collection they are working with determines the amount of effort involved in lifting, reaching, and moving objects.

Curators who work in large institutions may travel extensively to evaluate potential additions to the collection, organize exhibitions, and conduct research in their area of expertise. However, travel is rare for curators employed in small institutions.

Training, Other Qualifications, and Advancement

Employment as an archivist, conservator, or curator usually requires graduate education and related work experience. Museum technicians often start work with a bachelor's degree. While completing their formal education, many archivists and curators work in archives or museums to gain "hands-on" experience.

Education and training. Although archivists earn a variety of undergraduate degrees, a graduate degree in history or library science with courses in archival science is preferred by most employers. Many colleges and universities offer courses or practical training in archival techniques as part of their history, library science, or other curriculum. A few institutions now offer master's degrees in archival studies. Some positions may require knowledge of the discipline related to the collection, such as business or medicine.

For employment as a curator, most museums require a master's degree in an appropriate discipline of the museum's specialty—art, history, or archaeology—or in museum studies. Many employers prefer a doctoral degree, particularly for curators in natural history or science museums. Earning two graduate degrees—in museum studies (museology) and a specialized subject—gives a candidate a distinct advantage in this competitive job market. In small museums, curatorial positions may be available to individuals with a bachelor's degree. Because curators, particularly those in small museums, may have administrative and managerial responsibilities, courses in business administration, public relations, marketing, and fundraising also are recommended. For some positions, an internship of full-time museum work supplemented by courses in museum practices is needed.

When hiring conservators, employers look for a master's degree in conservation or in a closely related field, together with substantial experience. There are only a few graduate programs in museum conservation techniques in the United States. Competition for entry to these programs is keen; to qualify, a student must have a background in chemistry, archaeology or studio art, and art history, as well as work experience. For some programs, knowledge of a foreign language also is helpful. Conservation apprenticeships or internships as an undergraduate can enhance one's admission prospects. Graduate programs last 2 to 4 years, the latter years of which include internship training. A few individuals enter conservation through apprenticeships with museums, nonprofit organizations, and conservators in private practice. Apprenticeships should be supplemented with courses in chemistry, studio art, and history. Apprenticeship training, although accepted, is a more difficult route into the conservation profession.

Museum technicians usually need a bachelor's degree in an appropriate discipline of the museum's specialty, training in museum studies, or previous experience working in museums, particularly in the design of exhibits. Similarly, archives technicians usually need a bachelor's degree in library science or history, or relevant work experience. Relatively few schools grant a bachelor's degree in museum studies. More common are undergraduate minors or tracks of study that are part of an undergraduate degree in a related field, such as art history, history, or archaeology. Students interested in further study may obtain a master's degree in museum studies, offered in colleges and universities throughout the country. However, many employers feel that, while museum studies are helpful, a thorough knowledge of the museum's specialty and museum work experience are more important.

Certification and other qualifications. The Academy of Certified Archivists offers voluntary certification for archivists. The designation "Certified Archivist" can be obtained by those with at least a master's degree and a year of appropriate archival experience. The certification process requires candidates to pass a written examination, and they must renew their certification periodically.

Archivists need research skills and analytical ability to understand the content of documents and the context in which they were created and to decipher deteriorated or poor-quality printed matter, handwritten manuscripts, photographs, or films. A background in preservation management is often required of archi-

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vists because they are responsible for taking proper care of their records. Archivists also must be able to organize large amounts of information and write clear instructions for its retrieval and use. In addition, computer skills and the ability to work with electronic records and databases are very important. Because electronic records are becoming the prevalent form of record-keeping, and archivists must create searchable databases, knowledge of Web technology is increasingly being required.

Curatorial positions often require knowledge in a number of fields. For historic and artistic conservation, courses in chemistry, physics, and art are desirable. Like archivists, curators need computer skills and the ability to work with electronic databases. Many curators are responsible for posting information on the Internet, so they also need to be familiar with digital imaging, scanning technology, and copyright law.

Curators must be flexible because of their wide variety of duties, among which are the design and presentation of exhibits. In small museums, curators need manual dexterity to build exhibits or restore objects. Leadership ability and business skills are important for museum directors, while marketing skills are valuable in increasing museum attendance and fundraising.

Advancement. Continuing education is available through meetings, conferences, and workshops sponsored by archival, historical, and museum associations. Some larger organizations, such as the National Archives in Washington, D.C., offer such training in-house.

Many archives, including one-person shops, are very small and have limited opportunities for promotion. Archivists typically advance by transferring to a larger unit that has supervisory positions. A doctorate in history, library science, or a related field may be needed for some advanced positions, such as director of a State archive.

In large museums, curators may advance through several levels of responsibility, eventually becoming the museum director. Curators in smaller museums often advance to larger ones. Individual research and publications are important for advancement in larger institutions.

Technician positions often serve as a steppingstone for individuals interested in archival and curatorial work. Except in small museums, a master's degree is needed for advancement.

Employment

Archivists, curators, and museum technicians held about 27,000 jobs in 2006. About 38 percent were employed in museums, historical sites, and similar institutions, and 18 percent worked for State and private educational institutions, mainly college and university libraries. Nearly 31 percent worked in Federal, State, and local government, excluding educational institutions. Most Federal archivists work for the National Archives and Records Administration; others manage military archives in the U.S. Department of Defense. Most Federal Government curators work at the Smithsonian Institution, in the military museums of the Department of Defense, and in archaeological and other museums and historic sites managed by the U.S. Department of the Interior. All State governments have archival or historical record sections employing archivists. State and local governments also have numerous historical museums, parks, libraries, and zoos employing curators.

Some large corporations that have archives or record centers employ archivists to manage the growing volume of records created or maintained as required by law or necessary to the firms' operations. Religious and fraternal organizations, professional associations, conservation organizations, major private collectors, and research firms also employ archivists and curators.

Conservators may work under contract to treat particular items, rather than as regular employees of a museum or other institution. These conservators may work on their own as private contractors, or they may work as an employee of a conservation laboratory or regional conservation center that contracts their services to museums.

Job Outlook

Faster than average employment growth is expected through 2016. Keen competition is expected for most jobs as archivists, curators, and museum technicians because qualified applicants generally outnumber job openings.

Employment change. Employment of archivists, curators, and museum technicians is expected to increase 18 percent over the 2006-16 decade, faster than the average for all occupations. Jobs for archivists are expected to increase as public and private organizations require organization of and access to increasing volumes of records and information. Public interest in science, art, history, and technology will continue, creating opportunities for curators, conservators, and museum technicians. Museum attendance has held steady in recent years, many museums are financially healthy, and many have pursued building and renovation projects.

There has been an increase in self-employment among conservators, as many museums move toward hiring these workers on contract rather than keeping them permanently on staff. This trend is expected to continue.

Demand for archivists who specialize in electronic records and records management will grow more rapidly than the demand for archivists who specialize in older media formats.

Job prospects. Keen competition is expected for most jobs as archivists, curators, and museum technicians because quali-

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Archivists, curators, and museum technicians	25-4010	27,000	33,000	5,000	18
Archivists	25-4011	6,400	7,400	900	14
Curators	25-4012	10,000	13,000	2,400	23
Museum Technicians and Conservators	25-4013	11,000	12,000	1,700	16

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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fied applicants generally outnumber job openings. Graduates with highly specialized training, such as master's degrees in both library science and history, with a concentration in archives or records management and extensive computer skills, should have the best opportunities for jobs as archivists. Opportunities for those who manage electronic records are expected to be better than for those who specialize in older media formats.

Curator jobs, in particular, are attractive to many people, and many applicants have the necessary training and knowledge of the subject. But because there are relatively few openings, candidates may have to work part time, as an intern, or even as a volunteer assistant curator or research associate after completing their formal education. Substantial work experience in collection management, research, exhibit design, or restoration, as well as database management skills, will be necessary for permanent status.

Conservators also can expect competition for jobs. Competition is stiff for the limited number of openings in conservation graduate programs, and applicants need a technical background. Conservation program graduates with knowledge of a foreign language and a willingness to relocate will have an advantage over less qualified candidates.

Museums and other cultural institutions can be subject to cuts in funding during recessions or periods of budget tightening, reducing demand for these workers. Although the number of archivists and curators who move to other occupations is relatively low, the need to replace workers who retire will create some additional job openings.

Earnings

Median annual earnings of archivists in May 2006 were $40,730. The middle 50 percent earned between $30,610 and $53,990. The lowest 10 percent earned less than $23,890, and the highest 10 percent earned more than $73,060. Median annual earnings of curators in May 2006 were $46,300. The middle 50 percent earned between $34,410 and $61,740. The lowest 10 percent earned less than $26,320, and the highest 10 percent earned more than $80,030. Median annual earnings of museum technicians and conservators in May 2006 were $34,340. The middle 50 percent earned between $26,360 and $46,120. The lowest 10 percent earned less than $20,600, and the highest 10 percent earned more than $61,270.

In 2007, the average annual salary for archivists in the Federal Government was $79,199; for museum curators, $80,780; for museum specialists and technicians, $58,855; and for archives technicians, $44,547.

Related Occupations

The skills that archivists, curators, and museum technicians use in preserving, organizing, and displaying objects or information of historical interest are shared by artists and related workers; librarians; and anthropologists and archeologists, historians, and other social scientists.

Sources of Additional Information

For information on archivists and on schools offering courses in archival studies, contact:

➤ Society of American Archivists, 527 South Wells St., 5th floor, Chicago, IL 60607-3922. Internet: **http://www.archivists.org**

For general information about careers as a curator and schools offering courses in museum studies, contact:

➤ American Association of Museums, 1575 Eye St.NW., Suite 400, Washington, DC 20005. Internet: **http://www.aam-us.org**

For information about careers and education programs in conservation and preservation, contact:

➤ American Institute for Conservation of Historic and Artistic Works, 1717 K St.NW., Suite 200, Washington, DC 20006. Internet: **http://aic-faic.org**

For information about archivists and archivist certification, contact:

➤ Academy of Certified Archivists, 90 State St., Suite 1009, Albany, NY 12207. Internet: **http://www.certifiedarchivists.org**

For information about government archivists, contact:

➤ National Association of Government Archivists and Records Administrators, 90 State St., Suite 1009, Albany, NY 12207. Internet: **http://www.nagara.org**

Information on obtaining positions as archivists, curators, and museum technicians with the Federal Government is available from the Office of Personnel Management through USAJOBS, the Federal Government's official employment information system. This resource for locating and applying for job opportunities can be accessed through the Internet at **http://www.usajobs.opm.gov** or through an interactive voice response telephone system at (703) 724-1850 or TDD (978) 461-8404. These numbers are not toll free, and charges may result.

Instructional Coordinators

(O*NET 25-9031.00)

Significant Points

- Many instructional coordinators have experience as teachers or education administrators.
- A master's degree is required for positions in public schools and preferred for jobs in other settings.
- Employment is projected to grow much faster than average, reflecting the need to meet new educational standards, train teachers, and develop new materials.
- Favorable job prospects are expected.

Nature of the Work

Instructional coordinators—also known as curriculum specialists, personnel development specialists, instructional coaches, or directors of instructional material—play a large role in improving the quality of education in the classroom. They develop curricula, select textbooks and other materials, train teachers, and assess educational programs for quality and adherence to regulations and standards. They also assist in implementing new technology in the classroom.

At the primary and secondary school level, instructional coordinators often specialize in specific subjects, such as reading, language arts, mathematics, or science. At the postsecondary level, coordinators may work with employers to develop training programs that produce qualified workers.

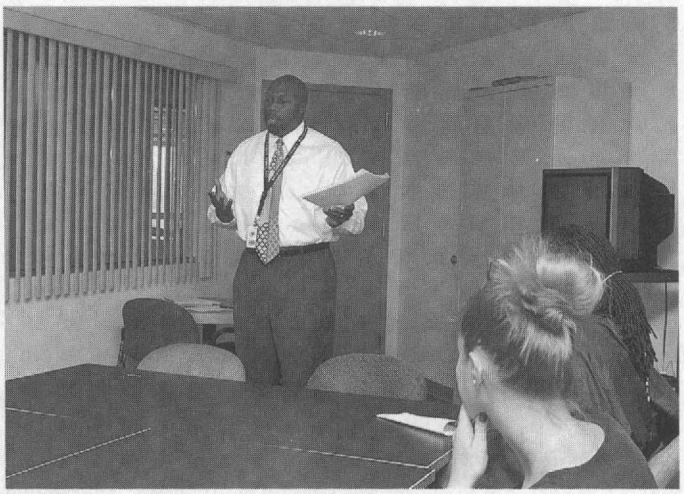
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Instructional coordinators evaluate how well a school or training program's curriculum, or plan of study, meets students' needs. Based on their research and observations of instructional practice, they recommend improvements. They research teaching methods and techniques and develop procedures to ensure that instructors are implementing the curriculum successfully and meeting program goals. To aid in their evaluation, they may meet with members of educational committees and advisory groups to learn about subjects—for example, English, history, or mathematics—and explore how curriculum materials meet students' needs and relate to occupations. Coordinators also may develop questionnaires and interview school staff about the curriculum.

Some instructional coordinators also review textbooks, software, and other educational materials and make recommendations on purchases. They monitor the ways in which teachers use materials in the classroom, and they supervise workers who catalogue, distribute, and maintain a school's educational materials and equipment.

Some instructional coordinators find ways to use technology to enhance student learning. They monitor the introduction of new technology, including the Internet, into a school's curriculum. In addition, instructional coordinators might recommend installing educational software, such as interactive books and exercises designed to enhance student literacy and develop math skills. Instructional coordinators may invite experts—such as computer hardware, software, and library or media specialists—to help integrate technological materials into the curriculum.

In addition to developing curriculum and instructional materials, many instructional coordinators also plan and provide onsite education for teachers and administrators. Instructional coordinators mentor new teachers and train experienced ones in the latest instructional methods. This role becomes especially important when a school district introduces new content, program innovations, or a different organizational structure. For example, when a State or school district introduces standards or tests that students must pass, instructional coordinators often advise teachers on the content of these standards and provide instruction on how to implement them in the classroom.



Instructional coordinators train teachers on new curriculum standards.

Work environment. Many instructional coordinators work long hours. They often work year round. Some spend much of their time traveling between schools meeting with teachers and administrators. The opportunity to shape and improve instructional curricula and work in an academic environment can be satisfying. However, some instructional coordinators find the work stressful because they are continually accountable to school administrators.

Training, Other Qualifications, and Advancement

The minimum educational requirement for most instructional coordinator positions in public schools is a master's or higher degree—usually in education—plus a State teacher or administrator license. A master's degree also is preferred for positions in other settings.

Education and training. Instructional coordinators should have training in curriculum development and instruction or in the specific field for which they are responsible, such as mathematics or history. Courses in research design teach how to create and implement research studies to determine the effectiveness of a given method of instruction or curriculum and how to measure and improve student performance.

Instructional coordinators usually are also required to take continuing education courses to keep their skills current. Topics may include teacher evaluation techniques, curriculum training, new teacher induction, consulting and teacher support, and observation and analysis of teaching.

Licensure. Instructional coordinators must be licensed to work in public schools. Some States require a teaching license, whereas others require an education administrator license.

Other qualifications. Instructional coordinators must have a good understanding of how to teach specific groups of students and expertise in developing educational materials. As a result, many people become instructional coordinators after working for several years as teachers. Also beneficial is work experience in an education administrator position, such as a principal or assistant principal, or in another advisory role, such as a master teacher.

Instructional coordinators must be able to make sound decisions about curriculum options and to organize and coordinate work efficiently. They should have strong interpersonal and communication skills. Familiarity with computer technology also is important for instructional coordinators, who are increasingly involved in gathering technical information for students and teachers.

Advancement. Depending on experience and educational attainment, instructional coordinators may advance to higher administrative positions in a school system or to management or executive positions in private industry.

Employment

Instructional coordinators held about 129,000 jobs in 2006. Almost 40 percent worked in public or private elementary and secondary schools, while more than 20 percent worked in public or private junior colleges, colleges and universities, and professional schools. Other employing industries included State and local government; individual and family services; child day care services; scientific research and development services; and management, scientific, and technical consulting services.

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Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Instructional coordinators	25-9031	129,000	159,000	29,000	22

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

Job Outlook

Much faster-than-average job growth is projected. Job opportunities generally should be favorable, particularly for those with experience in math and reading curriculum development.

Employment change. The number of instructional coordinators is expected to grow by 22 percent over the 2006-16 decade, much faster than the average for all occupations, as they will be instrumental in developing new curricula to meet the demands of a changing society and in training teachers. Although budget constraints may limit employment growth to some extent, a continuing emphasis on improving the quality of education should result in an increasing demand for these workers. The emphasis on accountability also should increase at all levels of government and cause more schools to focus on improving standards of educational quality and student performance. Growing numbers of coordinators will be needed to incorporate the new standards into existing curricula and make sure teachers and administrators are informed of changes.

Additional job growth for instructional coordinators will stem from the increasing emphasis on lifelong learning and on programs for students with special needs, including those for whom English is a second language. These students often require more educational resources and consolidated planning and management within the educational system.

Job prospects. Favorable job prospects are expected. Opportunities should be best for those who specialize in subjects targeted for improvement by the No Child Left Behind Act—namely, reading, math, and science. There also will be a need for more instructional coordinators to show teachers how to use technology in the classroom.

Earnings

Median annual earnings of instructional coordinators in May 2006 were $52,790. The middle 50 percent earned between $38,800 and $70,320. The lowest 10 percent earned less than $29,040, and the highest 10 percent earned more than $87,510.

Related Occupations

Instructional coordinators are professionals involved in education, training, and development. Occupations with similar characteristics include preschool, kindergarten, elementary, middle, and secondary school teachers; postsecondary teachers; education administrators; counselors; and human resources, training, and labor relations managers and specialists.

Sources of Additional Information

Information on requirements and job opportunities for instructional coordinators is available from local school systems and State departments of education.

Librarians

(O*NET 25-4021.00)

Significant Points

- Librarians use the latest information technology to perform research, classify materials, and help students and library patrons seek information.
- A master's degree in library science is the main qualification for most librarian positions, although school librarians often need experience as teachers to meet State licensing requirements.
- Despite slower-than-average projected employment growth, job opportunities are still expected to be favorable because a large number of librarians are expected to retire in the coming decade.

Nature of the Work

The traditional concept of a library is being redefined from a place to access paper records or books to one that also houses the most advanced electronic resources, including the Internet, digital libraries, and remote access to a wide range of information sources. Consequently, librarians, often called information professionals, increasingly combine traditional duties with tasks involving quickly changing technology. Librarians help people find information and use it effectively for personal and professional purposes. They must have knowledge of a wide variety of scholarly and public information sources and must follow trends related to publishing, computers, and the media in order to oversee the selection and organization of library materials. Librarians manage staff and develop and direct information programs and systems for the public and ensure that information is organized in a manner that meets users' needs.

Most librarian positions focus on one of three aspects of library work: user services, technical services, and administrative services. Still, even librarians specializing in one of these areas have other responsibilities, too. Librarians in user services, such as reference and children's librarians, work with patrons to help them find the information they need. The job involves analyzing users' needs to determine what information is appropriate and searching for, acquiring, and providing the information. The job also includes an instructional role, such as showing users how to find information. For example, librarians commonly help users navigate the Internet so they can search for and evaluate information efficiently. Librarians in technical services, such as acquisitions and cataloguing, acquire, prepare, and classify materials so that patrons can find

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it easily. Some write abstracts and summaries. Often, these librarians do not deal directly with the public. Librarians in administrative services oversee the management and planning of libraries: they negotiate contracts for services, materials, and equipment; supervise library employees; perform public-relations and fundraising duties; prepare budgets; and direct activities to ensure that everything functions properly.

In small libraries or information centers, librarians usually handle all aspects of library operations. They read book reviews, publishers' announcements, and catalogues to keep up with current literature and other available resources, and they select and purchase materials from publishers, wholesalers, and distributors. Librarians prepare new materials, classifying them by subject matter and describing books and other library materials to make them easy to find. Librarians supervise assistants, who enter classification information and descriptions of materials into electronic catalogs. In large libraries, librarians often specialize in a single area, such as acquisitions, cataloguing, bibliography, reference, special collections, or administration. Teamwork is increasingly important.

Librarians also recommend materials. Many compile lists of books, periodicals, articles, audiovisual materials, and electronic resources on particular subjects and analyze collections. They collect and organize books, pamphlets, manuscripts, and other materials in a specific field, such as rare books, genealogy, or music. In addition, they coordinate programs such as storytelling for children and literacy skills and book talks for adults. Some conduct classes, publicize services, write grants, and oversee other administrative matters.

Many libraries have access to remote databases and maintain their own computerized databases. The widespread use of electronic resources makes database-searching skills important for librarians. Librarians develop and index databases and help train users to develop searching skills. Some libraries are forming consortiums with other libraries to allow patrons to access a wider range of databases and to submit information requests to several libraries simultaneously. The Internet also has greatly expanded the amount of available reference information. Librarians must know how to use these resources and inform the public about the wealth of information available in them.

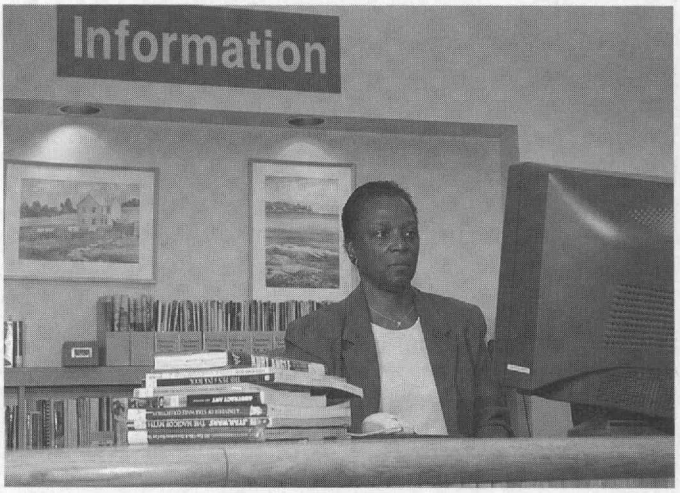
Librarians are classified according to the type of library in which they work: a public library; school library media center; college, university, or other academic library; or special library. Librarians in special libraries work in information centers or libraries maintained by government agencies or corporations, law firms, advertising agencies, museums, professional associations, unions, medical centers, hospitals, religious organizations, and research laboratories. They acquire and arrange an organization's information resources, which usually are limited to subjects of special interest to the organization. They can provide vital information services by preparing abstracts and indexes of current periodicals, organizing bibliographies, or analyzing background information and preparing reports on areas of particular interest. For example, a special librarian working for a corporation could provide the sales department with information on competitors or new developments affecting the field. A medical librarian may provide information about new medical treatments, clinical trials, and standard procedures to health professionals, patients, consumers, and corporations. Government document librarians, who work for government agencies and depository libraries in each of the States, preserve government publications, records, and other documents that make up a historical record of government actions.

Some librarians work with specific groups, such as children, young adults, adults, or the disadvantaged. In school library media centers, librarians—often called school media specialists—help teachers develop curricula and acquire materials for classroom instruction. They also conduct classes for students on how to use library resources for research projects.

Librarians with computer and information systems skills can work as automated-systems librarians, planning and operating computer systems, and as information architects, designing information storage and retrieval systems and developing procedures for collecting, organizing, interpreting, and classifying information. These librarians analyze and plan for future information needs. (See the section on computer scientists and database administrators elsewhere in the *Handbook*.) Automated information systems enable librarians to focus on administrative and budgeting responsibilities, grant writing, and specialized research requests, while delegating more routine services responsibilities to technicians. (See the section on library technicians elsewhere in the *Handbook*.)

More and more, librarians apply their information management and research skills to arenas outside of libraries—for example, database development, reference tool development, information systems, publishing, Internet coordination, marketing, Web content management and design, and training of database users. Entrepreneurial librarians sometimes start their own consulting practices, acting as freelance librarians or information brokers and providing services to other libraries, businesses, or government agencies.

Work environment. Librarians spend a significant portion of time at their desks or in front of computer terminals; extended work at video display terminals can cause eyestrain and headaches. Assisting users in obtaining information or books for their jobs, homework, or recreational reading can be chal-



Librarians assist patrons with their research and resource needs.

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lenging and satisfying, but working with users under deadlines can be demanding and stressful. Some librarians lift and carry books, and some climb ladders to reach high stacks, although most modern libraries have readily accessible stacks. Librarians in small settings without support staff sometimes shelve books themselves.

More than 20 percent of librarians work part time. Public and college librarians often work weekends, evenings, and some holidays. School librarians usually have the same workday and vacation schedules as classroom teachers. Special librarians usually work normal business hours, but in fast-paced industries—such as advertising or legal services—they can work longer hours when needed.

Training, Other Qualifications, and Advancement

A master's degree in library science (MLS) is necessary for librarian positions in most public, academic, and special libraries. Librarians in the Federal Government need an MLS or the equivalent in education and experience. School librarians do not typically need an MLS but must meet State licensing requirements.

Education and training. Entry into a library science graduate program requires a bachelor's degree, but any undergraduate major is acceptable. Many colleges and universities offer library science programs, but employers often prefer graduates of the 56 schools accredited by the American Library Association. Most programs take 1 year to complete; some take 2. A typical graduate program includes courses in the foundations of library and information science, such as the history of books and printing, intellectual freedom and censorship, and the role of libraries and information in society. Other basic courses cover the selection and processing of materials, the organization of information, research methods and strategies, and user services. Prospective librarians also study online reference systems, Internet search methods, and automated circulation systems. Elective course options include resources for children or young adults; classification, cataloguing, indexing, and abstracting; and library administration. Computer-related course work is an increasingly important part of an MLS degree. Some programs offer interdisciplinary degrees combining technical courses in information science with traditional training in library science.

The MLS degree provides general preparation for library work, but some individuals specialize in a particular area, such as reference, technical services, or children's services. A Ph.D. in library and information science is advantageous for a college teaching position or a top administrative job in a college or university library or large public library system.

Licensure. States generally have certification requirements for librarians in public schools and local libraries, though there are wide variations among States. School librarians in 14 States need a master's degree, either an MLS or a master's in education with a specialization in library media. In addition, about half of all States require that school librarians hold teacher certifications, although not all require teaching experience. Some States may also require librarians to pass a comprehensive assessment. Most States also have developed certification standards for local public libraries, although in some States these guidelines are only voluntary.

Other qualifications. In addition to an MLS degree, librarians in a special library, such as a law or corporate library, usually supplement their education with knowledge of the field in which they are specializing, sometimes earning a master's, doctoral, or professional degree in the subject. Areas of specialization include medicine, law, business, engineering, and the natural and social sciences. For example, a librarian working for a law firm may hold both library science and law degrees, while medical librarians should have a strong background in the sciences. In some jobs, knowledge of a foreign language is needed.

Librarians participate in continuing education and training to stay up to date with new information systems and technology.

Advancement. Experienced librarians can advance to administrative positions, such as department head, library director, or chief information officer.

Employment

Librarians held about 158,000 jobs in 2006. Most worked in school and academic libraries, but more than one-fourth worked in public libraries. The remainder worked in special libraries or as information professionals for companies and other organizations.

Job Outlook

Despite slower-than-average projected employment growth, job opportunities are still expected to be favorable because a large number of librarians are expected to retire in the coming decade.

Employment change. Employment of librarians is expected to grow by 4 percent between 2006 and 2016, slower than the average for all occupations. Growth in the number of librarians will be limited by government budget constraints and the increasing use of electronic resources. Both will result in the hiring of fewer librarians and the replacement of librarians with less costly library technicians and assistants. As electronic resources become more common and patrons and support staff become more familiar with their use, fewer librarians are needed to maintain and assist users with these resources. In addition, many libraries are equipped for users to access library resources directly from their homes or offices through library Web sites. Some users bypass librarians altogether and conduct research on their own. However, librarians will still

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Librarians	25-4021	158,000	164,000	5,800	4

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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be needed to manage staff, help users develop database-searching techniques, address complicated reference requests, choose materials, and help users to define their needs.

Jobs for librarians outside traditional settings will grow the fastest over the decade. Nontraditional librarian jobs include working as information brokers and working for private corporations, nonprofit organizations, and consulting firms. Many companies are turning to librarians because of their research and organizational skills and their knowledge of computer databases and library automation systems. Librarians can review vast amounts of information and analyze, evaluate, and organize it according to a company's specific needs. Librarians also are hired by organizations to set up information on the Internet. Librarians working in these settings may be classified as systems analysts, database specialists and trainers, webmasters or web developers, or local area network (LAN) coordinators.

Job prospects. More than 2 out of 3 librarians are aged 45 or older, which will result in many job openings over the next decade as many librarians retire. However, recent increases in enrollments in MLS programs will prepare a sufficient number of new librarians to fill these positions. Opportunities for public school librarians, who are usually drawn from the ranks of teachers, should be particularly favorable.

Earnings

Salaries of librarians vary according to the individual's qualifications and the type, size, and location of the library. Librarians with primarily administrative duties often have greater earnings. Median annual earnings of librarians in May 2006 were $49,060. The middle 50 percent earned between $39,250 and $60,800. The lowest 10 percent earned less than $30,930, and the highest 10 percent earned more than $74,670. Median annual earnings in the industries employing the largest numbers of librarians in 2006 were as follows:

Junior colleges	$52,030
Colleges, universities, and professional schools	51,160
Elementary and secondary schools	50,710
Local government	44,960
Other information services	44,170

The average annual salary for all librarians in the Federal Government in nonsupervisory, supervisory, and managerial positions was $80,873 in 2007.

About 1 in 4 librarians are a member of a union or are covered under a union contract.

Related Occupations

Librarians play an important role in the transfer of knowledge and ideas by providing people with information. Jobs requiring similar analytical, organizational, and communication skills include archivists, curators, and museum technicians and computer and information scientists, research. School librarians have many duties similar to those of school teachers. Librarians increasingly store, catalogue, and access information with computers. Other jobs that use computer skills include computer systems analysts, and computer scientists and database administrators.

Sources of Additional Information

For information on a career as a librarian and information on accredited library education programs and scholarships, contact:

➤ American Library Association, Office for Human Resource Development and Recruitment, 50 East Huron St., Chicago, IL 60611. Internet: **http://www.ala.org/ala/education/educationcareers.htm**

For information on a career as a special librarian, contact:

➤ Special Libraries Association, 331 South Patrick St., Alexandria, VA 22314. Internet: **http://www.sla.org**

For information on a career as a law librarian, scholarship information, and a list of ALA-accredited schools offering programs in law librarianship, contact:

➤ American Association of Law Libraries, 53 West Jackson Blvd., Suite 940, Chicago, IL 60604. Internet: **http://www.aallnet.org**

For information on employment opportunities for health sciences librarians and for scholarship information, credentialing information, and a list of MLA-accredited schools offering programs in health sciences librarianship, contact:

➤ Medical Library Association, 65 East Wacker Place, Suite 1900, Chicago, IL 60601. Internet: **http://www.mlanet.org**

Information concerning requirements and application procedures for positions in the Library of Congress can be obtained directly from:

➤ Human Resources Office, Library of Congress, 101 Independence Ave. SE., Washington, DC 20540-2231. Internet: **http://www.loc.gov/hr**

State library agencies can furnish information on scholarships available through their offices, requirements for certification, and general information about career prospects in the particular State of interest. Several of these agencies maintain job hot lines reporting openings for librarians.

State departments of education can furnish information on certification requirements and job opportunities for school librarians.

Library Technicians

(O*NET 25-4031.00)

Significant Points

- Increasing use of electronic resources enables library technicians to perform tasks once done by librarians.
- Training requirements range from a high school diploma to an associate degree, but computer skills are necessary for all workers.
- Employment should grow more rapidly in special libraries because increasing numbers of professionals and other workers use those libraries.
- Opportunities will be best for those with specialized postsecondary library training.

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Nature of the Work

Library technicians help librarians acquire, prepare, and organize materials and help users to find those materials. Library technicians usually work under the supervision of a librarian, although they sometimes work independently. Technicians in small libraries handle a range of duties; those in large libraries usually specialize. The duties of technicians are expanding and evolving as libraries increasingly use the Internet and other technologies to share information. Depending on where they work, library technicians can have other titles, such as *library technical assistant* or *media aide*.

Library technicians direct library users to standard references, organize and maintain periodicals, prepare volumes for binding, handle interlibrary loan requests, prepare invoices, perform routine cataloguing and coding of library materials, retrieve information from computer databases, and supervise support staff.

Technicians also market library services. They participate in and help plan reader advisory programs, used-book sales, and outreach programs. They may also design posters, bulletin boards, or displays to inform patrons of library events and services.

As libraries increasingly use the Internet, virtual libraries, and other electronic resources, the duties of library technicians are changing. In fact, new technologies allow some technicians to assume responsibilities which were previously performed only by librarians. Technicians now catalog new acquisitions and oversee the circulation of all library materials. They often maintain, update, and help customize electronic databases. Technicians also may help to maintain the library's Web site and instruct patrons in how to use the library's computers.

The automation of recordkeeping has reduced the amount of clerical work performed by library technicians. Many libraries now offer self-service registration and circulation areas, where patrons can register for library cards and check out materials themselves. These technologies decrease the time library technicians spend recording and inputting records.

Some library technicians operate and maintain audiovisual equipment, such as projectors, tape and CD players, and DVD and videocassette players. They also assist users with microfilm or microfiche readers.

Library technicians in school libraries encourage and teach students to use the library and media center. They also help teachers obtain instructional materials, and they assist students with assignments.

Some technicians work in special libraries maintained by government agencies, corporations, law firms, advertising agencies, museums, professional societies, medical centers, or research laboratories. These technicians conduct literature searches, compile bibliographies, and prepare abstracts, usually on subjects of particular interest to the organization.

To extend library services to more patrons, many libraries operate bookmobiles, which are often run by library technicians. The technicians take bookmobiles—trucks stocked with books—to shopping centers, apartment complexes, schools, nursing homes, and other places. Technicians may operate a bookmobile alone or with other library employees.



Library technicians may process materials for circulation.

Library technicians who drive bookmobiles are responsible for answering patrons' questions, receiving and checking out books, collecting fines, maintaining the book collection, shelving materials, and occasionally operating audiovisual equipment to show slides or movies. Technicians who drive the bookmobile keep track of mileage and sometimes are responsible for maintenance of the vehicle and any equipment, such as photocopiers, in it. Many bookmobiles are equipped with personal computers linked to the main library Internet system, allowing patrons access to electronic resources as well as books.

Work environment. Library technicians who prepare library materials sit at desks or computer terminals for long periods and can develop headaches or eyestrain. They may lift and carry books, climb ladders to reach high stacks, and bend low to shelve books on bottom shelves. Technicians who work in bookmobiles may assist handicapped or elderly patrons to the bookmobile or shovel snow to ensure their safety. They may enter hospitals or nursing homes to deliver books.

Library technicians in school libraries work regular school hours. Those in public libraries and college and university libraries may work weekends, evenings, and some holidays. Library technicians in corporate libraries usually work normal business hours, although they often work overtime as well. The schedules of technicians who drive bookmobiles often depend on the size of the area being served.

Training, Other Qualifications, and Advancement

Training requirements for library technicians vary widely, ranging from a high school diploma to specialized postsecondary training. Some employers only hire individuals who have library work experience or college training related to libraries; others train inexperienced workers on the job.

Education and training. Most libraries prefer to hire technicians who have earned a certificate or associate degree, but some smaller libraries may hire individuals with only a high school diploma.

Many library technicians in public schools must meet the same requirements as teacher assistants. Those in Title 1 schools—schools that receive special funding because of the high percentage of poor students enrolled—must hold an associate or higher degree, have a minimum of 2 years of college, or pass a rigorous State or local exam.

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Associate degree and certificate programs for library technicians include courses in liberal arts and subjects related to libraries. Students learn about library organization and operation and how to order, process, catalogue, locate, and circulate library materials and media. They often learn to use library automation systems. Libraries and associations offer continuing education courses to inform technicians of new developments in the field.

Other qualifications. Given the rapid spread of automation in libraries, computer skills are a necessity. Knowledge of databases, library automation systems, online library systems, online public access systems, and circulation systems is particularly valuable. Many bookmobile drivers must have a commercial driver's license.

Advancement. Library technicians usually advance by assuming added responsibilities. For example, technicians often start at the circulation desk, checking books in and out. After gaining experience, they may become responsible for storing and verifying information. As they advance, they may become involved in budget and personnel matters. Some library technicians advance to supervisory positions and are in charge of the day-to-day operation of their departments or, sometimes, a small library. Those who earn a graduate degree in library sciences can become librarians.

Employment

Library technicians held about 121,000 jobs in 2006; about half worked in local public libraries. Most of the rest worked in school or academic libraries, but some worked in special libraries in health care and legal settings. The Federal Government employs library technicians primarily at the U.S. Department of Defense and the U.S. Library of Congress.

Job Outlook

Employment of library technicians is expected to grow about as fast as average. Opportunities will be best for those with specialized postsecondary library training.

Employment change. The number of library technicians is expected to grow by 8 percent between 2006 and 2016, about as fast as the average for all occupations, as the increasing use of library automation creates more opportunities for these workers. Electronic information systems have simplified some tasks, enabling them to be performed by technicians rather than librarians, and spurring demand for technicians. However, job growth in educational institutions will be limited by slowing enrollment growth. In addition, public libraries often face budget pressures, which hold down overall growth in library services. However, this may result in the hiring of more library technicians because they are paid less than librarians and, thus, represent a lower-cost way to offer some library services. Employment should grow more rapidly in special libraries because increasing numbers of professionals and other workers use those libraries.

Job prospects. In addition to job openings from employment growth, some openings will result from the need to replace library technicians who transfer to other occupations or leave the labor force. Opportunities will be best for library technicians with specialized postsecondary library training. Increased use of special libraries in businesses, hospitals, and other places should result in good job opportunities for library technicians in those settings.

Earnings

Median annual earnings of library technicians in May 2006 were $26,560. The middle 50 percent earned between $20,220 and $34,280. The lowest 10 percent earned less than $15,820, and the highest 10 percent earned more than $42,850. Median annual earnings in the industries employing the largest numbers of library technicians in 2006 were as follows:

Colleges, universities, and professional schools	$29,950
Junior colleges	29,470
Local government	25,610
Elementary and secondary schools	24,760
Other information services	23,420

Salaries of library technicians in the Federal Government averaged $43,238 in 2007.

Related Occupations

Library technicians perform organizational and administrative duties. Workers in other occupations with similar duties include library assistants, clerical; information and record clerks; and medical records and health information technicians. Technicians also support and assist librarians in much the same way as teacher assistants support teachers.

Sources of Additional Information

For general career information on library technicians, including information on training programs, contact:

➤ American Library Association, Office for Human Resource Development and Recruitment, 50 East Huron St., Chicago, IL 60611. Internet: **http://www.ala.org/ala/education/educationcareers.htm**

➤ Council on Library/Media Technology, P.O. Box 42048, Mesa, AZ 85274-2048. Internet: **http://colt.ucr.edu**

Information concerning requirements and application procedures for positions in the Library of Congress can be obtained directly from:

➤ Human Resources Office, Library of Congress, 101 Independence Ave. SE., Washington, DC 20540-2231. Internet: **http://www.loc.gov/hr**

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Library technicians	25-4031	121,000	132,000	10,000	8

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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State library agencies can furnish information on requirements for technicians and general information about career prospects in the State. Several of these agencies maintain job hot lines that report openings for library technicians.

State departments of education can furnish information on requirements and job opportunities for school library technicians.

Teacher Assistants

(O*NET 25-9041.00)

Significant Points

- Almost 4 in 10 teacher assistants work part time.
- Educational requirements range from a high school diploma to some college training.
- Favorable job prospects are expected.
- Opportunities should be best for those with at least 2 years of formal postsecondary education, those with experience in helping special education students, or those who can speak a foreign language.

Nature of the Work

Teacher assistants provide instructional and clerical support for classroom teachers, allowing teachers more time for lesson planning and teaching. They support and assist children in learning class material using the teacher's lesson plans, providing students with individualized attention. Teacher assistants also supervise students in the cafeteria, schoolyard, and hallways, or on field trips; they record grades, set up equipment, and help prepare materials for instruction. Teacher assistants also are called teacher aides or instructional aides. Some assistants refer to themselves as paraeducators or paraprofessionals.

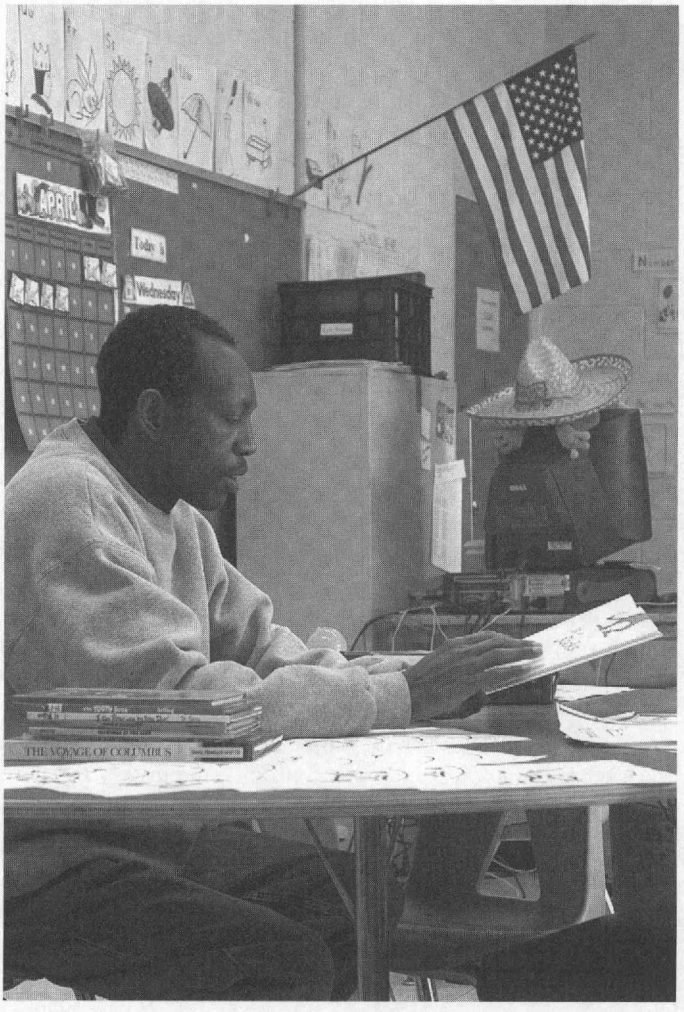
Some teacher assistants perform exclusively noninstructional or clerical tasks, such as monitoring nonacademic settings. Playground and lunchroom attendants are examples of such assistants. Most teacher assistants, however, perform a combination of instructional and clerical duties. They generally provide instructional reinforcement to children, under the direction and guidance of teachers. They work with students individually or in small groups—listening while students read, reviewing or reinforcing class lessons, or helping them find information for reports. At the secondary school level, teacher assistants often specialize in a certain subject, such as math or science. Teacher assistants often take charge of special projects and prepare equipment or exhibits, such as for a science demonstration. Some assistants work in computer laboratories, helping students to use computers and educational software programs.

In addition to instructing, assisting, and supervising students, teacher assistants may grade tests and papers, check homework, keep health and attendance records, do typing and filing, and duplicate materials. They also stock supplies, operate audiovisual equipment, and keep classroom equipment in order.

Many teacher assistants work extensively with special education students. As schools become more inclusive and integrate special education students into general education classrooms, teacher assistants in both general education and special education classrooms increasingly assist students with disabilities. They attend to the physical needs of students with disabilities, including feeding, teaching good grooming habits, or assisting students riding the schoolbus. They also provide personal attention to students with other special needs, such as those who speak English as a second language or those who need remedial education. Some work with young adults to help them obtain a job or to apply for community services to support them after schooling. Teacher assistants help assess a student's progress by observing performance and recording relevant data.

While the majority of teacher assistants work in primary and secondary educational settings, others work in preschools and other child care centers. Often one or two assistants will work with a lead teacher in order to better provide the individual attention that young children require. In addition to assisting in educational instruction, they also supervise the children at play and assist in feeding and other basic care activities.

Teacher assistants also work with infants and toddlers who have developmental delays or other disabilities. Under the guidance of a teacher or therapist, teacher assistants perform exercises or play games to help the child develop physically and behaviorally.



Teacher assistants work with small groups of students during reading lessons.

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Work environment. Teacher assistants work in a variety of settings—including preschools, child care centers, and religious and community centers, where they work with young adults—but most work in classrooms in elementary, middle, and secondary schools. They also work outdoors supervising recess when weather allows, and they spend much of their time standing, walking, or kneeling.

Approximately 4 in 10 teacher assistants work part time. However, even among full-time workers, about 17 percent work less than 40 hours per week. Most assistants who provide educational instruction work the traditional 9-month to 10-month school year.

Seeing students develop and gain appreciation of the joy of learning can be very rewarding. However, working closely with students can be both physically and emotionally tiring. Teacher assistants who work with special education students often perform more strenuous tasks, including lifting, as they help students with their daily routine. Those who perform clerical work may tire of administrative duties, such as copying materials or entering data.

Training, Other Qualifications, and Advancement

Training requirements for teacher assistants vary by State or school district and range from a high school diploma to some college training. Increasingly, employers prefer applicants with some related college coursework.

Education and training. Many teacher assistants need only a high school diploma and on-the-job training. A college degree or related coursework in child development improves job opportunities, however. In fact, teacher assistants who work in Title 1 schools—those with a large proportion of students from low-income households—must have college training or proven academic skills. They face new Federal requirements as of 2006: assistants must hold a 2-year or higher degree, have a minimum of 2 years of college, or pass a rigorous State or local assessment.

A number of colleges offer associate degrees or certificate programs that either prepare graduates to work as teacher assistants or provide additional training for current teacher assistants.

All teacher assistants receive some on-the-job training. Teacher assistants need to become familiar with the school system and with the operation and rules of the school. Those who tutor and review lessons with students, must learn and understand the class materials and instructional methods used by the teacher. Teacher assistants also must know how to operate audiovisual equipment, keep records, and prepare instructional materials, as well as have adequate computer skills.

Other qualifications. Many schools require previous experience in working with children and a valid driver's license. Some schools may require the applicant to pass a background check. Teacher assistants should enjoy working with children from a wide range of cultural backgrounds and be able to handle classroom situations with fairness and patience. Teacher assistants also must demonstrate initiative and a willingness to follow a teacher's directions. They must have good writing skills and be able to communicate effectively with students and teachers. Teacher assistants who speak a second language, especially Spanish, are in great demand for communicating with growing numbers of students and parents whose primary language is not English.

Advancement. Advancement for teacher assistants—usually in the form of higher earnings or increased responsibility—comes primarily with experience or additional education. Some school districts provide time away from the job or tuition reimbursement so that teacher assistants can earn their bachelor's degrees and pursue licensed teaching positions. In return for tuition reimbursement, assistants are often required to teach for a certain length of time in the school district.

Employment

Teacher assistants held 1.3 million jobs in 2006. About 3 out of 4 worked for public and private elementary and secondary schools. Child care centers and religious organizations employed most of the rest.

Job Outlook

Many job openings are expected for teacher assistants due to turnover and average employment growth in this large occupation, resulting in favorable job prospects.

Employment change. Employment of teacher assistants is expected to grow by 10 percent between 2006 and 2016, about as fast as the average for all occupations. A large number of new jobs, 137,000, will arise over the 2006-16 period because of the size of the occupation. School enrollments are projected to increase slowly over the next decade, but faster growth is expected among special education students and students for whom English is a second language, and they will increase as a share of the total school-age population. These students are the ones who most need teacher assistants.

Legislation requires students with disabilities and non-native English speakers to receive an education equal to that of other students, so it will continue to generate jobs for teacher assistants, who help to accommodate these students' special needs. Children with special needs require much personal attention, and teachers rely heavily on teacher assistants to provide much of that attention. An increasing number of after-school programs and summer programs also will create new opportunities for teacher assistants.

The greater focus on school quality and accountability in recent years also is likely to lead to an increased demand for teacher assistants. Growing numbers of teacher assistants may be needed to help teachers prepare students for standardized testing and to provide extra assistance to students who perform

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Teacher assistants	25-9041	1,312,000	1,449,000	137,000	10

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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poorly on these tests. Job growth of assistants may be moderated, however, if schools are encouraged to hire more full-fledged teachers for instructional purposes.

Job prospects. Favorable job prospects are expected. Opportunities for teacher assistant jobs should be best for those with at least 2 years of formal postsecondary education, those with experience in helping special education students, or those who can speak a foreign language. Demand is expected to vary by region of the country. Regions in which the population and school enrollments are expected to grow faster, such as many communities in the South and West, should have rapid growth in the demand for teacher assistants.

In addition to job openings stemming from employment growth, numerous openings will arise as assistants leave their jobs and must be replaced. Many assistant jobs require limited formal education and offer relatively low pay so many workers transfer to other occupations or leave the labor force to assume family responsibilities, to return to school, or for other reasons.

Earnings

Median annual earnings of teacher assistants in May 2006 were $20,740. The middle 50 percent earned between $16,430 and $26,160. The lowest 10 percent earned less than $13,910, and the highest 10 percent earned more than $31,610.

Full-time workers usually receive health coverage and other benefits. Teacher assistants who work part time ordinarily do not receive benefits. In 2006, about 3 out of 10 teacher assistants belonged to unions—mainly the American Federation of Teachers and the National Education Association—which bargain with school systems over wages, hours, and the terms and conditions of employment.

Related Occupations

Teacher assistants who instruct children have duties similar to those of preschool, kindergarten, elementary, middle, and secondary school teachers, as well as special education teachers. However, teacher assistants do not have the same level of responsibility or training. The support activities of teacher assistants and their educational backgrounds are similar to those of childcare workers, library technicians, and library assistants. Teacher assistants who work with children with disabilities perform many of the same functions as occupational therapist assistants and aides.

Sources of Additional Information

For information on teacher assistants, including training and certification, contact:

➤ American Federation of Teachers, Paraprofessional and School Related Personnel Division, 555 New Jersey Ave. NW., Washington, DC 20001.
Internet: **http://www.aft.org/psrp/index.html**

➤ National Education Association, Educational Support Personnel Division, 1201 16th Street, NW., Washington, DC 20036. Internet: **http://www.nea.org/esphome**

➤ National Resource Center for Paraprofessionals, 6526 Old Main Hill, Utah State University, Logan, UT 84322.
Internet: **http://www.nrcpara.org**

Human resource departments of school systems, school administrators, and State departments of education also can provide details about employment opportunities and required qualifications for teacher assistant jobs.

Teachers—Adult Literacy and Remedial Education

(O*NET 25-3011.00)

Significant Points

- Many adult literacy and remedial education teachers work part time and receive no benefits; unpaid volunteers also teach these subjects.
- Most programs require teachers to have at least a bachelor's degree; a public school teaching license is required for publicly run programs in some States.
- Job opportunities are expected to be favorable, particularly for teachers of English to speakers of other languages.

Nature of the Work

Adult literacy and remedial education teachers instruct adults and out-of-school youths in reading, writing, speaking English, and performing elementary mathematical calculations—basic skills that equip them to solve problems well enough to become active participants in our society, to hold a job, and to further their education. The instruction provided by these teachers can be divided into three principle categories: *remedial* or *adult basic education (ABE)* is geared toward adults whose skills are either at or below an eighth-grade level; *adult secondary education (ASE)* is geared towards students who wish to obtain their General Educational Development (GED) certificate or other high school equivalency credential; and *English literacy* instruction for adults with limited proficiency in English. For the most part, students in these adult education classes traditionally have been those who did not graduate from high school or who passed through school without acquiring the knowledge needed to meet their education goals or to participate fully in today's high-skill society. Increasingly, however, students in these classes are immigrants or other people whose native language is not English. Educators who work with adult English-language learners are usually called *teachers of English as a second language (ESL)* or *teachers of English to speakers of other languages (ESOL).*

Remedial education teachers, more commonly called adult basic education teachers, teach basic academic courses in mathematics, languages, history, reading, writing, science, and other areas, using instructional methods geared toward adult learning. They teach these subjects to students 16 years of age and older who demonstrate the need to increase their skills in one or more of the subject areas mentioned. Classes are taught to appeal to a variety of learning styles and usually include large-group, small-group, and one-on-one instruction. Because the students often are at different proficiency levels for different subjects, adult basic education teachers must make individual assessments of each student's abilities beforehand. In many

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programs, the assessment is used to develop an individualized education plan for each student. Teachers are required to evaluate students periodically to determine their progress and potential for advancement to the next level.

Teachers in remedial or adult basic education may have to assist students in acquiring effective study skills and the self-confidence they need to reenter an academic environment. Teachers also may encounter students with learning or physical disabilities that require additional expertise. Teachers should possess an understanding of how to help these students achieve their goals, but they also may need to have the knowledge to detect challenges their students may have and provide them with access to a broader system of additional services that are required to address their challenges.

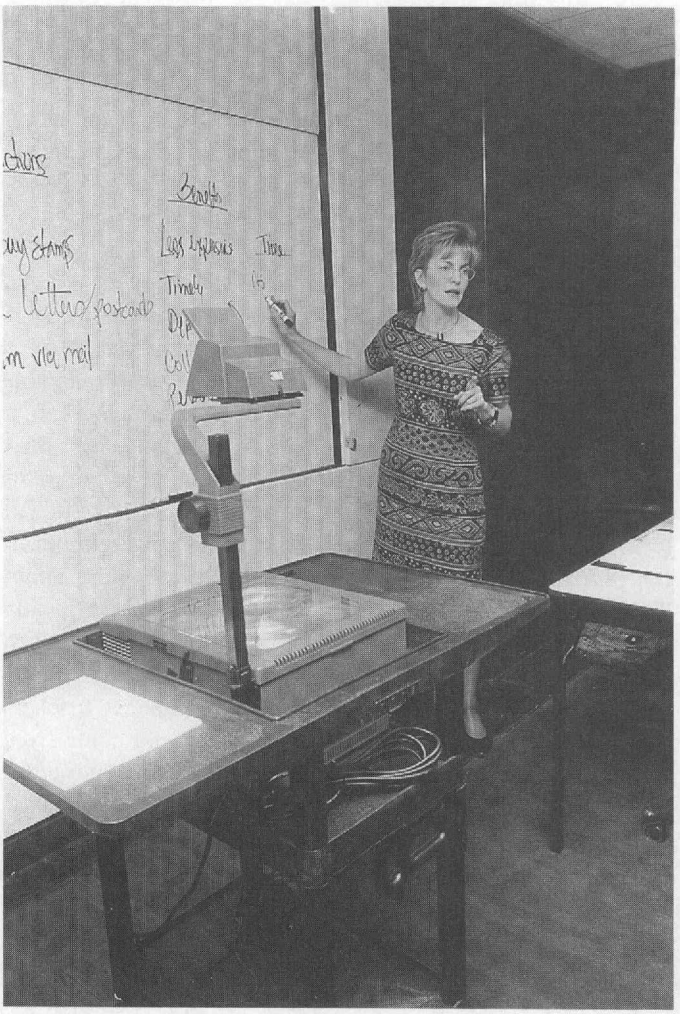
For students who wish to get a GED credential in order to get a job or qualify for postsecondary education, adult secondary education, or GED, teachers provide help in acquiring the necessary knowledge and skills to pass the test. Earning a GED requires passing a series of five tests in reading, writing, mathematics, science, and social studies; most teachers instruct students in all subject areas. To help students pass the tests and succeed later in life, teachers not only provide subject matter instruction but also focus on improving the communication, information-processing, problem-solving, and critical-thinking skills necessary for further education and successful careers.

ESOL teachers help adults to speak, listen, read, and write in English, often in the context of real-life situations to promote learning. More advanced students may concentrate on writing and conversational skills or focus on learning more academic or job-related communication skills. ESOL teachers work with adults from a wide range of backgrounds. They must be prepared to work with students of all ages and from many different language backgrounds. Some students may have extensive educational experiences in their native language, while others may have very little. As a result, some students may progress faster than others, so teachers must be able to tailor their instruction to the needs and abilities of their students. Because the teacher and students often do not share a common language, creativity is an important part of fostering communication in the classroom and achieving learning goals.

All adult literacy and remedial teachers must prepare lessons beforehand, do any related paperwork, and stay current in their fields. Attendance for students is mostly voluntary and course work is rarely graded. Because computers are increasingly being used to supplement instruction in basic skills and in teaching ESOL, many teachers also must learn the latest applications for computers in the classroom.

Work environment. Because many adult literacy and remedial education teachers work with adult students, they do not encounter some of the behavioral or social problems sometimes found with younger students. Adults attend by choice, are highly motivated, and bring years of experience to the classroom—attributes that can make teaching these students rewarding and satisfying. However, many adult education programs are located in cramped facilities that lack modern amenities, which can be frustrating for teachers.

A large number of these teachers work part time. Some have several part-time teaching assignments or work full time in addition to their part-time teaching job. Classes for adults are held on days and at times that best accommodate students who may have a job or family responsibilities, so evening and weekend work is common.



Adult literacy teachers help students learn by using examples from everyday life.

Training, Other Qualifications, and Advancement

Nearly all programs require teachers to have at least a bachelor's degree, but some require a master's degree in adult education or ESOL instruction. Some States require teachers to have a public school teacher license or a license specifically for adult education teachers.

Education and training. Adult education teachers need at least a bachelor's degree, although some programs prefer or require a master's degree. Programs may also prefer to hire those with teaching experience, especially with adults. Many colleges and universities offer master's degrees or graduate certificates in adult education, although some adult education programs offer classes or workshops themselves on topics relevant for their teachers. These include classes on teaching adults, using technology to teach, working with learners from a variety of cultures, and teaching adults with learning disabilities. ESOL teachers also should have courses or training in second-language acquisition theory and linguistics. In addition, knowledge of the citizenship and naturalization process may be useful. Knowledge of a second language is not necessary to teach ESOL students, but can be helpful in understanding

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the students' perspectives. GED teachers should know what is required to pass the GED and be able to instruct students in the subject matter.

Professional development among adult education and literacy teachers varies widely. Both part-time and full-time teachers are expected to participate in ongoing professional development activities in order to keep current on new developments in the field and to enhance skills already acquired. Each State's professional development system reflects the unique needs and organizational structure of that State. Attendance by teachers at professional development workshops and other activities is often outlined in State or local policy. Some teachers are able to access professional development activities through alternative delivery systems such as the Internet or distance learning.

Licensure. Most States require teachers in these programs to have some form of license if they are employed in a State or local government-run program. Some States have specific licenses for adult education teachers, while others require a public school teacher license. Requirements for a license typically consist of a bachelor's degree and completion of an approved teacher training program.

Other qualifications. Adult education and literacy teachers must have the ability to work with students who come from a variety of cultural, educational, and economic backgrounds. They must be understanding and respectful of their students' circumstances and be familiar with their concerns. All teachers, both paid and volunteer, should be able to communicate well and motivate their students.

Advancement. Opportunities for advancement for adult education and literacy teachers again vary from State to State and program to program. Some part-time teachers are able to move into full-time teaching positions or program administrator positions, such as coordinator or director, when such vacancies occur. Others may decide to use their classroom experience to move into policy work at a nonprofit organization or with the local, State, or Federal Government or to perform research.

Employment

Teachers of adult literacy and remedial education held about 76,000 jobs in 2006. Many additional teachers worked as unpaid volunteers. Many of the jobs are federally funded, with additional funds coming from State and local governments. The overwhelming majority of these teachers are employed by the educational services industry, primarily in local school districts, adult learning centers, and community colleges.

Job Outlook

Employment is expected to grow faster than the average for all occupations, and a large number of job openings is expected due to the need to replace people who leave the occupation or retire. Job opportunities are expected to be favorable, particularly for teachers of English to speakers of other languages.

Employment change. Employment of adult literacy and remedial education teachers is expected to grow by 14 percent through 2016, faster than the average for all occupations. As employers increasingly require a more literate workforce, workers' demand for adult literacy, basic education, and secondary education classes is expected to grow. Significant employment growth is anticipated especially for ESOL teachers, who will be needed by the increasing number of immigrants and other residents living in this country who need to learn or improve their English skills. In addition, greater proportions of these groups are expected to take ESOL classes.

The demand for adult literacy and basic and secondary education often fluctuates with the economy. When the economy is good and workers are hard to find, employers may relax their standards and hire workers without a degree or GED or good proficiency in English. As the economy softens, employers can be more selective, and more students may find that they need additional education to get a job. In addition, adult education classes often are subject to changes in funding levels, which can cause the number of teaching jobs to fluctuate from year to year. In particular, budget pressures may limit Federal funding of adult education, which may cause programs to rely more on volunteers if other organizations and governments do not make up the difference. Other factors such as immigration policies and the relative prosperity of the United States compared with other countries also may have an impact on the number of immigrants entering this country and, consequently, on the demand for ESOL teachers.

Job prospects. Job prospects should be favorable as high turnover of part time jobs in this occupation creates many openings. Opportunities will be best for ESOL teachers, particularly in States that have large populations of residents who have limited English skills—such as California, Florida, Texas, and New York. However, many other parts of the Nation have begun to attract large numbers of immigrants, making good opportunities in this field widely available.

Earnings

Median hourly earnings of adult literacy and remedial education teachers were $43,910 in May 2006. The middle 50 percent earned between $32,660 and $57,310. The lowest 10 percent earned less than $24,610, and the highest 10 percent earned more than $75,680. Part-time adult literacy and remedial education instructors are usually paid by the hour or for each class that they teach, and receive few or no benefits. Full-time teachers are generally paid a salary and receive health insurance and other benefits if they work for a school system or government.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Adult literacy, remedial education, and GED teachers and instructors	25-3011	76,000	87,000	11,000	14

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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Related Occupations

The work of adult literacy and remedial education teachers is closely related to that of other types of teachers, especially preschool, kindergarten, elementary school, middle school, and secondary school teachers. In addition, adult literacy and basic and secondary education teachers require a wide variety of skills and aptitudes. Not only must they be able to teach and motivate students (including, at times, those with learning disabilities), but they also must often take on roles as advisers and mentors. Workers in other occupations that require these aptitudes include special-education teachers, counselors, and social workers. Other occupations that involve working with speakers of languages other than English include interpreters and translators.

Sources of Additional Information

Information on adult literacy, basic and secondary education programs, and teacher certification requirements is available from State departments of education, local school districts, and literacy resource centers. Information also may be obtained through local religious and charitable organizations.

For information on adult education and family literacy programs, contact:

➤ The U.S. Department of Education, Office of Vocational and Adult Education, Potomac Center Plaza, 400 Maryland Ave. SW., Washington, DC 20202.
Internet:
http://www.ed.gov/about/offices/list/ovae/index.html

For information on teaching English as a second language, contact:

➤ The Center for Adult English Language Acquisition, 4646 40th St.NW., Washington, DC 20016.
Internet: **http://www.cal.org/caela**

Teachers—Postsecondary

(O*NET 25-1011.00, 25-1021.00, 25-1022.00, 25-1031.00, 25-1032.00, 25-1041.00, 25-1042.00, 25-1043.00, 25-1051.00, 25-1052.00, 25-1053.00, 25-1054.00, 25-1061.00, 25-1062.00, 25-1063.00, 25-1064.00, 25-1065.00, 25-1066.00, 25-1067.00, 25-1069.99, 25-1071.00, 25-1072.00, 25-1081.00, 25-1082.00, 25-1111.00, 25-1112.00, 25-1113.00, 25-1121.00, 25-1122.00, 25-1123.00, 25-1124.00, 25-1125.00, 25-1126.00, 25-1191.00, 25-1192.00, 25-1193.00, 25-1194.00, 25-1199.99)

Significant Points

- Educational qualifications range from expertise in a particular field to a Ph.D., depending on the subject taught and the type of educational institution.
- Job opportunities are expected to be very good, but many new openings will be for part-time or non-tenure-track positions.
- Prospects will be better and earnings higher in rapidly growing fields that offer many nonacademic career options.

Nature of the Work

Postsecondary teachers instruct students in a wide variety of academic and vocational subjects beyond the high school level. Most of theses students are working toward a degree, but many others are studying for a certificate or certification to improve their knowledge or career skills. Postsecondary teachers include college and university faculty, postsecondary career and technical education teachers, and graduate teaching assistants. Teaching in any venue involves forming a lesson plan, presenting material to students, responding to students learning needs, and evaluating student progress. In addition to instruction, postsecondary teachers, particularly those at 4-year colleges and universities, also perform a significant amount of research in the subject they teach. They must also keep up with new developments in their field and may consult with government, business, nonprofit, and community organizations.

College and university faculty make up the majority of postsecondary teachers. Faculty usually are organized into departments or divisions, based on academic subject or field. They typically teach several different related courses in their subject—algebra, calculus, and statistics, for example. They may instruct undergraduate or graduate students, or both. College and university faculty may give lectures to several hundred students in large halls, lead small seminars, or supervise students in laboratories. They prepare lectures, exercises, and laboratory experiments; grade exams and papers; and advise and work with students individually. In universities, they also supervise graduate students' teaching and research. College faculty work with an increasingly varied student population made up of growing shares of part-time, older, and culturally and racially diverse students.

Faculty keep up with developments in their field by reading current literature, talking with colleagues, and participating in professional conferences. They also are encouraged to do their own research to expand knowledge in their field by performing experiments; collecting and analyzing data; or examining original documents, literature, and other source material. They publish their findings in scholarly journals, books, and electronic media.

Most postsecondary teachers extensively use computer technology, including the Internet, e-mail, and software programs. They may use computers in the classroom as teaching aids and may post course content, class notes, class schedules, and other information on the Internet. The use of e-mail, chat rooms, and other techniques has greatly improved communications between students and teachers and among students.

Some instructors use the Internet to teach courses to students at remote sites. These so-called "distance learning" courses are an increasingly popular option for students who work while attending school. Faculty who teach these courses must be able to adapt existing courses to make them successful online or design a new course that takes advantage of the format.

Most full-time faculty members serve on academic or administrative committees that deal with the policies of their institution, departmental matters, academic issues, curricula, budgets, equipment purchases, and hiring. Some work with student and community organizations. Department chairpersons are faculty

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members who usually teach some courses but have heavier administrative responsibilities.

The proportion of time spent on research, teaching, administrative, and other duties varies by individual circumstance and type of institution. Faculty members at universities normally spend a significant part of their time doing research; those in 4-year colleges, somewhat less; and those in 2-year colleges, relatively little. The teaching load, however, often is heavier in 2-year colleges and somewhat lighter at 4-year institutions. At all types of institutions, full professors—those that have reached the highest level in their field—usually spend a larger portion of their time conducting research than do assistant professors, instructors, and lecturers.

In addition to traditional 2- and 4-year institutions, an increasing number of postsecondary educators work in alternative schools or in programs aimed at providing career-related education for working adults. Courses are usually offered online or on nights and weekends. Instructors at these programs generally work part time and are only responsible for teaching, with little to no administrative and research responsibilities.

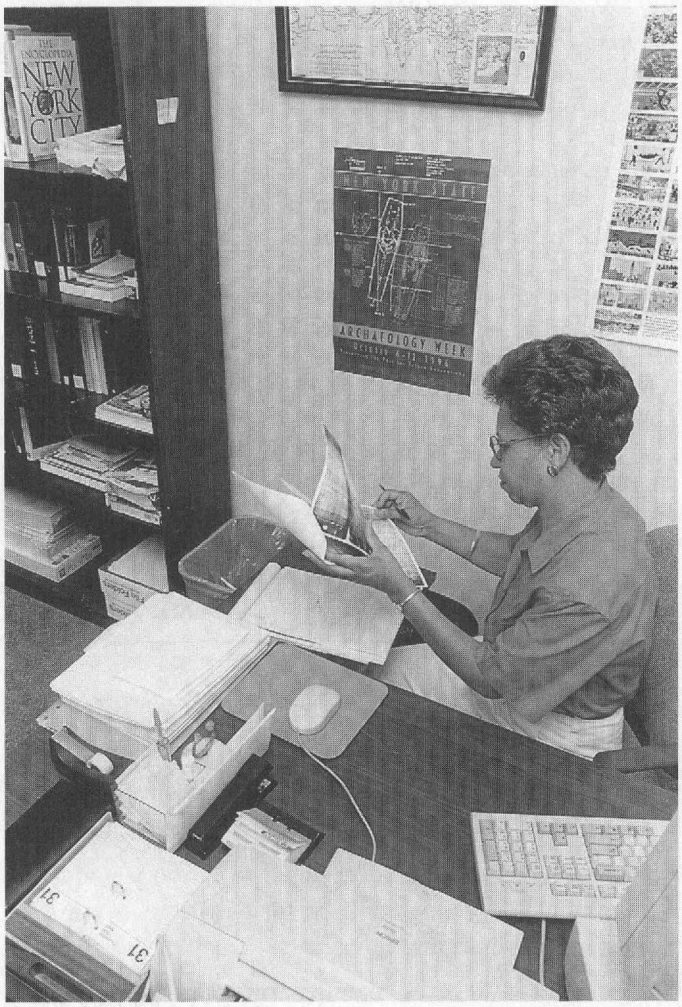
Postsecondary vocational education teachers, also known as *postsecondary career and technical education teachers*, provide instruction for occupations that require specialized training but not usually a 4-year degree. They may teach classes in welding, dental hygienics, x-ray technician techniques, auto mechanics, or cosmetology, for example. Classes often are taught in an industrial or laboratory setting where students are provided hands-on experience. For example, welding instructors show students various welding techniques and essential safety practices, watch them use tools and equipment, and have them repeat procedures until they meet the specific standards required by the trade. Increasingly, career and technical education teachers are integrating academic and vocational curriculums so that students obtain a variety of skills that can be applied on the job. In addition, career and technical education teachers at community colleges and career and technical schools also often play a key role in students' transition from school to work by helping to establish internship programs for students and by facilitating contact between students and prospective employers.

Graduate teaching assistants, often referred to as *graduate TAs*, assist faculty, department chairs, or other professional staff at colleges and universities by performing teaching or teaching-related duties. In addition to their work responsibilities, assistants have their own school commitments, as they are also students who are working towards earning a graduate degree, such as a Ph.D. Some teaching assistants have full responsibility for teaching a course—usually one that is introductory—which can include preparation of lectures and exams, and assigning final grades to students. Others help faculty members, which may include doing a variety of tasks such as grading papers, monitoring exams, holding office hours or help-sessions for students, conducting laboratory sessions, or administering quizzes to the class. Teaching assistants generally meet initially with the faculty member whom they are going to assist to determine exactly what is expected of them, as each faculty member may have his or her own needs. For example, some faculty members prefer assistants to sit in on classes, but others assign them other tasks to do during class time. Graduate teaching assistants may work one-on-one with a faculty member or, for large classes, they may be one of several assistants.

Work environment. Many postsecondary teachers find the environment intellectually stimulating and rewarding because they are surrounded by others who enjoy their subject. The ability to share their expertise with others is also appealing to many.

Most postsecondary teachers have flexible schedules. They must be present for classes, usually 12 to 16 hours per week, and for faculty and committee meetings. Most establish regular office hours for student consultations, usually 3 to 6 hours per week. Otherwise, teachers are free to decide when and where they will work, and how much time to devote to course preparation, grading, study, research, graduate student supervision, and other activities.

Classes are typically scheduled during weekdays, although some occur at night or during the weekend. This is particularly true for teachers at 2-year community colleges or institutions with large enrollments of older students who have full-time jobs or family responsibilities. Most colleges and universities require teachers to work 9 months of the year, which allows them time during the summer and school holidays to teach ad-



Postsecondary teachers conduct research and publish articles and papers, in addition to instructing students.

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ditional courses, do research, travel, or pursue nonacademic interests.

About 30 percent of college and university faculty worked part time in 2006. Some part-timers, known as "adjunct faculty," have primary jobs outside of academia—in government, private industry, or nonprofit research—and teach "on the side." Others may have multiple part-time teaching positions at different institutions. Most graduate teaching assistants work part time while working on their graduate studies. The number of hours that they work may vary, depending on their assignments.

University faculty may experience a conflict between their responsibilities to teach students and the pressure to do research and publish their findings. This may be a particular problem for young faculty seeking advancement in 4-year research universities. Also, recent cutbacks in support workers and the hiring of more part-time faculty have put a greater administrative burden on full-time faculty. Requirements to teach online classes also have added greatly to the workloads of postsecondary teachers. Many find that developing the courses to put online is very time-consuming, especially when learning how to operate the technology and answering large amounts of e-mail.

Graduate TAs usually have flexibility in their work schedules like college and university faculty, but they also must spend a considerable amount of time pursuing their own academic coursework and studies. Work may be stressful, particularly when assistants are given full responsibility for teaching a class. However, these types of positions allow graduate students the opportunity to gain valuable teaching experience, which is especially helpful for those who seek to become college faculty members after completing their degree.

Training, Other Qualifications, and Advancement

The education and training required of postsecondary teachers varies widely, depending on the subject taught and educational institution employing them. Educational requirements for teachers are generally highest at research universities, where a Ph.D. is the most commonly held degree; at career and technical institutes, experience and expertise in a related occupation is the principal qualification.

Education and training. Four-year colleges and universities usually require candidates for full-time, tenure-track positions, to hold a doctoral degree. However, they may hire master's degree holders or doctoral candidates for certain disciplines, such as the arts, or for part-time and temporary jobs.

Doctoral programs take an average of 6 years of full-time study beyond the bachelor's degree; this includes time spent completing a master's degree and a dissertation. Some programs, such as those in the humanities, may take longer to complete; others, such as those in engineering, usually are shorter. Candidates specialize in a subfield of a discipline, for example, organic chemistry, counseling psychology, or European history, and also take courses covering the entire discipline. Programs typically include 20 or more increasingly specialized courses and seminars plus comprehensive examinations on all major areas of the field. Candidates also must complete a dissertation—a written report on original research in the candidate's major field of study. The dissertation sets forth an original hypothesis or proposes a model and tests it. Students in the natural sciences and engineering usually do laboratory work; in the humanities, they study original documents and other published material. The dissertation is done under the guidance of one or more faculty advisors and usually takes 1 or 2 years of full-time work.

In 2-year colleges, master's degree holders fill most full-time teaching positions. However, in certain fields where there may be more applicants than available jobs, institutions can be more selective in their hiring practices. In these fields, master's degree holders may be passed over in favor of candidates holding Ph.Ds. Many 2-year institutions increasingly prefer job applicants to have some teaching experience or experience with distance learning. Preference also may be given to those holding dual master's degrees, especially at smaller institutions, because they can teach more subjects.

Training requirements for postsecondary career and technical education teachers vary by State and subject. In general, career and technical education teachers need a bachelor's or graduate degree, plus at least 3 years of work experience in their field. In some fields, a license or certificate that demonstrates one's qualifications may be all that is required. These teachers may need to update their skills through continuing education to maintain certification. They must also maintain ongoing dialogue with businesses to determine the skills most needed in the current workplace.

Other qualifications. Postsecondary teachers should communicate and relate well with students, enjoy working with them, and be able to motivate them. They should have inquiring and analytical minds, and a strong desire to pursue and disseminate knowledge. Additionally, they must be self-motivated and able to work in an environment in which they receive little direct supervision.

Obtaining a position as a graduate teaching assistant is a good way to gain college teaching experience. To qualify, candidates must be enrolled in a graduate school program. In addition, some colleges and universities require teaching assistants to attend classes or take some training prior to being given responsibility for a course.

Although graduate teaching assistants usually work at the institution and in the department where they are earning their degree, teaching or internship positions for graduate students at institutions that do not grant a graduate degree have become more common in recent years. For example, a program called Preparing Future Faculty, administered by the Association of American Colleges and Universities and the Council of Graduate Schools, has led to the creation of many programs that are now independent. These programs offer graduate students at research universities the opportunity to work as teaching assistants at other types of institutions, such as liberal arts or community colleges. Working with a mentor, the graduate students teach classes and learn how to improve their teaching techniques. They may attend faculty and committee meetings, develop a curriculum, and learn how to balance the teaching, research, and administrative roles that faculty play. These programs provide valuable learning opportunities for graduate students interested in teaching at the postsecondary level, and also

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help to make these students aware of the differences among the various types of institutions at which they may someday work.

Some degree holders, particularly those who studied in the natural sciences, spend additional years after earning their graduate degree on postdoctoral research and study before taking a faculty position. Some Ph.D.s are able to extend postdoctoral appointments, or take new ones, if they are unable to find a faculty job. Most of these appointments offer a nominal salary.

Advancement. For faculty, a major goal in the traditional academic career is attaining tenure. The process of attaining tenure can take approximately 7 years with faculty moving up the ranks in tenure-track positions as they meet specific criteria. The ranks are instructor, assistant professor, associate professor, and professor. Colleges and universities usually hire new tenure-track faculty as instructors or assistant professors under term contracts. At the end of the period, their record of teaching, research, and overall contribution to the institution is reviewed and tenure may be granted if the review is favorable. Those denied tenure usually must leave the institution. Tenured professors cannot be fired without just cause and due process. Tenure protects the faculty's academic freedom—the ability to teach and conduct research without fear of being fired for advocating controversial or unpopular ideas. It also gives both faculty and institutions the stability needed for effective research and teaching, and provides financial security for faculty. Some institutions have adopted post-tenure review policies to encourage ongoing evaluation of tenured faculty.

The number of tenure-track positions is declining as institutions seek flexibility in dealing with financial matters and changing student interests. Institutions rely more heavily on limited term contracts and part-time, or adjunct, faculty, thus shrinking the total pool of tenured faculty. Limited-term contracts—typically 2- to 5 years, may be terminated or extended when they expire but generally do not lead to the granting of tenure. In addition, some institutions have limited the percentage of faculty who can be tenured.

For tenured postsecondary teachers, further advancement involves a move into administrative and managerial positions, such as departmental chairperson, dean, and president. At 4-year institutions, such advancement requires a doctoral degree. At 2-year colleges, a doctorate is helpful but not usually required, except for advancement to some top administrative positions. (Deans and departmental chairpersons are covered in the *Handbook* statement on education administrators, while college presidents are included in the *Handbook* statement on top executives.)

Employment

Postsecondary teachers held nearly 1.7 million jobs in 2006. Most were employed in 4-year colleges and universities and in 2-year community colleges. Other postsecondary teachers are employed by schools and institutes that specialize in training people in a specific field, such as technology centers or culinary schools, or work for businesses that provide professional development courses to employees of companies. Some career and technical education teachers work for State and local governments and job training facilities. The following tabulation shows postsecondary teaching jobs in specialties having 20,000 or more jobs in 2006:

Health specialties teachers	145,000
Graduate teaching assistants	144,000
Vocational education teachers	119,000
Art, drama, and music teachers	88,000
Business teachers	82,000
English language and literature teachers	72,000
Education teachers	67,000
Biological science teachers	65,000
Mathematical science teachers	54,000
Nursing instructors and teachers	46,000
Computer science teachers	44,000
Engineering teachers	40,000
Psychology teachers	37,000
Foreign language and literature teachers	30,000
Communications teachers	29,000
History teachers	26,000
Philosophy and religion teachers	25,000
Chemistry teachers	24,000
Recreation and fitness studies teachers	20,000

Job Outlook

Employment of postsecondary teachers is expected to grow much faster than average as student enrollments continue to increase. However, a significant proportion of these new jobs will be part-time and non-tenure-track positions. Retirements of current postsecondary teachers should create numerous openings for all types of postsecondary teachers, so job opportunities are generally expected to be very good, although they will vary by the subject taught and the type of educational institution.

Employment change. Postsecondary teachers are expected to grow by 23 percent between 2006 and 2016, much faster than the average for all occupations. Because of the size of this occupation and its much faster than average growth rate, postsecondary teachers will account for 382,000 new jobs, which is among the largest number of new jobs for an occupation. Projected growth in the occupation will be primarily due to increases in college and university enrollment over the next decade. This enrollment growth stems mainly from the expected increase in the population of 18- to 24-year-olds, who constitute the majority of students at postsecondary institutions, and from

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Postsecondary teachers	25-1000	1,672,000	2,054,000	382,000	23

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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the increasing number of high school graduates who choose to attend these institutions. Adults returning to college to enhance their career prospects or to update their skills also will continue to create new opportunities for postsecondary teachers, particularly at community colleges and for-profit institutions that cater to working adults. However, many postsecondary educational institutions receive a significant portion of their funding from State and local governments, so expansion of public higher education will be limited by State and local budgets.

Job prospects. A significant number of openings in this occupation will be created by growth in enrollments and the need to replace the large numbers of postsecondary teachers who are likely to retire over the next decade. Many postsecondary teachers were hired in the late 1960s and the 1970s to teach members of the baby boom generation, and they are expected to retire in growing numbers in the years ahead. As a result, Ph.D. recipients seeking jobs as postsecondary teachers will experience favorable job prospects over the next decade.

Although competition will remain tight for tenure-track positions at 4-year colleges and universities, there will be available a considerable number of part-time or renewable, term appointments at these institutions and at community colleges. Opportunities for master's degree holders are also expected to be favorable because there will be considerable growth at community colleges, career education programs, and other institutions that employ them.

Opportunities for graduate teaching assistants are expected to be very good, reflecting expectations of higher undergraduate enrollments coupled with more modest increases in graduate student enrollment. Constituting almost 9 percent of all postsecondary teachers, graduate teaching assistants play an integral role in the postsecondary education system, and they are expected to continue to do so in the future.

Opportunities will also be excellent for postsecondary vocational teachers due to an increased emphasis on career and technical education at the postsecondary level. Job growth, combined with a large number of expected retirements, will result in many job openings for these workers. Prospects will be best for instructors in specialties that pay well outside of the teaching field, such as the construction trades and manufacturing technology.

One of the main reasons why students attend postsecondary institutions is to prepare themselves for careers, so the best job prospects for postsecondary teachers are likely to be in rapidly growing fields that offer many nonacademic career options. These will include fields such as business, nursing and other health specialties, and biological sciences. Community colleges and other institutions offering career and technical education have been among the most rapidly growing, and these institutions are expected to offer some of the best opportunities for postsecondary teachers.

Earnings

Median annual earnings of all postsecondary teachers in 2006 were $56,120. The middle 50 percent earned between $39,610 and $80,390. The lowest 10 percent earned less than $27,590, and the highest 10 percent earned more than $113,450.

Earnings for college faculty vary according to rank and type of institution, geographic area, and field. According to a 2006-07 survey by the American Association of University Professors, salaries for full-time faculty averaged $73,207. By rank, the average was $98,974 for professors, $69,911 for associate professors, $58,662 for assistant professors, $42,609 for instructors, and $48,289 for lecturers. Faculty in 4-year institutions earn higher salaries, on average, than do those in 2-year schools. In 2006-07, faculty salaries averaged $84,249 in private independent institutions, $71,362 in public institutions, and $66,118 in religiously affiliated private colleges and universities. In fields with high-paying nonacademic alternatives—medicine, law, engineering, and business, among others—earnings exceed these averages. In others fields, such as the humanities and education, earnings are lower. Earnings for postsecondary career and technical education teachers vary widely by subject, academic credentials, experience, and region of the country.

Many faculty members have significant earnings in addition to their base salary from consulting, teaching additional courses, research, writing for publication, or other employment. In addition, many college and university faculty enjoy unique benefits, including access to campus facilities, tuition waivers for dependents, housing and travel allowances, and paid leave for sabbaticals. Part-time faculty and instructors usually have fewer benefits than full-time faculty.

Related Occupations

Postsecondary teaching requires the ability to communicate ideas well, motivate students, and be creative. Workers in other occupations that require these skills are preschool, kindergarten, elementary, middle, and secondary school teachers; education administrators; librarians; counselors; writers and editors; public relations specialists; and management analysts. Faculty research activities often are similar to those of life, physical, and social scientists, as well as to those of managers and administrators in industry, government, and nonprofit research organizations.

Sources of Additional Information

Professional societies related to a field of study often provide information on academic and nonacademic employment opportunities. Names and addresses of many of these societies appear in statements elsewhere in the *Handbook*.

Special publications on higher education, such as The Chronicle of Higher Education, list specific employment opportunities for faculty. These publications are available in libraries.

For information on the Preparing Future Faculty program, contact:

➤ Council of Graduate Schools, One Dupont Circle, NW., Suite 430, Washington, DC 20036-1173.
Internet: **http://www.preparing-faculty.org**

For information on postsecondary career and technical education teaching positions, contact State departments of career and technical education. General information on adult and career and technical education is available from:

➤ Association for Career and Technical Education, 1410 King St., Alexandria, VA 22314. Internet: **http://www.acteonline.org**

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Teachers—Preschool, Kindergarten, Elementary, Middle, and Secondary

(O*NET 25-2011.00, 25-2012.00, 25-2021.00, 25-2022.00, 25-2023.00, 25-2031.00, 25-2032.00)

Significant Points

- Public school teachers must be licensed, which typically requires a bachelor's degree and completion of an approved teacher education program.
- Many States offer alternative licensing programs to attract people into teaching, especially for hard-to-fill positions.
- Job prospects should be favorable; opportunities will vary by geographic area and subject taught.

Nature of the Work

Teachers play an important role in fostering the intellectual and social development of children during their formative years. The education that teachers impart plays a key role in determining the future prospects of their students. Whether in preschools or high schools or in private or public schools, teachers provide the tools and the environment for their students to develop into responsible adults.

Teachers act as facilitators or coaches, using classroom presentations or individual instruction to help students learn and apply concepts in subjects such as science, mathematics, or English. They plan, evaluate, and assign lessons; prepare, administer, and grade tests; listen to oral presentations; and maintain classroom discipline. Teachers observe and evaluate a student's performance and potential and increasingly are asked to use new assessment methods. For example, teachers may examine a portfolio of a student's artwork or writing in order to judge the student's overall progress. They then can provide additional assistance in areas in which a student needs help. Teachers also grade papers, prepare report cards, and meet with parents and school staff to discuss a student's academic progress or personal problems.

Many teachers use a "hands-on" approach that uses "props" or "manipulatives" to help children understand abstract concepts, solve problems, and develop critical thought processes. For example, they teach the concepts of numbers or of addition and subtraction by playing board games. As the children get older, teachers use more sophisticated materials, such as science apparatus, cameras, or computers. They also encourage collaboration in solving problems by having students work in groups to discuss and solve problems together. To be prepared for success later in life, students must be able to interact with others, adapt to new technology, and think through problems logically.

Preschool, kindergarten, and elementary school teachers play a vital role in the development of children. What children learn and experience during their early years can shape their views of themselves and the world and can affect their later success or failure in school, work, and their personal lives. Preschool, kindergarten, and elementary school teachers introduce children to mathematics, language, science, and social studies. They use games, music, artwork, films, books, computers, and other tools to teach basic skills.

Preschool children learn mainly through play and interactive activities. *Preschool teachers* capitalize on children's play to further language and vocabulary development (using storytelling, rhyming games, and acting games), improve social skills (having the children work together to build a neighborhood in a sandbox), and introduce scientific and mathematical concepts (showing the children how to balance and count blocks when building a bridge or how to mix colors when painting). Thus, a less structured approach, including small-group lessons, one-on-one instruction, and learning through creative activities such as art, dance, and music, is adopted to teach preschool children. Play and hands-on teaching also are used by *kindergarten teachers*, but academics begin to take priority in kindergarten classrooms. Letter recognition, phonics, numbers, and awareness of nature and science, introduced at the preschool level, are taught primarily in kindergarten.

Most *elementary school teachers* instruct one class of children in several subjects. In some schools, two or more teachers work as a team and are jointly responsible for a group of students in at least one subject. In other schools, a teacher may teach one special subject—usually music, art, reading, science, arithmetic, or physical education—to a number of classes. A small but growing number of teachers instruct multilevel classrooms, with students at several different learning levels.

Middle school teachers and *secondary school teachers* help students delve more deeply into subjects introduced in elementary school and expose them to more information about the world. Middle and secondary school teachers specialize in a specific subject, such as English, Spanish, mathematics, history, or biology. They also may teach subjects that are career oriented. *Vocational education teachers*, also referred to as career and technical or career-technology teachers, instruct and train students to work in a wide variety of fields, such as healthcare, business, auto repair, communications, and, increasingly, technology. They often teach courses that are in high demand by area employers, who may provide input into the curriculum and offer internships to students. Many vocational teachers play an active role in building and overseeing these partnerships. Additional responsibilities of middle and secondary school teachers may include career guidance and job placement, as well as follow-ups with students after graduation. (*Special education teachers*—who instruct elementary and secondary school students who have a variety of disabilities—are discussed separately in this section of the *Handbook*.)

In addition to conducting classroom activities, teachers oversee study halls and homerooms, supervise extracurricular activities, and accompany students on field trips. They may identify students with physical or mental problems and refer the students to the proper authorities. Secondary school teachers occasionally assist students in choosing courses, colleges, and careers. Teachers also participate in education conferences and workshops.

Computers play an integral role in the education teachers provide. Resources such as educational software and the Inter-

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net expose students to a vast range of experiences and promote interactive learning. Through the Internet, students can communicate with other students anywhere in the world, allowing them to share experiences and differing viewpoints. Students also use the Internet for individual research projects and to gather information. Computers are used in other classroom activities as well, from solving math problems to learning English as a second language. Teachers also may use computers to record grades and perform other administrative and clerical duties. They must continually update their skills so that they can instruct and use the latest technology in the classroom.

Teachers often work with students from varied ethnic, racial, and religious backgrounds. With growing minority populations in most parts of the country, it is important for teachers to work effectively with a diverse student population. Accordingly, some schools offer training to help teachers enhance their awareness and understanding of different cultures. Teachers may also include multicultural programming in their lesson plans, to address the needs of all students, regardless of their cultural background.

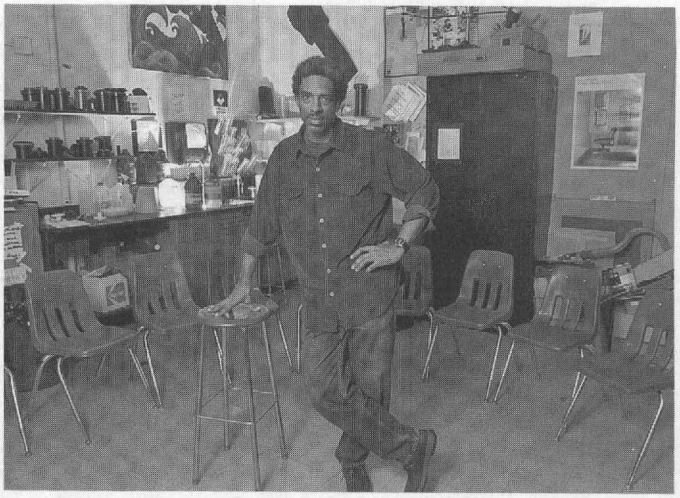
In recent years, site-based management, which allows teachers and parents to participate actively in management decisions regarding school operations, has gained popularity. In many schools, teachers are increasingly involved in making decisions regarding the budget, personnel, textbooks, curriculum design, and teaching methods.

Work environment. Seeing students develop new skills and gain an appreciation of knowledge and learning can be very rewarding. However, teaching may be frustrating when one is dealing with unmotivated or disrespectful students. Occasionally, teachers must cope with unruly behavior and violence in the schools. Teachers may experience stress in dealing with large classes, heavy workloads, or old schools that are run down and lack many modern amenities. Accountability standards also may increase stress levels, with teachers expected to produce students who are able to exhibit satisfactory performance on standardized tests in core subjects. Many teachers, particularly in public schools, are also frustrated by the lack of control they have over what they are required to teach.

Teachers in private schools generally enjoy smaller class sizes and more control over establishing the curriculum and setting standards for performance and discipline. Their students also tend to be more motivated, since private schools can be selective in their admissions processes.

Teachers are sometimes isolated from their colleagues because they work alone in a classroom of students. However, some schools allow teachers to work in teams and with mentors to enhance their professional development.

Including school duties performed outside the classroom, many teachers work more than 40 hours a week. Part-time schedules are more common among preschool and kindergarten teachers. Although most school districts have gone to all-day kindergartens, some kindergarten teachers still teach two kindergarten classes a day. Most teachers work the traditional 10-month school year with a 2-month vacation during the summer. During the vacation break, those on the 10-month schedule may teach in summer sessions, take other jobs, travel, or pursue personal interests. Many enroll in college courses or workshops



Teachers instruct students in both academic and personal enrichment subjects.

to continue their education. Teachers in districts with a year-round schedule typically work 8 weeks, are on vacation for 1 week, and have a 5-week midwinter break. Preschool teachers working in day care settings often work year round.

Most States have tenure laws that prevent public school teachers from being fired without just cause and due process. Teachers may obtain tenure after they have satisfactorily completed a probationary period of teaching, normally 3 years. Tenure does not absolutely guarantee a job, but it does provide some security.

Training, Other Qualifications, and Advancement

The traditional route to becoming a public school teacher involves completing a bachelor's degree from a teacher education program and then obtaining a license. However, most States now offer alternative routes to licensure for those who have a college degree in other fields. Private school teachers do not have to be licensed but still need a bachelor's degree. A bachelor's degree may not be needed by preschool teachers and vocational education teachers, who need experience in their field rather than a specific degree.

Education and training. Traditional education programs for kindergarten and elementary school teachers include courses designed specifically for those preparing to teach. These courses include mathematics, physical science, social science, music, art, and literature, as well as prescribed professional education courses, such as philosophy of education, psychology of learning, and teaching methods. Aspiring secondary school teachers most often major in the subject they plan to teach while also taking a program of study in teacher preparation. Many 4-year colleges require students to wait until their sophomore year before applying for admission to teacher education programs. To maintain their accreditation, teacher education programs are now required to include classes in the use of computers and other technologies. Most programs require students to perform a student-teaching internship. Teacher education programs are accredited by the National Council for Accreditation of Teacher Education and the Teacher Education Accreditation Council. Graduation from an accredited program is not necessary to become a teacher, but it may make fulfilling licensure requirements easier.

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Many States now offer professional development schools, which are partnerships between universities and elementary or secondary schools. Professional development schools merge theory with practice and allow the student to experience a year of teaching firsthand, under professional guidance. Students enter these 1-year programs after completion of their bachelor's degree.

Licensure and certification. All 50 States and the District of Columbia require public school teachers to be licensed. Licensure is not required for teachers in most private schools. Usually licensure is granted by the State Board of Education or a licensure advisory committee. Teachers may be licensed to teach the early childhood grades (usually preschool through grade 3); the elementary grades (grades 1 through 6 or 8); the middle grades (grades 5 through 8); a secondary-education subject area (usually grades 7 through 12); or a special subject, such as reading or music (usually grades kindergarten through 12).

Requirements for regular licenses to teach kindergarten through grade 12 vary by State. However, all States require general education teachers to have a bachelor's degree and to have completed an approved teacher training program with a prescribed number of subject and education credits, as well as supervised practice teaching. Some States also require technology training and the attainment of a minimum grade point average. A number of States require that teachers obtain a master's degree in education within a specified period after they begin teaching.

Almost all States require applicants for a teacher's license to be tested for competency in basic skills, such as reading and writing, and in teaching. Almost all also require teachers to exhibit proficiency in their subject. Many school systems are presently moving toward implementing performance-based systems for licensure, which usually require teachers to demonstrate satisfactory teaching performance over an extended period in order to obtain a provisional license, in addition to passing an examination in their subject. Most States require teachers to complete a minimum number of hours of continuing education to renew their license. Many States have reciprocity agreements that make it easier for teachers licensed in one State to become licensed in another.

Licensing requirements for preschool teachers also vary by State. Requirements for public preschool teachers are generally more stringent than those for private preschool teachers. Some States require a bachelor's degree in early childhood education, while others require an associate's degree, and still others require certification by a nationally recognized authority. The Child Development Associate (CDA) credential, the most common type of certification, requires a mix of classroom training and experience working with children, along with an independent assessment of the teacher's competence.

Nearly all States now also offer alternative licensure programs for teachers who have a bachelor's degree in the subject they will teach, but who lack the necessary education courses required for a regular license. Many of these alternative licensure programs are designed to ease shortages of teachers of certain subjects, such as mathematics and science. Other programs provide teachers for urban and rural schools that have difficulty filling positions with teachers from traditional licensure programs. Alternative licensure programs are intended to attract people into teaching who do not fulfill traditional licensing standards, including recent college graduates who did not complete education programs and those changing from another career to teaching. In some programs, individuals begin teaching quickly under provisional licensure under the close supervision of experienced educators while taking education courses outside school hours. If they progress satisfactorily, they receive regular licensure after working for 1 or 2 years. In other programs, college graduates who do not meet licensure requirements take only those courses that they lack and then become licensed. This approach may take 1 or 2 semesters of full-time study. The coursework for alternative certification programs often leads to a master's degree. In extreme circumstances, when schools cannot attract enough qualified teachers to fill positions, States may issue emergency licenses to individuals who do not meet the requirements for a regular license that let them begin teaching immediately.

In many States, vocational teachers have many of the same licensure requirements as other teachers. However, knowledge and experience in a particular field are important, so some States will license vocational education teachers without a bachelor's degree, provided they can demonstrate expertise in their field. A minimum number of hours in education courses may also be required.

Private schools are generally exempt from meeting State licensing standards. For secondary school teacher jobs, they prefer candidates who have a bachelor's degree in the subject they intend to teach, or in childhood education for elementary school teachers. They seek candidates among recent college graduates as well as from those who have established careers in other fields.

Other qualifications. In addition to being knowledgeable about the subjects they teach, teachers must have the ability to communicate, inspire trust and confidence, and motivate students, as well as understand the students' educational and emotional needs. Teachers must be able to recognize and respond to individual and cultural differences in students and employ different teaching methods that will result in higher student achievement. They should be organized, dependable, patient, and creative. Teachers also must be able to work cooperatively and communicate effectively with other teachers, support staff, parents, and members of the community. Private schools associated with religious institutions also desire candidates who share the values that are important to the institution.

Additional certifications and advancement. In some cases, teachers of kindergarten through high school may attain professional certification in order to demonstrate competency beyond that required for a license. The National Board for Professional Teaching Standards offers a voluntary national certification. To become nationally certified, experienced teachers must prove their aptitude by compiling a portfolio showing their work in the classroom and by passing a written assessment and evaluation of their teaching knowledge. Currently, teachers may become certified in a variety of areas, on the basis of the age of the students and, in some cases, the subject taught. For example, teachers may obtain a certificate for teaching English language

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arts to early adolescents (aged 11 to 15), or they may become certified as early childhood generalists. All States recognize national certification, and many States and school districts provide special benefits to teachers who earn certification. Benefits typically include higher salaries and reimbursement for continuing education and certification fees. In addition, many States allow nationally certified teachers to carry a license from one State to another.

With additional preparation, teachers may move into such positions as school librarians, reading specialists, instructional coordinators, or guidance counselors. Teachers may become administrators or supervisors, although the number of these positions is limited and competition for them can be intense. In some systems, highly qualified, experienced teachers can become senior or mentor teachers, with higher pay and additional responsibilities. They guide and assist less experienced teachers while keeping most of their own teaching responsibilities. Preschool teachers usually work their way up from assistant teacher, to teacher, to lead teacher—who may be responsible for the instruction of several classes—and, finally, to director of the center. Preschool teachers with a bachelor's degree frequently are qualified to teach kindergarten through grade 3 as well. Teaching at these higher grades often results in higher pay.

Employment

Preschool, kindergarten, elementary school, middle school, and secondary school teachers, except special education, held about 4.0 million jobs in 2006. Of the teachers in those jobs, about 1.5 million are elementary school teachers, 1.1 million are secondary school teachers, 673,000 are middle school teachers, 437,000 are preschool teachers, and 170,000 are kindergarten teachers. The vast majority work in elementary and secondary schools. Preschool teachers, except special education, are most often employed in child daycare services (59 percent), public and private educational services (16 percent), and religious organizations (15 percent). Employment of teachers is geographically distributed much the same as the population.

Job Outlook

Employment of preschool, kindergarten, elementary, middle, and secondary school teachers is projected to grow about as fast as average. Job prospects are expected to be favorable, with particularly good prospects for teachers in high-demand fields like math, science, and bilingual education, or in less desirable urban or rural school districts.

Employment change. Employment of school teachers is expected to grow by 12 percent between 2006 and 2016, about as fast as the average for all occupations. However, because of the size of the occupations in this group, this growth will create 479,000 additional teacher positions, more than all but a few occupations.

Through 2016, overall student enrollments in elementary, middle, and secondary schools—a key factor in the demand for teachers—are expected to rise more slowly than in the past as children of the baby boom generation leave the school system. This will cause employment of teachers from kindergarten through the secondary grades to grow as fast as the average. Projected enrollments will vary by region. Fast-growing States in the South and West—led by Nevada, Arizona, Texas, and Georgia—will experience the largest enrollment increases. Enrollments in the Midwest are expected to hold relatively steady, while those in the Northeast are expected to decline. Teachers who are geographically mobile and who obtain licensure in more than one subject should have a distinct advantage in finding a job.

The number of teachers employed is dependent on State and local expenditures for education and on the enactment of legislation to increase the quality and scope of public education. At the Federal level, there has been a large increase in funding for education, particularly for the hiring of qualified teachers in lower income areas. Also, some States are instituting programs to improve early childhood education, such as offering full day kindergarten and universal preschool. These programs, along with projected higher enrollment growth for preschool age children, will create many new jobs for preschool teachers, which are expected to grow much faster than the average for all occupations.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Teachers—preschool, kindergarten, elementary, middle, and secondary	—	3,954,000	4,433,000	479,000	12
Preschool and kindergarten teachers	25-2010	607,000	750,000	143,000	23
Preschool teachers, except special education	25-2011	437,000	552,000	115,000	26
Kindergarten teachers, except special education	25-2012	170,000	198,000	28,000	16
Elementary and middle school teachers	25-2020	2,214,000	2,496,000	282,000	13
Elementary school teachers, except special education	25-2021	1,540,000	1,749,000	209,000	14
Middle school teachers, except special and vocational education	25-2022	658,000	732,000	74,000	11
Vocational education teachers, middle school	25-2023	16,000	15,000	-800	-5
Secondary school teachers	25-2030	1,133,000	1,187,000	54,000	5
Secondary school teachers, except special and vocational education	25-2031	1,038,000	1,096,000	59,000	6
Vocational education teachers, secondary school	25-2032	96,000	91,000	-4,400	-5

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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Job prospects. Job opportunities for teachers over the next 10 years will vary from good to excellent, depending on the locality, grade level, and subject taught. Most job openings will result from the need to replace the large number of teachers who are expected to retire over the 2006-16 period. Also, many beginning teachers decide to leave teaching for other careers after a year or two—especially those employed in poor, urban schools—creating additional job openings for teachers.

The job market for teachers also continues to vary by school location and by subject taught. Job prospects should be better in inner cities and rural areas than in suburban districts. Many inner cities—often characterized by overcrowded, ill-equipped schools and higher-than-average poverty rates—and rural areas—characterized by their remote location and relatively low salaries—have difficulty attracting and retaining enough teachers. Currently, many school districts have difficulty hiring qualified teachers in some subject areas—most often mathematics, science (especially chemistry and physics), bilingual education, and foreign languages. Increasing enrollments of minorities, coupled with a shortage of minority teachers, should cause efforts to recruit minority teachers to intensify. Also, the number of non-English-speaking students will continue to grow, creating demand for bilingual teachers and for those who teach English as a second language. Qualified vocational teachers also are currently in demand in a variety of fields at both the middle school and secondary school levels. Specialties that have an adequate number of qualified teachers include general elementary education, physical education, and social studies.

The supply of teachers is expected to increase in response to reports of improved job prospects, better pay, more teacher involvement in school policy, and greater public interest in education. In addition, more teachers may be drawn from a reserve pool of career changers, substitute teachers, and teachers completing alternative certification programs. In recent years, the total number of bachelor's and master's degrees granted in education has been increasing slowly. But many States have implemented policies that will encourage even more students to become teachers because of a shortage of teachers in certain locations and in anticipation of the loss of a number of teachers to retirement.

Earnings

Median annual earnings of kindergarten, elementary, middle, and secondary school teachers ranged from $43,580 to $48,690 in May 2006; the lowest 10 percent earned $28,590 to $33,070; the top 10 percent earned $67,490 to $76,100. Median earnings for preschool teachers were $22,680.

According to the American Federation of Teachers, beginning teachers with a bachelor's degree earned an average of $31,753 in the 2004–05 school year. The estimated average salary of all public elementary and secondary school teachers in the 2004–05 school year was $47,602.

In 2006, more than half of all elementary, middle, and secondary school teachers belonged to unions—mainly the American Federation of Teachers and the National Education Association—that bargain with school systems over salaries, hours, and other terms and conditions of employment. Fewer preschool and kindergarten teachers were union members—about 17 percent in 2006.

Teachers can boost their earnings in a number of ways. In some schools, teachers receive extra pay for coaching sports and working with students in extracurricular activities. Getting a master's degree or national certification often results in a raise in pay, as does acting as a mentor. Some teachers earn extra income during the summer by teaching summer school or performing other jobs in the school system. Although private school teachers generally earn less than public school teachers, they may be given other benefits, such as free or subsidized housing.

Related Occupations

Preschool, kindergarten, elementary school, middle school, and secondary school teaching requires a variety of skills and aptitudes, including a talent for working with children; organizational, administrative, and recordkeeping abilities; research and communication skills; the power to influence, motivate, and train others; patience; and creativity. Workers in other occupations requiring some of these aptitudes include teachers—postsecondary; counselors; teacher assistants; education administrators; librarians; child care workers; public relations specialists; social workers; and athletes, coaches, umpires, and related workers.

Sources of Additional Information

Information on licensure or certification requirements and approved teacher training institutions is available from local school systems and State departments of education.

Information on teachers' unions and education-related issues may be obtained from the following sources:

➤ American Federation of Teachers, 555 New Jersey Ave. NW., Washington, DC 20001. Internet: **http://www.aft.org**

➤ National Education Association, 1201 16th St.NW., Washington, DC 20036. Internet: **http://www.nea.org**

A list of institutions with accredited teacher education programs can be obtained from:

➤ National Council for Accreditation of Teacher Education, 2010 Massachusetts Ave. NW., Suite 500, Washington, DC 20036-1023. Internet: **http://www.ncate.org**

➤ Teacher Education Accreditation Council, Suite 300, One Dupont Circle, Washington, DC 20036.
Internet: **http://www.teac.org**

Information on alternative certification programs can be obtained from:

➤ National Center for Alternative Certification, 1901 Pennsylvania Ave NW., Suite 201, Washington, DC 20006. Internet: **http://www.teach-now.org**

Information on National Board Certification can be obtained from:

➤ National Board for Professional Teaching Standards, 1525 Wilson Blvd., Suite 500, Arlington, VA 22209.
Internet: **http://www.nbpts.org**

For information on vocational education and vocational education teachers, contact:

➤ Association for Career and Technical Education, 1410 King St., Alexandria, VA 22314. Internet: **http://www.acteonline.org**

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For information on careers in educating children and issues affecting preschool teachers, contact either of the following organizations:

➤ National Association for the Education of Young Children, 1509 16th St.NW., Washington, DC 20036.
Internet: **http://www.naeyc.org**

➤ Council for Professional Recognition, 2460 16th St.NW., Washington, DC 20009-3575.
Internet: **http://www.cdacouncil.org**

Teachers—Self-Enrichment Education

(O*NET 25-3021.00)

Significant Points

- Many self-enrichment teachers are self-employed or work part time.
- Teachers should have knowledge and enthusiasm for their subject, but little formal training is required.
- Employment is projected to grow much faster than average, and job prospects should be favorable; opportunities may vary by subject taught.

Nature of the Work

Self-enrichment teachers provide instruction in a wide variety of subjects that students take for fun or self-improvement. Some teach a series of classes that provide students with useful life skills, such as cooking, personal finance, and time management. Others provide group instruction intended solely for recreation, such as photography, pottery, and painting. Many others provide one-on-one instruction in a variety of subjects, including dance, singing, or playing a musical instrument. Some teachers conduct courses on academic subjects, such as literature, foreign language, and history, in a non-academic setting. The classes self-enrichment teachers give seldom lead to a degree and attendance is voluntary, but dedicated, talented students sometimes go on to careers in the arts.

Self-enrichment teachers may have styles and methods of instruction that differ greatly. Most self-enrichment classes are relatively informal. Some classes, such as pottery or sewing, may be largely hands-on, with the instructor demonstrating methods or techniques for the class, observing students as they attempt to do it themselves, and pointing out mistakes to students and offering suggestions to improve techniques. Other classes, such as those involving financial planning or religion and spirituality, may center on lectures or might rely more heavily on group discussions. Self-enrichment teachers may also teach classes offered through religious institutions, such as marriage preparation or classes in religion for children.

Many of the classes that self-enrichment educators teach are shorter in duration than classes taken for academic credit; some finish in 1 or 2 days or several weeks. These brief classes tend to be introductory in nature and generally focus on only one topic—for example, a cooking class that teaches students how to make bread. Some self-enrichment classes introduce children and youth to activities, such as piano or drama, and may be designed to last anywhere from 1 week to several months.

Many self-enrichment teachers provide one-on-one lessons to students. The instructor may only work with the student for an hour or two a week, but tells the student what to practice in the interim until the next lesson. Many instructors work with the same students on a weekly basis for years and derive satisfaction from observing them mature and gain expertise. The most talented students may go on to paid careers as craft artists, painters, sculptors, dancers, singers, or musicians.

All self-enrichment teachers must prepare lessons beforehand and stay current in their fields. Many self-enrichment teachers are self employed and provide instruction as a business. As such, they must collect any fees or tuition and keep records of students whose accounts are prepaid or in arrears. Although not a requirement for most types of classes, teachers may use computers and other modern technologies in their instruction or to maintain business records.

Work environment. Few self-enrichment education teachers are full-time salaried workers. Most either work part time or are self-employed. Some have several part-time teaching assignments, but it is most common for teachers to have a full-time job in another occupation, often related to the subject that they teach, in addition to their part-time teaching job. Although jobs in this occupation are primarily part time and pay is low, most teachers enjoy their work because it gives them the opportunity to share a subject they enjoy with others.

Many classes for adults are held in the evenings and on weekends to accommodate students who have a job or family responsibilities. Similarly, self-enrichment classes for children are usually held after school, on weekends, or during school vacations.

Students in self-enrichment programs attend by choice so they tend to be highly motivated and eager to learn. Students



Self-enrichment teachers cover a wide range of subjects, including gardening, photography, and personal finance.

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also often bring their own unique experiences to class, which can make teaching them rewarding and satisfying. Self-enrichment teachers must have a great deal of patience, however, particularly when working with young children.

Training, Other Qualifications, and Advancement

The main qualification for self-enrichment teachers is expertise in their subject area, but requirements vary greatly with the type of class taught and the place of employment.

Education and training. In general, there are few educational or training requirements for a job as a self-enrichment teacher beyond being an expert in the subject taught. To demonstrate expertise, however, self enrichment teachers may be required to have formal training in disciplines, such as art or music, where specific teacher training programs are available. Prospective dance teachers, for example, may complete programs that prepare them to teach many types of dance—from ballroom to ballet. Other employers may require a portfolio of a teacher's work. For example, to secure a job teaching a photography course, an applicant often needs to show examples of previous work. Some self-enrichment teachers are trained educators or other professionals who teach enrichment classes in their spare time. In many self-enrichment fields, however, instructors are simply experienced in the field, and want to share that experience with others.

Other qualifications. In addition to knowledge of their subject, self-enrichment teachers should have good speaking skills and a talent for making the subject interesting. Patience and the ability to explain and instruct students at a basic level are important as well, particularly for teachers who work with children.

Advancement. Opportunities for advancement in this profession are limited. Some part-time teachers are able to move into full-time teaching positions or program administrator positions, such as coordinator or director. Experienced teachers may mentor new instructors.

Employment

Teachers of self-enrichment education held about 261,000 jobs in 2006. The largest numbers of teachers were employed by public and private educational institutions, religious organizations, and providers of social assistance and amusement and recreation services. More than 20 percent of workers were self employed.

Job Outlook

Employment of self-enrichment education teachers is expected to grow much faster than average, and job prospects should be favorable. A large number of job openings are expected due to job growth, the retirement of existing teachers, and because of those who leave their jobs for other reasons. New opportunities arise constantly because many jobs are short term and are often held as a second job.

Employment change. Employment of self-enrichment education teachers is expected to increase by 23 percent between 2006 and 2016, much faster than the average for all occupations. The need for self-enrichment teachers is expected to grow as more people embrace lifelong learning and as course offerings expand. Demand for self-enrichment education will also increase as a result of demographic changes. Retirees are one of the larger groups of participants in self-enrichment education because they have more time for classes. As members of the baby boom generation begin to retire, demand for self-enrichment education should grow. At the same time, the children of the baby boomers will be entering the age range of another large group of participants, young adults—who often are single and participate in self-enrichment classes for the social, as well as the educational, experience.

Job prospects. Job prospects should be favorable as increasing demand and high turnover creates many opportunities, but opportunities may vary as some fields have more prospective teachers than others. Opportunities should be best for teachers of subjects that are not easily researched on the Internet and those that benefit from hands-on experiences, such as cooking, crafts, and the arts. Classes on self-improvement, personal finance, and computer and Internet-related subjects are also expected to be popular.

Earnings

Median hourly earnings of wage-and-salary self-enrichment teachers were $16.08 in May 2006. The middle 50 percent earned between $11.29 and $23.08. The lowest 10 percent earned less than $8.53, and the highest 10 percent earned more than $32.02. Self-enrichment teachers are generally paid by the hour or for each class that they teach. Earnings may also be tied to the number of students enrolled in the class.

Part-time instructors are usually paid for each class that they teach, and receive few benefits. Full-time teachers are generally paid a salary and may receive health insurance and other benefits.

Related Occupations

The work of self-enrichment teachers is closely related to that of other types of teachers, especially preschool, kindergarten, elementary school, middle school, and secondary school teachers. Self-enrichment teachers also teach a wide variety of subjects that may be related to the work done by those in many other occupations, such as dancers and choreographers; artists and related workers; musicians, singers, and related workers; recreation workers; and athletes, coaches, umpires, and related workers.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Self-enrichment education teachers	25-3021	261,000	322,000	60,000	23

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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Sources of Additional Information

For information on employment of self-enrichment teachers, contact local schools, colleges, or companies that offer self-enrichment programs.

Teachers—Special Education

(O*NET 25-2041.00, 25-2042.00, 25-2043.00)

Significant Points

- All States require teachers to be licensed; traditional licensing requires the completion of a special education teacher training program and at least a bachelor's degree, though many States require a master's degree.
- Many States offer alternative licensure programs to attract college graduates who do not have training in education.
- Excellent job prospects are expected due to rising enrollments of special education students and reported shortages of qualified teachers.

Nature of the Work

Special education teachers work with children and youths who have a variety of disabilities. A small number of special education teachers work with students with severe cases of mental retardation or autism, primarily teaching them life skills and basic literacy. However, the majority of special education teachers work with children with mild to moderate disabilities, using or modifying the general education curriculum to meet the child's individual needs. Most special education teachers instruct students at the elementary, middle, and secondary school level, although some work with infants and toddlers.

The various types of disabilities that may qualify individuals for special education programs include specific learning disabilities, speech or language impairments, mental retardation, emotional disturbance, multiple disabilities, hearing impairments, orthopedic impairments, visual impairments, autism, combined deafness and blindness, traumatic brain injury, and other health impairments. Students are classified under one of the categories, and special education teachers are prepared to work with specific groups. Early identification of a child with special needs is an important part of a special education teacher's job, because early intervention is essential in educating children with disabilities.

Special education teachers use various techniques to promote learning. Depending on the disability, teaching methods can include individualized instruction, problem-solving assignments, and small-group work. When students need special accommodations to take a test, special education teachers see that appropriate ones are provided, such as having the questions read orally or lengthening the time allowed to take the test.

Special education teachers help to develop an Individualized Education Program (IEP) for each student. The IEP sets personalized goals for the student and is tailored to that student's individual needs and ability. When appropriate, the program includes a transition plan outlining specific steps to prepare students with disabilities for middle school or high school or, in the case of older students, a job or postsecondary study. Teachers review the IEP with the student's parents, school administrators, and the student's general education teachers. Teachers work closely with parents to inform them of their child's progress and suggest techniques to promote learning at home.

Special education teachers design and teach appropriate curricula, assign work geared toward each student's needs and abilities, and grade papers and homework assignments. They are involved in the students' behavioral, social, and academic development, helping them develop emotionally, feel comfortable in social situations, and be aware of socially acceptable behavior. Preparing special education students for daily life after graduation also is an important aspect of the job. Teachers provide students with career counseling or help them learn routine skills, such as balancing a checkbook.

As schools become more inclusive, special education teachers and general education teachers increasingly work together in general education classrooms. Special education teachers help general educators adapt curriculum materials and teaching techniques to meet the needs of students with disabilities. They coordinate the work of teachers, teacher assistants, and related personnel, such as therapists and social workers, to meet the individualized needs of the student within inclusive special education programs. A large part of a special education teacher's job involves communicating and coordinating with others involved in the child's well being, including parents, social workers, school psychologists, occupational and physical therapists, school administrators, and other teachers.

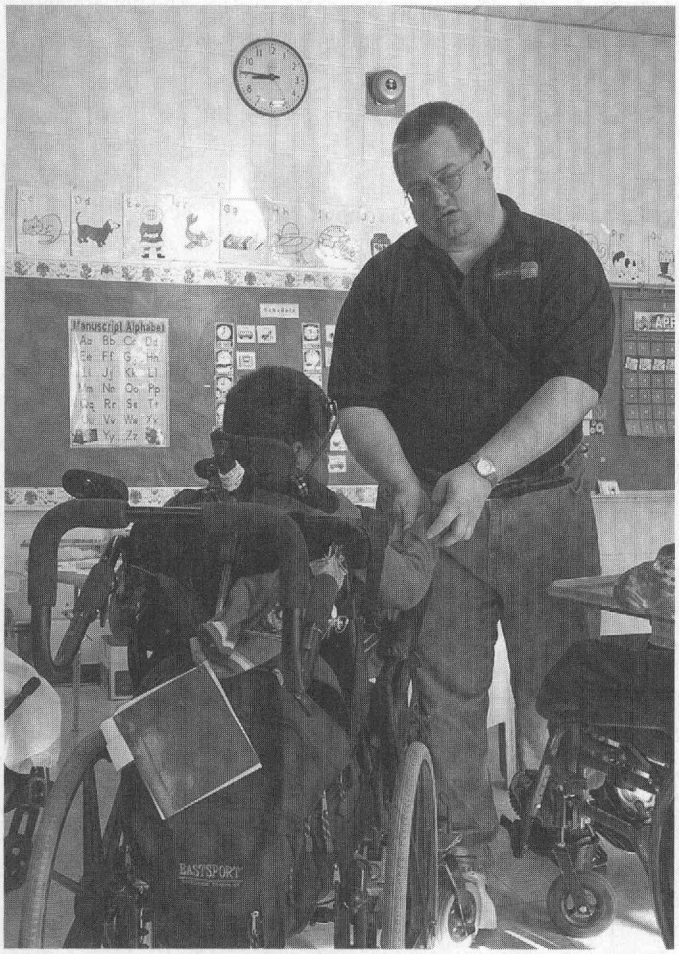
Special education teachers work in a variety of settings. Some have their own classrooms and teach only special education students; others work as special education resource teachers and offer individualized help to students in general education classrooms; still others teach together with general education teachers in classes including both general and special education students. Some teachers work with special education students for several hours a day in a resource room, separate from their general education classroom. Considerably fewer special education teachers work in residential facilities or tutor students in homebound or hospital environments.

Some special education teachers work with infants and usually travel to the child's home to work with the parents. Many of these infants have medical problems that slow or preclude normal development. Special education teachers show parents techniques and activities designed to stimulate the infant and encourage the growth and development of the child's skills. Toddlers usually receive their services at a preschool where special education teachers help them develop social, self-help, motor, language, and cognitive skills, often through the use of play.

Technology is becoming increasingly important in special education. Teachers use specialized equipment such as computers with synthesized speech, interactive educational software programs, and audiotapes to assist children.

Work environment. Special education teachers enjoy the challenge of working with students with disabilities and the

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Special education teachers adapt learning plans to the individual needs of their students.

opportunity to establish meaningful relationships with them. Although helping these students can be highly rewarding, the work also can be emotionally and physically draining. Many special education teachers are under considerable stress due to heavy workloads and administrative tasks. They must produce a substantial amount of paperwork documenting each student's progress and work under the threat of litigation against the school or district by parents if correct procedures are not followed or if they feel that their child is not receiving an adequate education. Recently passed legislation, however, is intended to reduce the burden of paperwork and the threat of litigation. The physical and emotional demands of the job cause some special education teachers to leave the occupation.

Some schools offer year-round education for special education students, but most special education teachers work only the traditional 10-month school year.

Training, Other Qualifications, and Advancement

All States require special education teachers to be licensed, which typically requires at least a bachelor's degree and completion of an approved training program in special education teaching. Many States require a master's degree. Most States have alternative methods for entry for bachelor's degree holders who do not have training in education.

Education and training. Many colleges and universities across the United States offer programs in special education at the undergraduate, master's, and doctoral degree levels. Special education teachers usually undergo longer periods of training than do general education teachers. Most bachelor's degree programs last years and include general and specialized courses in special education. However, an increasing number of institutions require a 5th year or other graduate-level preparation. Among the courses offered are educational psychology, legal issues of special education, child growth and development, and strategies for teaching students with disabilities. Some programs require specialization, while others offer generalized special education degrees or a course of study in several specialized areas. The last year of the program usually is spent student teaching in a classroom supervised by a certified teacher.

Licensure. All 50 States and the District of Columbia require special education teachers to be licensed. The State board of education or a licensure advisory committee usually grants licenses, and licensure varies by State. In some States, special education teachers receive a general education credential to teach kindergarten through grade 12. These teachers then train in a specialty, such as learning disabilities or behavioral disorders. Many States offer general special education licenses across a variety of disability categories, while others license several different specialties within special education.

For traditional licensing, all States require a bachelor's degree and the completion of an approved teacher preparation program with a prescribed number of subject and education credits and supervised practice teaching. However, many States also require a master's degree in special education, involving at least 1 year of additional course work, including a specialization, beyond the bachelor's degree. Often a prospective teacher must pass a professional assessment test as well. Some States have reciprocity agreements allowing special education teachers to transfer their licenses from one State to another, but many others still require that experienced teachers reapply and pass licensing requirements to work in the State.

Most States also offer alternative routes to licensing which are intended to attract people into teaching who do not fulfill traditional licensing standards. Most alternative licensure programs are open to anyone with a bachelor's degree, although some are designed for recent college graduates or professionals in other education occupations. Programs typically require the successful completion of a period of supervised preparation and instruction and passing an assessment test. Individuals can then begin teaching under a provisional license and can obtain a regular license after teaching under the supervision of licensed teachers for a period of 1 to 2 years and completing required education courses through a local college or other provider.

Other qualifications. Special education teachers must be patient, able to motivate students, understanding of their students' special needs, and accepting of differences in others. Teachers must be creative and apply different types of teaching methods to reach students who are having difficulty learning. Communication and cooperation are essential skills because special education teachers spend a great deal of time interacting with others, including students, parents, and school faculty and administrators.

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Advancement. Special education teachers can advance to become supervisors or administrators. They may also earn advanced degrees and become instructors in colleges that prepare others to teach special education. In some school systems, highly experienced teachers can become mentors to less experienced ones, providing guidance to those teachers while maintaining a light teaching load.

Employment

Special education teachers held a total of about 459,000 jobs in 2006. Nearly all work in public and private educational institutions. A few worked for individual and social assistance agencies or residential facilities, or in homebound or hospital environments.

Job Outlook

Employment of special education teachers is expected to increase faster than average. Job prospects should be excellent as many districts report problems finding adequate numbers of certified special education teachers.

Employment change. The number of special education teachers is expected to increase by 15 percent from 2006 to 2016, faster than the average for all occupations. Although student enrollments in general are expected to grow slowly, continued increases in the number of special education students needing services will generate a greater need for special education teachers.

The number of students requiring special education services has grown steadily in recent years due to improvements that have allowed learning disabilities to be diagnosed at earlier ages and medical advances that have resulted in more children surviving serious accidents or illnesses, but with impairments that require special accommodations. In addition, legislation emphasizing training and employment for individuals with disabilities and educational reforms requiring higher standards for graduation has increased demand for special education services. The percentage of foreign-born special education students also is expected to grow, as teachers become more adept in recognizing disabilities in that population. Finally, more parents are expected to seek special services for their children who have difficulty meeting the new, higher standards required of students.

Job prospects. In addition to job openings resulting from growth, a large number of openings will result from the need to replace special education teachers who switch to teaching general education, change careers altogether, or retire. At the same time, many school districts report difficulty finding sufficient numbers of qualified teachers. As a result, special education teachers should have excellent job prospects.

The job outlook does vary by geographic area and specialty. Although most areas of the country report difficulty finding qualified applicants, positions in inner cities and rural areas usually are more plentiful than job openings in suburban or wealthy urban areas. Student populations also are expected to increase more rapidly in certain parts of the country, such as the South and West, resulting in increased demand for special education teachers in those regions. In addition, job opportunities may be better in certain specialties—such as teachers who work with children with multiple disabilities or severe disabilities like autism—because of large increases in the enrollment of special education students classified under those categories. Legislation encouraging early intervention and special education for infants, toddlers, and preschoolers has created a need for early childhood special education teachers. Bilingual special education teachers and those with multicultural experience also are needed to work with an increasingly diverse student population.

Earnings

Median annual earnings in May 2006 of wage-and-salary special education teachers who worked primarily in preschools, kindergartens, and elementary schools were $46,360. The middle 50 percent earned between $37,500 and $59,320. The lowest 10 percent earned less than $31,320, and the highest 10 percent earned more than $73,620.

Median annual earnings of wage-and-salary middle school special education teachers were $47,650. The middle 50 percent earned between $38,460 and $61,530. The lowest 10 percent earned less than $32,420, and the highest 10 percent earned more than $80,170.

Median annual earnings of wage-and-salary special education teachers who worked primarily in secondary schools were $48,330. The middle 50 percent earned between $38,910 and $62,640. The lowest 10 percent earned less than $32,760, and the highest 10 percent earned more than $78,020.

In 2006, about 58 percent of special education teachers belonged to unions—mainly the American Federation of Teachers and the National Education Association—that bargain with school systems over wages, hours, and the terms and conditions of employment.

In most schools, teachers receive extra pay for coaching sports and working with students in extracurricular activities. Some teachers earn extra income during the summer, working in the school system or in other jobs.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016	
				Number	Percent
Special education teachers	25-2040	459,000	530,000	71,000	15
Special education teachers, preschool, kindergarten, and elementary school	25-2041	219,000	262,000	43,000	20
Special education teachers, middle school	25-2042	102,000	118,000	16,000	16
Special education teachers, secondary school	25-2043	138,000	150,000	12,000	9

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook.*

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Related Occupations

Special education teachers work with students who have disabilities and special needs. Other occupations involved with the identification, evaluation, and development of students with disabilities include psychologists, social workers, speech-language pathologists, audiologists, counselors, teacher assistants, occupational therapists, recreational therapists, and teachers—preschool, kindergarten, elementary, middle, and secondary.

Sources of Additional Information

For information on professions related to early intervention and education for children with disabilities, listings of schools with special education training programs, information on teacher certification, and general information on related personnel issues, contact:

➤ The Council for Exceptional Children, 1110 N. Glebe Rd., Suite 300, Arlington, VA 22201.
Internet: **http://www.cec.sped.org**

➤ National Center for Special Education Personnel & Related Service Providers, National Association of State Directors of Special Education, 1800 Diagonal Rd., Suite 320, Alexandria, VA 22314. Internet: **http://www.personnelcenter.org**

To learn more about the special education teacher certification and licensing requirements in individual States, contact the State's department of education.

Art and Design Occupations

Artists and Related Workers

(O*NET 27-1011.00, 27-1012.00, 27-1013.00, 27-1014.00, 27-1019.99)

Significant Points

- About 62 percent of artists and related workers are self-employed.
- Keen competition is expected for both salaried jobs and freelance work because the arts attract many talented people with creative ability.
- Artists usually develop their skills through a bachelor's degree program or other postsecondary training in art or design.
- Earnings for self-employed artists vary widely; some well-established artists earn more than salaried artists, while others find it difficult to rely solely on income earned from selling art.

Nature of the Work

Artists create art to communicate ideas, thoughts, or feelings. They use a variety of methods—painting, sculpting, or illustration—and an assortment of materials, including oils, watercolors, acrylics, pastels, pencils, pen and ink, plaster, clay, and computers. Artists' works may be realistic, stylized, or abstract and may depict objects, people, nature, or events.

Artists generally fall into one of four categories. Art directors formulate design concepts and presentation approaches for visual communications. Craft artists create or reproduce handmade objects for sale or exhibition. Fine artists, including painters, sculptors, and illustrators, create original artwork, using a variety of media and techniques. Multi-media artists and animators create special effects, animation, or other visual images on film, on video, or with computers or other electronic media. (Designers, including graphic designers, are discussed elsewhere in the *Handbook*.)

Art directors develop design concepts and review material that is to appear in periodicals, newspapers, and other printed or digital media. They decide how best to present information visually, so that it is eye catching, appealing, and organized. Art directors decide which photographs or artwork to use and oversee the design, layout, and production of material to be published. They may direct workers engaged in artwork, design, layout, and copywriting.

Craft artists make a wide variety of objects, mostly by hand, that are sold either in their own studios, in retail outlets, or at arts-and-crafts shows. Some craft artists display their works in galleries and museums. Craft artists work with many different materials, including ceramics, glass, textiles, wood, metal, and paper, to create unique pieces of art, such as pottery, stained glass, quilts, tapestries, lace, candles, and clothing. Many craft artists also use fine-art techniques—for example, painting, sketching, and printing—to add finishing touches to their art.

Fine artists typically display their work in museums, commercial art galleries, corporate collections, and private homes. Some of their artwork may be commissioned (done on request from clients), but most is sold by the artist or through private art galleries or dealers. The gallery and the artist predetermine how much each will earn from the sale. Only the most successful fine artists are able to support themselves solely through the sale of their works. Most fine artists have at least one other job to support their art careers. Some work in museums or art galleries as fine-arts directors or as curators, planning and setting up art exhibits. A few artists work as art critics for newspapers or magazines or as consultants to foundations or institutional collectors. Other artists teach art classes or conduct workshops in schools or in their own studios. Some artists also hold full-time or part-time jobs unrelated to art and pursue fine art as a hobby or second career.

Usually, fine artists specialize in one or two art forms, such as painting, illustrating, sketching, sculpting, printmaking, and restoring. Painters, illustrators, cartoonists, and sketch artists work with two-dimensional art forms, using shading, perspective, and color to produce realistic scenes or abstractions.

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Illustrators usually create pictures for books, magazines, and other publications and for commercial products such as textiles, wrapping paper, stationery, greeting cards, and calendars. Increasingly, illustrators are working in digital format, preparing work directly on a computer. This has created new opportunities for illustrators to work with animators and in broadcast media.

Medical and *scientific illustrators* combine drawing skills with knowledge of biology or other sciences. Medical illustrators work digitally or traditionally to create images of human anatomy and surgical procedures as well as 3-dimensional models and animations. Scientific illustrators draw animal and plant life, atomic and molecular structures, and geologic and planetary formations. These illustrations are used in medical and scientific publications and in audiovisual presentations for teaching purposes. Illustrators also work for lawyers, producing exhibits for court cases.

Cartoonists draw political, advertising, social, and sports cartoons. Some cartoonists work with others who create the idea or story and write captions. Some cartoonists write captions themselves. Most cartoonists have comic, critical, or dramatic talents in addition to drawing skills.

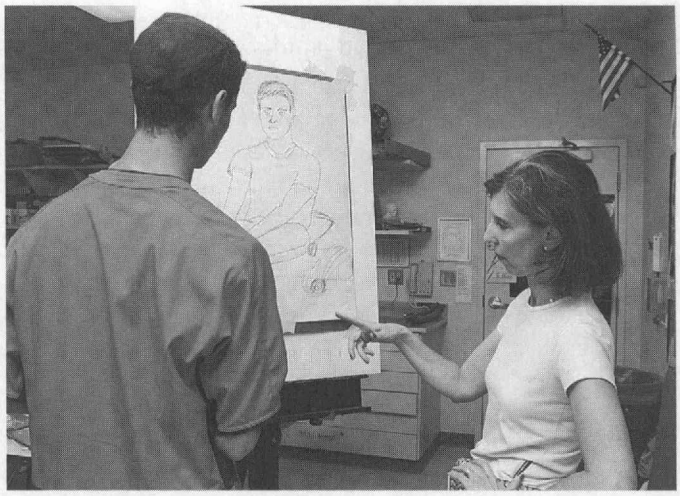
Sketch artists create likenesses of subjects with pencil, charcoal, or pastels. Sketches are used by law enforcement agencies to assist in identifying suspects, by the news media to depict courtroom scenes, and by individual patrons for their own enjoyment.

Sculptors design three-dimensional artworks, either by molding and joining materials such as clay, glass, wire, plastic, fabric, or metal or by cutting and carving forms from a block of plaster, wood, or stone. Some sculptors combine various materials to create mixed-media installations. Some incorporate light, sound, and motion into their works.

Printmakers create printed images from designs cut or etched into wood, stone, or metal. After creating the design, the artist inks the surface of the woodblock, stone, or plate and uses a printing press to roll the image onto paper or fabric. Some make prints by pressing the inked surface onto paper by hand or by graphically encoding and processing data, using a computer. The digitized images are then printed on paper with the use of a computer printer.

Painting restorers preserve and restore damaged and faded paintings. They apply solvents and cleaning agents to clean the surfaces of the paintings, they reconstruct or retouch damaged areas, and they apply preservatives to protect the paintings. Restoration is highly detailed work and usually is reserved for experts in the field.

Multi-media artists and animators work primarily in motion picture and video industries, advertising, and computer systems design services. They draw by hand and use computers to create the series of pictures that form the animated images or special effects seen in movies, television programs, and computer games. Some draw storyboards for television commercials, movies, and animated features. Storyboards present television commercials in a series of scenes similar to a comic strip and allow an advertising agency to evaluate commercials proposed by advertising companies. Storyboards also serve as guides to placing actors and cameras on the television or motion picture set and to other production details. Many multimedia artists model objects in three dimensions by computer and work with programmers to make those images move.



Many artists develop their skills through formal training in art and design.

Work environment. Many artists work in fine art or commercial art studios located in office buildings, warehouses, or lofts. Others work in private studios in their homes. Some fine artists share studio space, where they also may exhibit their work. Studio surroundings usually are well lighted and ventilated; however, fine artists may be exposed to fumes from glue, paint, ink, and other materials and to dust or other residue from filings, splattered paint, or spilled cleaners and other fluids. Artists who sit at drafting tables or who use computers for extended periods may experience back pain, eyestrain, or fatigue.

Artists employed by publishing companies, advertising agencies, and design firms generally work a standard workweek. During busy periods, they may work overtime to meet deadlines. Self-employed artists can set their own hours. They may spend much time and effort selling their artwork to potential customers or clients and building a reputation.

Training, Other Qualifications, and Advancement

Artists usually develop their skills through a bachelor's degree program or other postsecondary training in art or design. Although formal schooling is not strictly required for craft and fine artists, it is very difficult to become skilled enough to make a living without some training. Art directors usually have years of work experience and generally need at least a bachelor's degree. Due to the level of technical expertise demanded, multimedia artists and animators generally also need a bachelor's degree.

Education and training. Many colleges and universities offer programs leading to a bachelor's or master's degree in fine arts. Courses usually include core subjects such as English, social science, and natural science, in addition to art history and studio art. Independent schools of art and design also offer postsecondary studio training in the craft, fine, and multi-media arts leading to certificates in the specialties or to an associate or bachelor's degree in fine arts. Typically, these programs focus more intensively on studio work than do the academic programs in a university setting. In 2007 the

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National Association of Schools of Art and Design accredited 282 postsecondary institutions with programs in art and design; most of these schools award a degree in art.

Many educational programs in art also provide training in computer techniques. Computers are used widely in the visual arts, and knowledge and training in computer graphics and other visual display software are critical elements of many jobs in these fields.

Medical illustrators must have both a demonstrated artistic ability and a detailed knowledge of living organisms, surgical and medical procedures, and human and animal anatomy. A bachelor's degree combining art and premedical courses usually is required. However, most medical illustrators also choose to pursue a master's degree in medical illustration. This degree is offered in four accredited schools in the United States.

Art directors usually begin as entry-level artists in advertising, publishing, design, and motion picture production firms. Artists are promoted to art director after demonstrating artistic and leadership abilities. Some art schools offer coursework in art direction as part of their curricula. Depending on the scope of their responsibilities, some art directors also may pursue a degree in art administration, which teaches non-artistic skills such as project management and finance.

Those who want to teach fine arts at public elementary or secondary schools usually must have a teaching certificate in addition to a bachelor's degree. An advanced degree in fine arts or arts administration is usually necessary for management or administrative positions in government or in foundations or for teaching in colleges and universities. (See the statements for teachers—postsecondary; and teachers—preschool, kindergarten, elementary, middle, and secondary school elsewhere in the *Handbook*.)

Other qualifications. Evidence of appropriate talent and skill, displayed in an artist's portfolio, is an important factor used by art directors, clients, and others in deciding whether to hire an individual or contract for their work. A portfolio is a collection of handmade, computer-generated, photographic, or printed samples of the artist's best work. Assembling a successful portfolio requires skills usually developed through postsecondary training in art or visual communications. Internships also provide excellent opportunities for artists to develop and enhance their portfolios.

Advancement. Artists hired by firms often start with relatively routine work. While doing this work, however, they may observe other artists and practice their own skills.

Craft and fine artists advance professionally as their work circulates and as they establish a reputation for a particular style. Many of the most successful artists continually develop new ideas, and their work often evolves over time.

Many artists freelance part-time while continuing to hold a full-time job until they are established. Others freelance part time while still in school, to develop experience and to build a portfolio of published work.

Freelance artists try to develop a set of clients who regularly contract for work. Some freelance artists are widely recognized for their skill in specialties such as cartooning or children's book illustration. These artists may earn high incomes and can choose the type of work they do.

Employment

Artists held about 218,000 jobs in 2006. About 62 percent were self-employed. Employment was distributed as follows:

Multimedia artists and animators	87,000
Art directors	78,000
Fine artists, including painters, sculpters and illustrators	30,000
Craft artists	8,800
Artists and related workers, all other	14,000

Of the artists who were not self-employed, many worked for advertising and related services; newspaper, periodical, book, and software publishers; motion picture and video industries; specialized design services; and computer systems design and related services. Some self-employed artists offered their services to advertising agencies, design firms, publishing houses, and other businesses.

Job Outlook

Employment of artists is projected to grow faster than average. Competition for jobs is expected to be keen for both salaried and freelance jobs in all specialties because the number of people with creative ability and an interest in this career is expected to continue to exceed the number of available openings. Despite the competition, employers and individual clients are always on the lookout for talented and creative artists.

Employment change. Employment of artists and related workers is expected to grow 16 percent through 2016, faster than the average for all occupations.

Projections data from the National Employment Matrix

Occupational Title	SOC Code	Employment, 2006	Projected employment, 2016	Change, 2006-2016 Number	Change, 2006-2016 Percent
Artists and related workers	27-1010	218,000	253,000	34,000	16
Art directors	27-1011	78,000	85,000	7,000	9
Craft artists	27-1012	8,800	9,500	700	8
Fine artists, including painters, sculptors, and illustrators	27-1013	30,000	33,000	3,000	10
Multi-media artists and animators	27-1014	87,000	110,000	23,000	26
Artists and related workers, all other	27-1019	14,000	15,000	1,200	8

NOTE: Data in this table are rounded. See the discussion of the employment projections table in the *Handbook* introductory chapter on *Occupational Information Included in the Handbook*.

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Demand for illustrators who work on a computer will increase as Web sites use more detailed images and backgrounds in their designs. Many cartoonists, in particular, opt to post their work on political Web sites and online publications. Cartoonists often create animated or interactive images to satisfy readers' demands for more sophisticated images. The small number of medical illustrators will also be in greater demand as medical research continues to grow.

Demand for multimedia artists and animators will increase as consumers continue to demand more realistic video games, movie and television special effects, and 3D animated movies. Additional job openings will arise from an increasing demand for Web site development and for computer graphics adaptation from the growing number of mobile technologies. Animators are also increasingly finding work in alternative areas such as scientific research or design services.

Job prospects. Competition for jobs as artists and related workers will be keen because there are more qualified candidates than available jobs. Employers in all industries should be able to choose from among the most qualified candidates.

Despite the competition, studios, galleries, and individual clients are always on the lookout for artists who display outstanding talent, creativity, and style. Among craft and fine artists, talented individuals who have developed a mastery of artistic techniques and skills will have the best job prospects. Multi-media artists and animators should have better job opportunities than other artists, but still will experience competition. Job opportunities for animators of lower-technology cartoons could be hampered as these jobs continue to be outsourced overseas.

Despite an expanding number of opportunities, art directors should experience keen competition for the available openings. Craft and fine artists work mostly on a freelance or commission basis and may find it difficult to earn a living solely by selling their artwork. Only the most successful craft and fine artists receive major commissions for their work. Competition among artists for the privilege of being shown in galleries is expected to remain acute, as will competition for grants from sponsors such as private foundations, State and local arts councils, and the National Endowment for the Arts.

The growth in computer graphics packages and stock art Web sites is making it easier for writers, publishers, and art directors to create their own illustrations. As the use of this technology grows, there will be fewer opportunities for illustrators. However, it also has opened up new opportunities for illustrators who prefer to work digitally. Salaried cartoonists will have fewer job opportunities because many newspapers and magazines increasingly rely on freelance work.

Earnings

Median annual earnings of salaried art directors were $68,100 in May 2006. The middle 50 percent earned between $49,480 and $94,920. The lowest 10 percent earned less than $37,920, and the highest 10 percent earned more than $135,090. Median annual earnings were $70,630 in advertising and related services.

Median annual earnings of salaried craft artists were $24,090. The middle 50 percent earned between $18,860 and $35,840. The lowest 10 percent earned less than $14,130, and the highest 10 percent earned more than $46,700. Earnings data for the many self-employed craft artists were not available.

Median annual earnings of salaried fine artists, including painters, sculptors, and illustrators were $41,970. The middle 50 percent earned between $28,500 and $58,550. The lowest 10 percent earned less than $18,350, and the highest 10 percent earned more than $79,390. Earnings data for the many self-employed fine artists were not available.

Median annual earnings of salaried multi-media artists and animators were $51,350, not including the earnings of the self-employed. The middle 50 percent earned between $38,980 and $70,050. The lowest 10 percent earned less than $30,390, and the highest 10 percent earned more than $92,720. Median annual earnings were $57,310 in motion picture and video industries and $48,860 in advertising and related services.

Earnings for self-employed artists vary widely. Some charge only a nominal fee while they gain experience and build a reputation for their work. Others, such as well-established freelance fine artists and illustrators, can earn more than salaried artists. Many, however, find it difficult to rely solely on income earned from selling paintings or other works of art. Like other self-employed workers, freelance artists must provide their own benefits.

Related Occupations

Other workers who apply artistic skills include architects, except landscape and naval; archivists, curators, and museum technicians; commercial and industrial designers; fashion designers; floral designers; graphic designers; interior designers; jewelers and precious stone and metal workers; landscape architects; photographers; and woodworkers. Some workers who use computers extensively, including computer software engineers and desktop publishers, may require art skills.

Sources of Additional Information

For general information about art and design and a list of accredited college-level programs, contact:

➤ National Association of Schools of Art and Design, 11250 Roger Bacon Dr., Suite 21, Reston, VA 20190. Internet: **http://nasad.arts-accredit.org**

For information on careers in the craft arts and for a list of schools and workshops, contact:

➤ American Craft Council Library, 72 Spring St., 6th Floor, New York, NY 10012. Internet: **http://www.craftcouncil.org**

For information on careers in illustration, contact:

➤ Society of Illustrators, 128 E. 63rd St., New York, NY 10021. Internet: **http://www.societyillustrators.org**

For information on careers in medical illustration, contact:

➤ Association of Medical Illustrators, 245 First St., Suite 1800, Cambridge, MA 02142. Internet: **http://www.ami.org**

For information on workshops, scholarships, internships, and competitions for art students interested in advertising careers, contact:

➤ Art Directors Club, 106 W. 29th St., New York, NY 10001. Internet: **http://www.adcglobal.org**

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