

Studying Life

THINK ABOUT IT Think about important and exciting news stories you've seen or heard. Bird flu spreads around the world, killing thousands of birds and threatening a human epidemic. Users of certain illegal drugs experience permanent damage to their brains and other parts of their nervous systems. Reports surface about efforts to clone human cells to grow new organs to replace those lost to disease or injury. These and many other stories involve biology—the science that employs scientific methodology to study living things. (The Greek word *bios* means “life,” and *-logy* means “study of.”)

Characteristics of Living Things

Key *What characteristics do all living things share?*

Biology is the study of life. But what is life? What distinguishes living things from nonliving matter? Surprisingly, it isn't as simple as you might think to describe what makes something alive. No single characteristic is enough to describe a living thing. Also, some nonliving things share one or more traits with organisms. For example, a firefly and fire both give off light, and each moves in its own way. Mechanical toys, automobiles, and clouds (which are not alive) move around, while mushrooms and trees (which are alive) stay in one spot. To make matters more complicated, some things, such as viruses, exist at the border between organisms and nonliving things.

Despite these difficulties, we can list characteristics that most living things have in common. **Key** **Living things are made up of basic units called cells, are based on a universal genetic code, obtain and use materials and energy, grow and develop, reproduce, respond to their environment, maintain a stable internal environment, and change over time.**

FIGURE 1-12 Is It Alive? The fish are clearly alive, but what about the colorful structure above them? Is it alive? As a matter of fact, it is. The antlerlike structure is actually a marine animal called elkhorn coral. Corals show all the characteristics common to living things.

Key Questions

Key *What characteristics do all living things share?*

Key *What are the central themes of biology?*

Key *How do different fields of biology differ in their approach to studying life?*

Key *How is the metric system important in science?*

Vocabulary

biology • DNA • stimulus • sexual reproduction • asexual reproduction • homeostasis • metabolism • biosphere

Taking Notes

Concept Map As you read, draw a concept map showing the big ideas in biology.



VISUAL SUMMARY

THE CHARACTERISTICS OF LIVING THINGS

FIGURE 1-13 Apple trees share certain characteristics with other living things.

Compare and Contrast How are the apple tree and the grass growing below similar? How are they different?



Living things are based on a universal genetic code. All organisms store the complex information they need to live, grow, and reproduce in a genetic code written in a molecule called **DNA**. That information is copied and passed from parent to offspring. With a few minor variations, life's genetic code is almost identical in every organism on Earth.

◀ The growth, form, and structure of an apple tree are determined by information in its DNA.

Living things grow and develop.

Every organism has a particular pattern of growth and development. During development, a single fertilized egg divides again and again. As these cells divide, they differentiate, which means they begin to look different from one another and to perform different "functions."

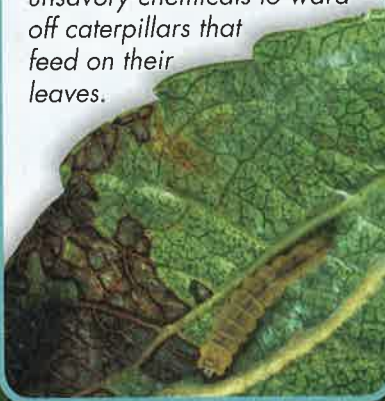
◀ An apple tree develops from a tiny seed.




Living things respond to their environment.

Organisms detect and respond to stimuli from their environment. A **stimulus** is a signal to which an organism responds.


▼ Some plants can produce unsavory chemicals to ward off caterpillars that feed on their leaves.





Living things reproduce. All organisms reproduce, which means that they produce new similar organisms. Most plants and animals engage in sexual reproduction. In **sexual reproduction**, cells from two parents unite to form the first cell of a new organism. Other organisms reproduce through **asexual reproduction**, in which a single organism produces offspring identical to itself.

► Beautiful blossoms are part of the apple tree's cycle of sexual reproduction.



Living things maintain a stable internal environment. All organisms need to keep their internal environment relatively stable, even when external conditions change dramatically. This condition is called **homeostasis**.

◀ These specialized cells help leaves regulate gases that enter and leave the plant. SEM 1200×

Living things obtain and use material and energy. All organisms must take in materials and energy to grow, develop, and reproduce. The combination of chemical reactions through which an organism builds up or breaks down materials is called **metabolism**.

► Various metabolic reactions occur in leaves.



Taken as a group, living things evolve.

Over generations, groups of organisms evolve, or change over time. Evolutionary change links all forms of life to a common origin more than 3.5 billion years ago. Evidence of this shared history is found in all aspects of living and fossil organisms, from physical features to structures of proteins to sequences of information in DNA.

► Signs of one of the first land plants, *Cooksonia*, are preserved in rock over 400 million years old.



Living things are made up of cells.

Organisms are composed of one or more cells—the smallest units considered fully alive. Cells can grow, respond to their surroundings, and reproduce. Despite their small size, cells are complex and highly organized.

▲ A single branch of an apple tree contains millions of cells. LM 800×