

Biologists

Research or study basic principles of plant and animal life, such as origin, relationship, development, anatomy, and functions.

Sample of reported job titles: Aquatic Scientist, Assistant Scientist, Biologist, Environmental Analyst, Environmental Specialist, Fisheries Biologist, Marine Biologist, Research Biologist, Research Scientist, Scientist

Tasks

- Collect and analyze biological data about relationships among and between organisms and their environment.
- Supervise biological technicians and technologists and other scientists.
- Program and use computers to store, process, and analyze data.
- Prepare technical and research reports, such as environmental impact reports, and communicate the results to individuals in industry, government, or the general public.
- Develop and maintain liaisons and effective working relations with groups and individuals, agencies, and the public to encourage cooperative management strategies or to develop information and interpret findings.
- Prepare requests for proposals or statements of work.
- Represent employer in a technical capacity at conferences.
- Study and manage wild animal populations.
- Study aquatic plants and animals and environmental conditions affecting them, such as radioactivity or pollution.
- Study basic principles of plant and animal life, such as origin, relationship, development, anatomy, and function.
- Teach or supervise students and perform research at universities and colleges.
- Plan and administer biological research programs for government, research firms, medical industries, or manufacturing firms.
- Measure salinity, acidity, light, oxygen content, and other physical conditions of water to determine their relationship to aquatic life.
- Prepare plans for management of renewable resources.
- Communicate test results to state and federal representatives and general public.
- Review reports and proposals, such as those relating to land use classifications and recreational development, for accuracy, adequacy, or adherence to policies, regulations, or scientific standards.
- Research environmental effects of present and potential uses of land and water areas, determining methods of improving environmental conditions or such outputs as crop yields.

- Identify, classify, and study structure, behavior, ecology, physiology, nutrition, culture, and distribution of plant and animal species.
- Develop methods and apparatus for securing representative plant, animal, aquatic, or soil samples.

Tools & Technology

Tools used in this occupation:

- **Analytical balances** — Laboratory analytical balances
- **Automated microscope stages** — Automated microscopes
- **Barometers** — Mercury barometers
- **Benchtop centrifuges** — Swinging bucket centrifuges
- **Bi distillation units** — Distillation units
- **Binocular light compound microscopes** — Optical compound microscopes
- **Chemical or gas sterilizers** — Gas autoclaves
- **Commercial fishing nets** — Dip nets; Plankton nets
- **Conductivity meters**
- **Cuvettes** — Plastic cuvettes
- **Dehydrators** — Vacuum dehydration units
- **Deoxyribonucleic sequence analyzers** — Deoxyribonucleic acid DNA sequencers
- **Desktop computers**
- **Digestion systems** — Digestion units
- **Digital camcorders or video cameras** — Video imaging systems
- **Digital cameras**
- **Direction finding compasses** — Navigational compasses
- **Dissolved carbon dioxide analyzers** — Respirometers
- **Dropping pipettes** — Laboratory dropping pipettes; Micropipettes
- **Dry wall single chamber carbon dioxide incubators** — Water-jacketed CO2 incubators
- **Drying cabinets or ovens** — Vertical drying ovens
- **Electron microscopes**
- **Electronic toploading balances** — Top-loading electronic balances
- **Fluorescent microscopes** — Fluorescence microscopes
- **Forced air or mechanical convection general purpose incubators** — Mechanical laboratory incubators
- **Freezedryers or lyophilizers** — Benchtop lyophilizers

- **French pressure cells** — French presses
- **Fume hoods or cupboards** — Fume hoods
- **Gas burners** — Bunsen burners
- **Gas chromatographs** — Gas chromatographs GC
- **Gel boxes** — Electrophoresis chambers
- **Global positioning system GPS receiver** — Global positioning system GPS receivers
- **Goggles** — Safety goggles
- **Handheld thermometer** — Handheld digital thermometers
- **HEPA filtered enclosures** — Biosafety cabinets
- **High pressure liquid chromatograph chromatography** — High pressure liquid chromatograph HPLC equipment
- **Homogenizers**
- **Inverted microscopes** — Inverted compound microscopes
- **Laboratory balances** — Electronic precision balances
- **Laboratory beakers** — Glass beakers
- **Laboratory burets** — Glass burets
- **Laboratory evaporators** — Vacuum evaporators
- **Laboratory flasks** — Erlenmeyer flasks
- **Laboratory forceps**
- **Laboratory funnels**
- **Laboratory general purpose tubing** — Plastic laboratory tubing
- **Laboratory graduated cylinders** — Glass graduated cylinders
- **Laboratory hotplates** — Laboratory hot plates
- **Laboratory microwave ovens**
- **Laboratory stirring rods** — Spreading rods
- **Laboratory washing machines** — Glass washers
- **Laminar flow cabinets or stations** — Laminar flow cabinets
- **Liquid scintillation counters** — Fluid scintillation counters
- **Magnetic stirrers** — Heated magnetic stirrers
- **Mainframe computers**
- **Microbiology inoculation loops or needles** — Inoculating loops
- **Microplate readers** — Microtiter plate readers
- **Microplates** — Multiwell microplates
- **Microscope slides**
- **Microtomes** — Ultramicrotomes

- **Multipurpose or general test tubes** — General purpose laboratory test tubes
- **Notebook computers** — Laptop computers
- **Open stream current meters** — Water flow gauges
- **Orbital shaking water baths**
- **Pasteur or transfer pipettes** — Pasteur pipettes
- **Personal computers**
- **Petri plates or dishes** — Petri dishes
- **pH meters** — pH indicators
- **Photo attachments for microscopes** — Microscope digital cameras
- **Photometers** — Luminometers
- **Portable data input terminals** — Portable dataloggers
- **Protective gloves** — Safety gloves
- **Radiation detectors** — Phosphorimagers
- **Rapid amplification or complementary deoxyribonucleic acid ends RACE technology products** — Polymerase chain reaction PCR equipment
- **Refrigerated benchtop centrifuges**
- **Robotic or automated liquid handling systems** — Automatic pipettors; Liquid handling robots
- **Safety glasses**
- **Salinity meter** — Salinity meters
- **Sampling syringes** — Laboratory bulb syringes
- **Scanning electron microscopes** — Scanning electron microscopes SEM
- **Scanning light or spinning disk or laser scanning microscopes** — Scanning laser confocal microscopes
- **Scientific calculator** — Scientific calculators
- **Shaking incubators**
- **Specialty plates for bacteria** — Agar plates
- **Specimen collection container** — Specimen collection containers
- **Spectrometers** — X ray spectrometers
- **Spectrophotometers** — Ultraviolet UV visible spectrophotometers
- **Standard fermentation units** — Fermenters
- **Stereo or dissecting light microscopes** — Dissecting microscopes; Zoom microscopes
- **Stirring hotplates** — Heated stir plates
- **Tissue culture coated plates or dishes or inserts** — Tissue culture plates
- **Tissue culture incubators** — Bioreactors

- **Transilluminators** — Ultraviolet UV transilluminators
- **Transmission electron microscopes** — Transmission electron microscopes
TEM
- **Triple beam balances**
- **Tube furnaces** — Carbolite ovens
- **Ultra cold or ultralow upright cabinets or freezers** — Propane jet freezers
- **Ultra violet water purification units** — Ultraviolet water purification systems
- **Ultracentrifuges**
- **Ultrasonic disintegrators** — Sonicators
- **Vacuum or centrifugal concentrators** — Centrifugal evaporators
- **Video attachments for microscopes** — Video microscopes
- **Vortex mixers** — Test tube shakers
- **Water samplers**
- **Weather stations**

Technology used in this occupation:

- **Analytical or scientific software** — Blue Tractor Software DNADynamo; Gene Codes Sequencer; VayTek VoxBlast; Visual Molecular Dynamics VMD
- **Data base user interface and query software** — Microsoft Access; Structured query language SQL
- **Development environment software** — National Instruments LabVIEW
- **Graphics or photo imaging software** — Adobe Systems Adobe Photoshop software
- **Internet browser software** — Web browser software
- **Map creation software** — ESRI ArcGIS software
- **Object or component oriented development software** — C++ ; Practical extraction and reporting language Perl ; Python
- **Office suite software** — Microsoft Office software
- **Operating system software** — Linux ; UNIX
- **Presentation software** — Microsoft PowerPoint
- **Spreadsheet software** — Microsoft Excel
- **Word processing software** — Microsoft Word

Knowledge

- **Biology** — Knowledge of plant and animal organisms, their tissues, cells, functions, interdependencies, and interactions with each other and the environment.

- **Chemistry** — Knowledge of the chemical composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods.
- **English Language** — Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
- **Mathematics** — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- **Computers and Electronics** — Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- **Administration and Management** — Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

Skills

- **Science** — Using scientific rules and methods to solve problems.
- **Critical Thinking** — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
- **Reading Comprehension** — Understanding written sentences and paragraphs in work related documents.
- **Active Listening** — Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
- **Complex Problem Solving** — Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
- **Judgment and Decision Making** — Considering the relative costs and benefits of potential actions to choose the most appropriate one.
- **Mathematics** — Using mathematics to solve problems.
- **Speaking** — Talking to others to convey information effectively.
- **Writing** — Communicating effectively in writing as appropriate for the needs of the audience.
- **Active Learning** — Understanding the implications of new information for both current and future problem-solving and decision-making.
- **Time Management** — Managing one's own time and the time of others.
- **Instructing** — Teaching others how to do something.
- **Management of Personnel Resources** — Motivating, developing, and directing people as they work, identifying the best people for the job.

- **Monitoring** — Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.
- **Social Perceptiveness** — Being aware of others' reactions and understanding why they react as they do.
- **Coordination** — Adjusting actions in relation to others' actions.
- **Learning Strategies** — Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things.

Abilities

- **Deductive Reasoning** — The ability to apply general rules to specific problems to produce answers that make sense.
- **Inductive Reasoning** — The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
- **Written Comprehension** — The ability to read and understand information and ideas presented in writing.
- **Category Flexibility** — The ability to generate or use different sets of rules for combining or grouping things in different ways.
- **Information Ordering** — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- **Oral Comprehension** — The ability to listen to and understand information and ideas presented through spoken words and sentences.
- **Mathematical Reasoning** — The ability to choose the right mathematical methods or formulas to solve a problem.
- **Near Vision** — The ability to see details at close range (within a few feet of the observer).
- **Oral Expression** — The ability to communicate information and ideas in speaking so others will understand.
- **Problem Sensitivity** — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
- **Speech Clarity** — The ability to speak clearly so others can understand you.
- **Written Expression** — The ability to communicate information and ideas in writing so others will understand.
- **Speech Recognition** — The ability to identify and understand the speech of another person.
- **Far Vision** — The ability to see details at a distance.
- **Flexibility of Closure** — The ability to identify or detect a known pattern (a figure, object, word, or sound) that is hidden in other distracting material.

- **Fluency of Ideas** — The ability to come up with a number of ideas about a topic (the number of ideas is important, not their quality, correctness, or creativity).
- **Originality** — The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.
- **Selective Attention** — The ability to concentrate on a task over a period of time without being distracted.

Work Activities

- **Documenting/Recording Information** — Entering, transcribing, recording, storing, or maintaining information in written or electronic/magnetic form.
- **Analyzing Data or Information** — Identifying the underlying principles, reasons, or facts of information by breaking down information or data into separate parts.
- **Updating and Using Relevant Knowledge** — Keeping up-to-date technically and applying new knowledge to your job.
- **Communicating with Supervisors, Peers, or Subordinates** — Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person.
- **Identifying Objects, Actions, and Events** — Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.
- **Getting Information** — Observing, receiving, and otherwise obtaining information from all relevant sources.
- **Processing Information** — Compiling, coding, categorizing, calculating, tabulating, auditing, or verifying information or data.
- **Interacting With Computers** — Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information.
- **Thinking Creatively** — Developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions.
- **Communicating with Persons Outside Organization** — Communicating with people outside the organization, representing the organization to customers, the public, government, and other external sources. This information can be exchanged in person, in writing, or by telephone or e-mail.
- **Making Decisions and Solving Problems** — Analyzing information and evaluating results to choose the best solution and solve problems.
- **Monitor Processes, Materials, or Surroundings** — Monitoring and reviewing information from materials, events, or the environment, to detect or assess problems.
- **Interpreting the Meaning of Information for Others** — Translating or explaining what information means and how it can be used.
- **Organizing, Planning, and Prioritizing Work** — Developing specific goals and plans to prioritize, organize, and accomplish your work.

- **Developing Objectives and Strategies** — Establishing long-range objectives and specifying the strategies and actions to achieve them.
- **Establishing and Maintaining Interpersonal Relationships** — Developing constructive and cooperative working relationships with others, and maintaining them over time.
- **Estimating the Quantifiable Characteristics of Products, Events, or Information** — Estimating sizes, distances, and quantities; or determining time, costs, resources, or materials needed to perform a work activity.
- **Judging the Qualities of Things, Services, or People** — Assessing the value, importance, or quality of things or people.
- **Evaluating Information to Determine Compliance with Standards** — Using relevant information and individual judgment to determine whether events or processes comply with laws, regulations, or standards.
- **Scheduling Work and Activities** — Scheduling events, programs, and activities, as well as the work of others.

Detailed Work Activities

- Plan biological research.
- Prepare scientific or technical reports or presentations.
- Provide technical information or assistance to public.
- Analyze chemical compounds or substances.
- Communicate with government agencies.
- Research diseases or parasites.
- Collect environmental data or samples.
- Conduct research of processes in natural or industrial ecosystems.
- Develop plans to manage natural or renewable resources.
- Supervise scientific or technical personnel.
- Instruct college students in physical or life sciences.
- Research environmental impact of industrial or development activities.
- Prepare proposal documents or grant applications.
- Classify organisms based on their characteristics or behavior.
- Communicate results of environmental research.
- Prepare research or technical reports on environmental issues.
- Examine characteristics or behavior of living organisms.
- Care for plants or animals.
- Develop collaborative relationships between departments or with external organizations.
- Develop biological research methods.

- Review plans or proposals for environmental conservation.

Work Context

- **Electronic Mail** — 100% responded “Every day.”
- **Indoors, Environmentally Controlled** — 90% responded “Every day.”
- **Face-to-Face Discussions** — 88% responded “Every day.”
- **Telephone** — 83% responded “Every day.”
- **Contact With Others** — 58% responded “Constant contact with others.”
- **Importance of Being Exact or Accurate** — 57% responded “Extremely important.”
- **Freedom to Make Decisions** — 47% responded “A lot of freedom.”
- **Work With Work Group or Team** — 37% responded “Very important.”
- **Structured versus Unstructured Work** — 44% responded “A lot of freedom.”
- **Duration of Typical Work Week** — 61% responded “More than 40 hours.”
- **Time Pressure** — 52% responded “Once a week or more but not every day.”
- **Coordinate or Lead Others** — 37% responded “Extremely important.”
- **Spend Time Sitting** — 43% responded “More than half the time.”
- **Wear Common Protective or Safety Equipment such as Safety Shoes, Glasses, Gloves, Hearing Protection, Hard Hats, or Life Jackets** — 41% responded “Every day.”
- **Letters and Memos** — 32% responded “Once a month or more but not every week.”
- **Level of Competition** — 36% responded “Moderately competitive.”
- **Importance of Repeating Same Tasks** — 27% responded “Extremely important.”
- **Responsibility for Outcomes and Results** — 44% responded “High responsibility.”
- **Frequency of Decision Making** — 19% responded “Once a year or more but not every month.”
- **Impact of Decisions on Co-workers or Company Results** — 25% responded “Minor results.”
- **Consequence of Error** — 23% responded “Very serious.”
- **Exposed to Hazardous Conditions** — 45% responded “Once a year or more but not every month.”

Job Zone

Title Job Zone Five: Extensive Preparation Needed

Education Most of these occupations require graduate school. For example, they may require a master's degree, and some require a Ph.D., M.D., or J.D. (law degree).

Related Experience Extensive skill, knowledge, and experience are needed for these occupations. Many require more than five years of experience. For example, surgeons must complete four years of college and an additional five to seven years of specialized medical training to be able to do their job.

Job Training Employees may need some on-the-job training, but most of these occupations assume that the person will already have the required skills, knowledge, work-related experience, and/or training.

Job Zone Examples These occupations often involve coordinating, training, supervising, or managing the activities of others to accomplish goals. Very advanced communication and organizational skills are required. Examples include librarians, lawyers, astronomers, biologists, clergy, surgeons, and veterinarians.

Education

Percentage of Respondents	Education Level Required
24	Bachelor's degree
24	Master's degree
24	Post-doctoral training

This occupation may require a background in the following science, technology, engineering, and mathematics (STEM) educational disciplines:

Life Sciences — Anatomy; Animal Genetics; Animal Physiology; Aquatic Biology/Limnology; Biochemistry; Biological and Biomedical Sciences, Other

Interests

Interest code: **IR**

- **Investigative** — Investigative occupations frequently involve working with ideas, and require an extensive amount of thinking. These occupations can involve searching for facts and figuring out problems mentally.

- **Realistic** — Realistic occupations frequently involve work activities that include practical, hands-on problems and solutions. They often deal with plants, animals, and real-world materials like wood, tools, and machinery. Many of the occupations require working outside, and do not involve a lot of paperwork or working closely with others.

Work Styles

- **Attention to Detail** — Job requires being careful about detail and thorough in completing work tasks.
- **Integrity** — Job requires being honest and ethical.
- **Analytical Thinking** — Job requires analyzing information and using logic to address work-related issues and problems.
- **Dependability** — Job requires being reliable, responsible, and dependable, and fulfilling obligations.
- **Initiative** — Job requires a willingness to take on responsibilities and challenges.
- **Stress Tolerance** — Job requires accepting criticism and dealing calmly and effectively with high stress situations.
- **Independence** — Job requires developing one's own ways of doing things, guiding oneself with little or no supervision, and depending on oneself to get things done.
- **Persistence** — Job requires persistence in the face of obstacles.
- **Achievement/Effort** — Job requires establishing and maintaining personally challenging achievement goals and exerting effort toward mastering tasks.
- **Adaptability/Flexibility** — Job requires being open to change (positive or negative) and to considerable variety in the workplace.
- **Cooperation** — Job requires being pleasant with others on the job and displaying a good-natured, cooperative attitude.
- **Self Control** — Job requires maintaining composure, keeping emotions in check, controlling anger, and avoiding aggressive behavior, even in very difficult situations.
- **Innovation** — Job requires creativity and alternative thinking to develop new ideas for and answers to work-related problems.
- **Leadership** — Job requires a willingness to lead, take charge, and offer opinions and direction.
- **Concern for Others** — Job requires being sensitive to others' needs and feelings and being understanding and helpful on the job.

Work Values

- **Achievement** — Occupations that satisfy this work value are results oriented and allow employees to use their strongest abilities, giving them a feeling of accomplishment. Corresponding needs are Ability Utilization and Achievement.

- **Recognition** — Occupations that satisfy this work value offer advancement, potential for leadership, and are often considered prestigious. Corresponding needs are Advancement, Authority, Recognition and Social Status.
- **Independence** — Occupations that satisfy this work value allow employees to work on their own and make decisions. Corresponding needs are Creativity, Responsibility and Autonomy.

CAREER MASTERS