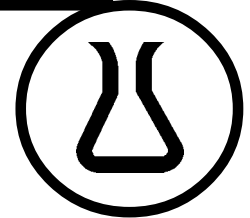


# Botanists



## Occupational Brief Title Codes:

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## Occupational Subtitles:

- Aquatic Botanists
- Cytologists
- Mycologists
- Paleobotanists
- Plant Biochemists
- Plant Biophysicists
- Plant Breeders
- Plant Geneticists
- Plant Pathologists
- Plant Physiologists

## Work Classification Based Related

### D.O.T. Occupations:

- Anatomists
- Animal Biophysicists
- Animal Breeders
- Animal Geneticists
- Apiculturists
- Biochemists
- Ecologists
- Food Technologists

## Interests Based Related

### G.O.E. Occupations:

- Forest Ecologists
- Horticulturists
- Range Managers
- Silviculturists
- Soil Conservationists
- Soil Scientists
- Wood Technologists

## Skills Based Related

### O\*NET Occupations:

- Agricultural Inspectors
- Animal Scientists
- Farmers and Ranchers
- First-Line supervisors and Manager/  
Supervisor-Agricultural Crop Workers
- Purchasing Agents and Buyers, Farm  
Products
- Soil Conservationists
- Soil Scientists

**Botanists** ('bot-a-nists) study and work with plants. They conduct research into plant structure, function, environment, heredity, evolution, and economic value as foods and medicines.

Botany, the study of plants, is one of the two main branches of biology. The other is zoology, the study of animals. Botany is important because all animal life on earth, including human beings, depends on plants to convert the energy of the sun into oxygen and food the animal kingdom can use. Botanists study the basic biology of plants: the structure and function, genetics, growth, and development. This information allows botanists and other scientists to develop ways to increase crop yields and feed the growing population. They find ways to prevent diseases from destroying crops. Botanists develop drugs and medicines to combat heart ailments, cancer, anemia, tooth decay, and other human ailments.

## Work Performed

Botanists study plants. They investigate the development and the life processes of plants. They look into the physiology, heredity, environment, taxonomic relationships, and habitat of plants. Botanists study plants from the standpoint of their economic value in fields such as agronomy, forestry, horticulture, and pharmacology. Other investigations include the effects of rainfall, temperature, climate, soil, and the elevation of plant growth. Botanists identify and classify plants. They may conduct environmental studies and write reports.

Modern botanical research can be highly technical. Some of the research tools are scanning and transmission electron microscopes, radioisotope detectors, spectrophotometers, satellites, and telemetry units. Genetic engineering of plants utilizes breakthroughs in molecular biology, genetics, and biochemistry.



*Botanists conduct research into plant structure, function, environment, heredity, evolution, and economic value as foods and medicines.*  
Photo by Amy Elliott

Some botanists study plants in general; others work in a specialty. They may have titles that identify their field of specializations, which often overlap.

**Plant physiologists** study the vital processes of plants. They are interested in the normal functions of plants. They investigate photosynthesis, the process by which chlorophyll in plants absorbs the rays of the sun and uses that energy to convert carbon dioxide in the air and water from the soil into sugar. They observe how, by taking nitrogen and other nutrients from the soil, the plants convert starch into protein. Plant physiologists study the effects of environmental factors such as soil, temperature, and light on plants. They also study the growth and development of plants and the role that hormones play in these processes.

**Plant biochemists** study the chemical aspects of plant life processes. This includes the chemical products of plants as well as the chemistry of living processes, such as mechanisms of development of normal and abnormal cells and living energy changes, such as growth, aging, and death.

**Plant geneticists** study the structure of genes and their behavior in plants. They also study plant heredity and the way traits pass from one generation to the next. Modern plant geneticists may try to improve domesticated plants by combining traits to produce abundant crops that can also resist disease and drought.

**Plant biophysicists** apply physics and biology to the study of plant life. Among the principles studied are mechanics, heat, light, radiation, and energy. They are interested in how these principles operate in the living cells of plants.

**Cytologists** study the structure, function, and life history of plant cells. Their work relates to morphology, physiology, and genetics.

**Morphologists** are botanists who study the evolution and development of leaves, roots, stems, and flowers. Their research focuses on the meristems, the tissues at the tips of stems. The cells in this part of plants have the power to divide. **Systematists** also study the history and evolution of plants and the relationships among them. A sub discipline of systematics is taxonomy. The binomial system of naming plants by two terms (the genus and the species) is used today. **Taxonomists** identify, name, and classify organisms. **Chemotaxonomists** examine chemicals and the DNA of plant groups to help classify them.

**Paleobotanists** work with the biology and evolution of fossil plants. Paleobotany is a division of paleontology, which is the study of extinct forms of plant and animal life.

**Plant pathologists** work on the causes and control of plant diseases. They may work with a specific group of plants, such as forest trees, vegetables, cereals, flowers and ornamental plants, or field crops. Others concentrate on the interactions between the host plants and pathogens (the causes of disease) such as fungi, bacteria, nematodes, and viruses.

**Economic botanists** work with plants that have the potential to be commercially valuable. They study both harmful and beneficial plants.

**Plant breeders** develop better plants. They choose and crossbreed plants with desirable traits, like the ability to resist disease.

**Bryologists** study mosses, liverworts, and hornworts. They identify, classify, and study the ecology of these plants.

**Mycologists** study fungi, which are crucial to the biosphere. These organisms help recycle dead organic material. Some fungi are important sources of food, vitamins, and antibiotics. Other fungi are a major cause of disease in plants. **Lichenologists** study lichens, dual organisms that are both fungi and algae.

**Aquatic botanists** analyze plants living in water and the environmental conditions affecting them. They study temperature, acidity, light, oxygen content, and other physical conditions of water to determine their relationship to aquatic plant life. **Phycologists** study algae, which are at the base of the food chain in water environments.

### Working Conditions

Many of the jobs in botany offer a great deal of individual freedom. The work is varied, and the surroundings are pleasant.

Botanists work in laboratories, in greenhouses, and in the field. A good deal of research is performed outside of laboratories. For example, a botanist may research in tropical rain forests to see what plants grow there. Botanists also spend time in libraries and herbaria studying the results of research by others.

### Hours and Earnings

Many jobs in botany offer a great deal of freedom with respect to hours. Botanists in research may adapt their hours to fit their special research projects. Often, since a good deal of effort is invested in research, they choose to work many more than forty hours a week. Whether their sponsor is public or private determines how they are paid for their research. Those who are not wage and salary workers in private industry typically 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 have the potential to advance new ideas or processes.

Botanists in an industrial setting usually have a standard forty-hour week with regular holidays and vacations. Botanists in federal or government agencies may arrange hours to fit appointments with logging firms, farmers, or other individuals with whom they confer on matters of common interest.

The Bureau of Labor Statistics classifies botanists with biological scientists. In the year 2000, the average annual salary for these workers was \$49,239. As with most occupations, earnings vary depending on geographic location, employer, and years of experience.

### **Education and Training**

High school students planning a career in botany should take courses required for admission to the college they plan to attend. Studies should include biology, English, a foreign language, and mathematics. Since botanists often work in public affairs, courses in social studies and history also are valuable.

A four-year college degree is the minimum requirement for most jobs in botany. College studies should be a broad general education with a concentration in botany courses. Students should take courses in English, the social sciences, the arts and humanities, and computer science. Mathematics, chemistry, and physics are other recommended courses. Graduate studies for botany consist of fieldwork, laboratory research, and a thesis or dissertation.

Summer jobs or internships are valuable experience. Counselors may be able to direct students to opportunities in laboratory research, or to jobs in agricultural experiment stations, freshwater and marine biology stations, or private companies.

A bachelor's degree in a biological science or botany is sufficient for some nonresearch jobs such as testing and inspection. Jobs as laboratory technicians or technical assistants in education, industry, government, museums, parks, or botanical gardens are also available to those with a bachelor's degree. Botanists with a master's or doctoral degree can usually maintain careers in research as well as administration.

Some careers in botany require a bachelor's degree in plant biology and an advanced degree in another field. For instance, a bachelor's degree in botany along with a master's degree in journalism may qualify an individual to be a science writer for trade publications and news media. A career in environmental law may require a bachelor's degree in botany and a law degree.

### **Licensing, Certification, Unions and Professional Societies**

Many professional associations and societies support the interests of botanists. They are mainly nonprofit groups that publish newsletters to keep members informed about the latest developments in the field. Among associations active in the field of botany are the American Phytopathological Society, the Botanical Society of America, the Mycological Society of America, and the American Society of Plant Taxonomists. These associations also sponsor meetings where members exchange

ideas and information about their work. Some of these associations accredit programs of study offered by colleges and universities.

### **Personal Qualifications**

The ability to work alone as well as with others is necessary for most positions. The ability to pay attention to detail, patience, perseverance in completing long projects, analytical skills, and an inquiring mind are valuable qualities for work in plant biology. Botanists should be able to communicate well both orally and in writing.

Occupations can be adapted for workers with disabilities. Persons should contact their school or employment counselors, their state office of vocational rehabilitation, or their state department of labor to explore fully their individual needs and requirements as well as the requirements of the occupation.

### **Where Employed**

Plant biologists work in botanical gardens, state and national parks, or serve as curators in museums. Botanists also conduct research in universities and colleges, and in associated foundations.

Many plant biologists work for the U.S. Department of Agriculture. The U.S. Department of the Interior employs botanical scientists. Other federal agencies who employ botanists are the U.S. Public Health Service, the U.S. Department of State, the U.S. Forest Service, the National Aeronautics and Space Administration, the Smithsonian Institution, and the Environmental Protection Agency. All fifty states also employ plant scientists as part of their environmental department. An increasing number work in conservation agencies.

In industry botanists work for petrochemical industries, chemical industries, and lumber and paper industries. Other employers are pharmaceutical companies, seed and nursery companies, fruit growers, food companies, ecological consulting companies, biological supply houses, and biotechnology firms.

### **Employment Outlook**

Concern about the environment—air, water, and soil pollution—will create openings for botanists in government, industry, and business. The field of drugs and medicines is also creating a need for more botanists. The management and conservation of resources are another issue of growing interest. A growing world population is increasing the need for food supplies.

In general, botanists will be able to find good jobs. The outlook is best, but still competitive, for those with an advanced degree, especially in environmental fields. Much research and development is funded by the federal government. Recent budget tightening has led to smaller increases in research and development expenditures, further limiting

the dollar amount of each grant and slowing the growth of the number of grants awarded to researchers. Employers favor applicants who have had experience in the field: in parks, agricultural research centers, plant nurseries, and laboratories. The outlook for those with only a bachelor's degree is more limited.

### Entry Methods

College placement offices and faculty help graduating students find positions as botanists. Industrial firms send recruiters to campuses to find qualified applicants. Graduates may get recommendations from their professors. Professional organizations sometimes maintain a registry of positions for reference by its members.

For government employment, job seekers should apply to the personnel department of the agency or agencies for whom they want to work. These employers have information on current openings and application procedures. Regional offices of the Office of Personnel Management can also explain how to apply for federal jobs.

### Advancement

Plant scientists can begin as laboratory aides or as technicians. With experience and an advanced education they can raise their status and earnings. Researchers may move onto more complicated or prestigious work. Some botanists work in managerial or administrative positions, usually after spending some time doing research and learning about the firm, agency, or project. Advancement in a laboratory depends on the size of the company or agency. Competition in some fields is greater than in others.

In government agencies civil service promotions and pay increases follow a schedule of grades through which employees advance as they acquire time on the job, education, and job skills. For some promotions employees may take examinations.

### For Further Research

**Botanical Society of America**, P.O. Box 299, St. Louis, MO 63166-0299. Web Site: [www.botany.org](http://www.botany.org)

*Careers in Botany: A Guide to Working with Plants*. Single copy free.

**American Phytopathological Society**, 3340 Pilot Knob Road, St. Paul, MN 55121-2097. Visit their Web Site at [www.scisoc.org](http://www.scisoc.org)

*Careers in Plant Pathology*. Brochure. Free.

**Mycological Society of America**, P.O. Box 19687, New Orleans, LA 70179. Web Site: [www.erin.utoronto.ca/~w3msa/index.html](http://www.erin.utoronto.ca/~w3msa/index.html).

### Acknowledgments

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