

## Biology

Biology is the study of all living things, from plants and animals to micro-organisms. The subject also covers how we can protect living things, and how we can use them to solve problems. There are lots of specialist areas within biology, including human biology, other animals (zoology), microbiology, biochemistry and biotechnology.

There are qualifications in biology at many levels. Because biology is such a wide-ranging subject, there are also courses in the many specialist areas.

At GCSE, you can study this subject in a number of ways, depending on your school and what your teacher thinks is best for you. You might be able to take GCSE Biology. Otherwise, you can study biology alongside the other sciences, for example, through GCSE Science (with Additional Science or Additional Applied Science if you want to go on to A level).

You could then go on to take Biology A-level. After that, there are university courses such as degrees, foundation degrees and HNDs in various aspects of biology. Alternatives to GCSEs and A levels include Edexcel (BTEC) level 2 Firsts and level 3 Nationals in Applied Science, and Cambridge Nationals in Science. This article divides careers where biology is useful into the following areas:

It's important to find out more about the careers you're interested in, for example, to check which qualifications you'll need for entry.

teaching	<p>Science is one of the statutory subjects in the National Curriculum at Key Stage 4, meaning all pupils study it up to the age of 16. It covers biology, chemistry and physics, but students might be able to study these as separate subjects, depending on their school.</p> <p>Science teachers teach pupils about how science is relevant to their everyday lives and the natural world around them. They study scientific theories, and topics such as global warming, genetic modification, radioactive substances, how to keep healthy and how drugs affect the body.</p> <p>Teaching methods include group and project work, doing experiments, and using interactive whiteboards, audio-visual materials and the internet, as well as more traditional teaching sessions.</p> <p>To become a science teacher, you'll need a degree that leads to Qualified Teacher Status (QTS), or to follow a relevant degree with postgraduate training leading to QTS. It's possible to take a PGCE in combined science or in biology.</p> <p>Biology is also useful if you want to become a physical education (PE) teacher.</p>
health and medicine	<p><b>Physiotherapists</b> treat people who have lost some or all of the movement in their joints or limbs because of illness, injury, old age or disability. Entry is with a recognised degree or postgraduate qualification.</p> <p><b>Medical laboratory assistants</b> help and support scientists in medical laboratories. They have tasks such as sorting blood samples, sterilising equipment and carefully throwing away waste. To do this job, GCSEs in English, Maths and Science or Biology, or equivalent qualifications, are useful.</p> <p><b>Optometrists</b> examine people's eyes to detect problems such as long- or short-sightedness, or disease. They try to correct sight problems by prescribing glasses or contact lenses. Optometrists have completed a recognised degree course.</p> <p><b>Doctors</b> diagnose and treat illness and injury. There are many different types of doctor. Mainly, there are GPs and hospital doctors (including surgeons and psychiatrists). To become a doctor, you usually need to complete a five-year medicine degree and then take further general and specialist training.</p> <p><b>Nurses</b> care for people who are ill or injured. They also look after people who need special care, for example, because they are pregnant or are disabled. To become a nurse, you need a degree in nursing.</p>

complementary medicine	<p>Complementary medicine includes a wide range of therapies and treatments. They have in common that they don't rely on the use of artificial medicines, or surgery, which are the usual (conventional) ways of treating illness.</p> <p>There are courses at various levels in complementary medicine. Depending on the type of therapy, some of them are at degree level. Others are college courses. Here are some examples of careers in this area.</p> <p><b>Homeopaths</b> work on the principle that 'like is cured by like'. They aim to treat illness by using highly diluted doses of drugs that would produce the same symptoms of the disease in a healthy person.</p> <p><b>Medical herbalists</b> use medicines made from plants.</p> <p><b>Naturopaths</b> don't use medicines. They treat people by getting them to change their lifestyle, for example, eating healthily, taking more exercise or learning how to relax. They can also give treatments such as massage, hydrotherapy and herbal medicine.</p> <p><b>Osteopaths</b> and <b>chiropractors</b> manipulate patients' joints, especially in the back, to treat problems and reduce pain.</p> <p><b>Acupuncturists</b> insert needles into particular points on a patient's body to treat illness or reduce pain.</p>
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The life sciences are biology and related subjects. In the following careers, it's possible to do either pure or applied research.

**Biologists** carry out laboratory research and fieldwork, using their findings to gain knowledge, solve problems or develop new products and processes in a very wide range of areas. Areas of applied research include finding a new drug to treat disease, improving crop yields, managing pollution and protecting endangered species.

Most entrants have at least a first (undergraduate) degree, either in a general biology subject (biological sciences or applied biology) or in one of the very many specialist areas, such as zoological science, biotechnology, biomedical science, ecology and botany.

**Botanists** study plant life at all levels. They look into how and where plants grow, study their cells, and investigate the impact that chemicals and diseases have on them.

Some botanists apply their knowledge to solve horticultural problems. For example, crossing two plant species enables botanists to develop a hybrid plant, sometimes with desirable characteristics from each of its 'parents'. The hybrid plant might have increased resistance to drought, pests and weeds, or a petal colour that will make it attractive to people who buy flowers and plants. In biotechnology companies, botanists are also able to benefit horticulture. They can use the modern methods of genetic modification to change plant characteristics. To become a botanist, you usually need a relevant degree.

**Biology laboratory technician's** help and support the work of biological scientists. They set up equipment, prepare and carry out experiments, take measurements and report on their findings. They work in a wide range of areas, including industry, education, medical science and research institutions.

They have a variety of duties, including:

- Managing equipment stocks, ordering replacements when necessary.
- Disposing of laboratory waste.
- Preparing and maintaining equipment.
- Taking and testing samples.
- Recording and analysing experiment results.

Most employers ask for at least four or five GCSEs (or equivalent) at grade C or above, including English, Maths and Science or Biology. Entrants often have higher qualifications, such as A levels or equivalent.

**Zoological scientists** specialise in the study of animal life, including their physiology, reproduction and genetics, behaviour, diseases and ecology.

They are involved in many areas, including:

- protecting endangered species
- improving livestock, for example, their breeding and resistance to disease
- preventing pests and diseases from damaging crops
- developing drugs to treat both animals and humans
- undertaking environmental surveys.

Entrants are usually graduates in relevant degree subjects, and many have specialist postgraduate qualifications.

**Ecologists** study how living things relate to each other and their environment. They look at the impact of human activity, such as intensive farming and industrial development, on the habitat and development of plants and animals. They advise local councils, civil engineering and industrial companies on how planned developments, like new roads or

factories, will affect the local environment. Some ecologists manage and protect conservation areas, working as site managers, rangers or wardens. They protect the area against pollution and vandalism, and give information to visitors. Entry is usually with a first degree or postgraduate qualification in a biological or environmental subject. Specialist degree courses in ecology are available at a number of universities.

**Biotechnologists** combine biology, the science of living things, with technology. They research and develop the use of biology to solve problems in areas such as health care, the pharmaceutical and chemical industries, agriculture, food production and environmental protection.

The processes of making food and drink products such as beer, bread and yoghurt have always relied on biotechnology.

Modern areas of work include:

- developing vegetarian substitutes for meat
- using genetic modification to improve plant growth
- creating biodegradable plastics
- developing and testing new drugs, hormones and vaccines.

Most biotechnologists have a degree in a relevant subject. Degrees in biotechnology are widely available.

**Microbiologists** study life forms such as bacteria and viruses ('micro-organisms' or 'microbes') that are too small to be seen without a microscope. Some microbes cause disease, but others are harmless and some can be used to benefit humans. For example, sewage treatment relies on bacteria and protozoa that break down the waste material. In medical research and pharmaceutical companies, microbiologists help to develop drugs and vaccines. In the food and drink industry, microbiologists use microbes to help make products such as beer, wine, bread and yoghurt.

Many microbiologists are involved in environmental work, for example, using microbes to break down industrial waste. In agriculture, they can use microbes to tackle the pests and diseases that affect crops. The usual entry requirement is a relevant degree.

conservation

Knowledge of biology can help you to enter careers in environmental conservation. Generally, skills and knowledge gained through relevant work experience are at least as important as qualifications for entry to careers in this area.

*Environmental Conservation Officer*

Environmental conservation officers (ECOs) manage and protect areas of land, and the wildlife within them.

Together with other environmental specialists, they organise surveys of important wildlife areas, including 'sites of special scientific interest' (SSSI) and nature reserves.

They identify plant and animal species, map their habitats and set up conservation plans to keep those habitats safe.

They encourage people to learn about and enjoy the natural environment without causing damage to it, and they try to ensure that everyone has access to these areas. For example, they write leaflets, give talks and set up displays and exhibitions.

ECOs plan and supervise long-term environmental projects, for example, establishing and managing heath or woodland. As managers, they recruit, train and supervise staff, including volunteers. They manage budgets and enforce regulations to protect the environment.

To enter this career, it's usual to have a degree in a relevant subject. For entry, it's very useful to have developed knowledge and skills through relevant work experience, including voluntary work.

*Countryside Ranger/Warden*

Countryside rangers/wardens manage and look after areas of the countryside for use by the public, while also protecting plant and animal life.

They are responsible for places such as nature reserves, country parks, coastal areas, heath and moor land, forests and national parks.

Their duties include:

- Talking to visitors and taking them on guided walks.

- Practical conservation work like mending fences and clearing vegetation.

- Making sure people obey by-laws to protect the environment.

- Creating and maintaining favourable habitats to encourage the development of plant and animal life.

There are no set entry requirements. However, many new entrants have a relevant degree, foundation degree or HND. It is possible for people with lower-level qualifications to become rangers/wardens.

engineering	<p>Engineering and biology might not seem to have much in common, but there are specialist engineers whose work is related to biology.</p> <p>The usual requirement for these careers is a relevant degree, foundation degree or HND.</p> <p><i>Clinical Engineer</i></p> <p>Clinical engineers design and develop equipment that is used by the medical profession to diagnose, treat and monitor illnesses and injuries. Examples include incubators for premature babies, artificial limbs and pacemakers.</p> <p><i>Biochemical Engineer</i></p> <p>Biochemical engineering is an offshoot of chemical engineering. Biochemical engineers are concerned with the biological changes that can be very important in the production and processing of medicines and foodstuffs, and the treatment of waste.</p> <p>Biochemical engineers work in a wide range of areas, especially health care, nutrition, environmental protection and advanced chemicals.</p>
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*Agricultural Research Scientist*

Agricultural research scientists develop knowledge and test methods to improve agriculture. They carry out research to solve problems in planting, harvesting and cultivating crops, and investigate better ways to house, feed and care for livestock.

They explore issues such as pest control, animal and plant diseases, and the environmental impact of chemicals used in agriculture.

Entrants usually have degrees in subjects such as biological sciences, biochemistry, chemistry, agricultural science and other sciences relevant to agriculture.

*Veterinary Surgeon*

Veterinary surgeons (vets) diagnose and treat sick and injured animals. They prevent disease and improve the general health of animals.

Duties include:

- examining and testing animals to diagnose illness
- treating animals, for example, cleaning wounds, giving medicine, surgery
- immunising animals against disease
- 'putting down' sick, old or unwanted animals
- advising owners on aspects of animal welfare.

In a town or city general practice, they will spend most of their time treating domestic pets, while vets in rural practices are more likely to treat livestock and horses.

To become a vet, you'll need to complete a degree in veterinary science/medicine that is approved by the Royal College of Veterinary Surgeons (RCVS).

*Veterinary Nurse*

Veterinary nurses help and support veterinary surgeons in the diagnosis and treatment of animal illness and injury.

Typical duties include:

- developing X-rays
- sterilising instruments
- testing blood and urine samples
- dressing wounds
- feeding, watering and exercising animals.

They might have clerical and receptionist duties, such as booking appointments and updating records.

You will usually need five GCSEs (A\*-C), including English, Maths and a science subject to start training.