The Branches of Biology

Inquire: Branches of Biological Study

Overview

During this lesson, students will be learning about the various branches and subdisciplines in biology. Students will learn about microbiology, cell biology, paleontology, and zoology, just to name a few. Students will discover what each branch of biology studies and how the branches work interdependently. One branch that will be focused on in depth is forensic science. If you wish to learn even more about forensic science, such as techniques forensic scientists use, a Career Spotlight is located in the toolbox. At the end of this lesson, students will be able to describe various types of biology.

Big Question: What are the types of biology?

Watch: Pioneers of Science

The field of biology is very broad, including many branches and subdivisions. While each branch has a special focus, the branches of biology are quite interdisciplinary.

Microbiology is the study of the structure and function of microorganisms. A famous microbiologist, Anton Van Leeuwenhoek, studied such microorganisms with a microscope he developed. This development paved the way for the field itself, and for future microbiologists.

Molecular biology is the study of biological processes and their regulation at the molecular level, including interactions among molecules such as DNA, RNA, and proteins. Rosalind Franklin was a molecular biologist who discovered the structure of DNA.

Biochemistry is the study of the chemistry of biological organisms. Hans Adolf Krebs studies cellular respiration. Cellular respiration occurs during photosynthesis. He developed the Krebs Cycle which is a biochemical cycle to produce energy in plants.

Neurobiology is the study of the biology of the nervous system. Camillo Golgi discovered an organelle that assists with intracellular transport. The organelle was named the Golgi Apparatus.

Cell biology, also known as cytology, is a branch of biology dealing with the structure, function, and life history of cells and their constituents. Matthias Schleiden was a co-founder of the Cell Theory.

Paleontology is the study of life’s history by means of fossils. Charles Darwin is most known for his controversial theory of evolution. Darwin used fossils to draw conclusions about the relationship between organisms. Darwin wrote a book, On The Origin of Species by Means of Natural Selection.
Forensic biology applies science to answer questions related to the law. Dr. Michael M. Baden is a forensic biologist that worked on the O.J. Simpson case.

Zoology is the study of animals. A famous zoologist, Jane Goodall, is most well known for her study of chimpanzee social and family life. Because she was studying animal behavior under natural conditions, she is also an ethologist.

Botany is the study of plants. Gregor Mendel, a famous botanist, discovered the basic principles of heredity through experiments with pea plants in his garden.

Read: The Branches of Biology

Overview
Biology is broad and includes many branches and subdisciplines. Examples include molecular biology, microbiology, neurobiology, zoology, and botany, among others. Each branch has its own focus; however, many branches and subdisciplines work interdependently.

Branches of Biological Study

The scope of biology is broad and therefore contains many branches and subdisciplines. Biologists may pursue one of those subdisciplines and work in a more focused field. For instance, molecular biology and biochemistry study biological processes at the molecular level and chemical level, including interactions among molecules such as DNA, RNA, and proteins, as well as the way they are regulated. Molecular biologists study the effects of drugs on molecules in cells. Microbiology is the study of the structure and function of single celled organisms called microorganisms. It is quite a broad branch itself, and depending on the subject of study, there are also microbial physiologists, ecologists, and geneticists, among others.

Another field of biological study, neurobiology, studies the biology of the nervous system, and although it is considered a branch of biology, it is also recognized as an interdisciplinary field of study known as neuroscience. Because of its interdisciplinary nature, this subdiscipline studies different functions of the nervous system using molecular, cellular, developmental, medical, and computational approaches. Cell biology studies how normal cells can become cancer cells when exposed to the chemicals found in cigarette smoke or to radiation.

Paleontology, another branch of biology, uses fossils to study life’s history and extinct organisms. A paleontologist may try to explain how certain animals changed or evolved over time. Zoology is the study of animals while ethology studies animal behavior, such as why males of a particular organism are more brightly colored than females. Zoologists might be interested in the changes within animals that tell them when to sleep, eat, or mate. Botany is the study of plants. Biologists can also specialize as biotechnologists, ecologists, or physiologists, to name just a few areas. Biotechnologists apply the knowledge of biology to create useful products. Ecologists study the interactions of organisms in their environments. Physiologists study the workings of cells, tissues, and organs. This is just a small sample of the many fields that biologists can pursue. From our own bodies to the world we live in, discoveries in biology can affect us in very direct and important ways. We depend on these discoveries for our health, our food sources, and the benefits provided by our ecosystem. Because of this, knowledge of biology can benefit us in making decisions in our day-to-day lives.
The development of technology in the 20th century that continues today, particularly the technology to describe and manipulate the genetic material, DNA, has transformed biology. This transformation will allow biologists to continue to understand the history of life in greater detail, how the human body works, our human origins, and how humans can survive as a species on this planet despite the stresses caused by our increasing numbers. Biologists continue to decipher huge mysteries about life suggesting that we have only begun to understand life on the planet, its history, and our relationship to it. For this and other reasons, the knowledge of biology gained through this textbook and other printed and electronic media should be a benefit in whichever field you enter.

Biology is the culmination of the achievements of the natural sciences from their inception to today. Excitingly, it is the cradle of emerging sciences, such as the biology of brain activity, genetic engineering of custom organisms, and the biology of evolution that uses the laboratory tools of molecular biology to retrace the earliest stages of life on earth. A scan of news headlines — whether reporting on immunizations, a newly discovered species, sports doping, or a genetically-modified food — demonstrates the way biology is active in and important to our everyday world.

**Reflect**

Poll: Which scientist do you feel had the most influence in biology?

Based on everything you have learned about Reconstruction, in your opinion, was it effective?

- Anton Van Leeuwenhoek
- Rosiland Franklin
- Camillo Golgi
- Charles Darwin

**Expand: Career Connection**

**Forensic Scientist**

Forensic science is the application of science to answer questions related to the law. Biologists as well as chemists and biochemists can be forensic scientists. Forensic scientists provide scientific evidence for use in courts, and their job involves examining trace materials associated with crimes. Interest in forensic science has increased in the last few years, possibly because of popular television shows that feature forensic scientists on the job. Also, the development of molecular techniques and the establishment of DNA databases have expanded the types of work that forensic scientists can do. Their work involves analyzing samples such as hair, blood, and other body fluids and also processing DNA found in many different environments and materials. Forensic scientists also analyze other biological evidence left at crime scenes, such as insect larvae or pollen grains. Students who want to pursue careers in forensic science will most likely be required to take chemistry and biology courses as well as some intensive math courses.

**Ecologist**

A career in ecology contributes to many facets of human society. Understanding ecological issues can help society meet the basic human needs of food, shelter, and health care. Ecologists can conduct their research in the laboratory and outside in natural environments. These natural environments can be as close to home as the stream running through your town or as far away as the hydrothermal vents at the bottom of the Pacific Ocean. Ecologists manage natural resources such as white-tailed deer populations (Odocoileus virginianus) for hunting or aspen (Populus spp.) timber stands for paper production.
Ecologists also work as educators who teach children and adults at various institutions including universities, high schools, museums, and nature centers. Ecologists may also work in advisory positions assisting local, state, and federal policymakers to develop laws that are ecologically sound, or they may develop policies and legislation themselves. Becoming an ecologist requires at least an undergraduate degree, usually in a natural science. The undergraduate degree is often followed by specialized training or an advanced degree, depending on the area of ecology selected. Ecologists should also have a broad background in the physical sciences, as well as a solid foundation in mathematics and statistics.

Lesson Toolbox

Additional Resources and Readings

Career Spotlight: Forensic Biologist

- A video focusing on techniques forensic biologists use to solve crimes
- https://www.youtube.com/watch?v=g7KCFpALTrI

Prospects

- An article listing several career options for biology majors with links to in depth discussions of each career

Learn How to Become

- A link to information on what is required to become a biologist

Lesson Glossary

biochemistry: study of the chemistry of biological organisms
botany: study of plants
cell biology: a branch of biology dealing with the structure, function, and life history of cells and their constituents
ethology: the scientific and objective study of animal behavior especially under natural conditions
microbiology: study of the structure and function of microorganisms
molecular biology: study of biological processes and their regulation at the molecular level, including interactions among molecules such as DNA, RNA, and proteins
neurobiology: study of the biology of the nervous system
paleontology: study of life’s history by means of fossils
zoology: study of animals

Check Your Knowledge

1. _____________ is a branch of biology dealing with the structure, function, and life history of cells and their constituents.
   A. Biochemistry
   B. Ethology
   C. Cell Biology
   D. Paleontology
2. True or False: Microbiology is the study of the structure and function of microorganisms.
   A. True
   B. False

3. True or False: Biochemistry is the study of biological processes and their regulation at the molecular level, including interactions among molecules such as DNA, RNA, and proteins.
   A. True
   B. False

Answer Key:

Citations

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