

EXPLORING BIOLOGY

ORGANISMS & ECOSYSTEMS



Contents

Understanding Organisms and Ecosystems . . .	4
Classification	6
Bacteria	8
Bacterial Cells	10
Protists.	12
Plants	14
Simple Invertebrates	16
Arthropods.	18
Lower Vertebrates	20
Fungi	22
Ecosystems	24
Food Webs	26
Carbon Cycle	28
Other Cycles	30
Dry Biomes	32
Wet Biomes	34
Ocean Zones	36
Symbiosis.	38
Symbiogenesis.	40
The Future of Organisms and Ecosystems. . .	42
Review and Reflect	44
Glossary	46
Read More	47
Learn More Online.	47
Index	48

Understanding Organisms and Ecosystems

Earth is populated by millions of different species, including animals, fungi, plants, and bacteria. These living things, or organisms, come in many different shapes, sizes, and colors. Scientists believe each of these living things can be traced back to one single-celled organism that divided billions of years ago. Since then, life-forms have evolved over time to fill a diverse array of ecosystems worldwide in which living things depend on one another for survival.

Soil

Soil is composed of air, living organisms, minerals, and organic matter. Scientists estimate that more than 50 percent of all life on Earth can be found within the dirt. A single teaspoon of healthy soil can contain up to one billion microorganisms from thousands of different species.

Soil supports life on Earth by filtering water, preventing flooding, trapping carbon dioxide, and helping plants grow.



Asteroids and Comets

The planet existed long before it had organisms. Scientists think that around four billion years ago, a series of asteroids and comets slammed into Earth, making the planet's surface too hot to support living things. This theory is known as the Late Heavy Bombardment. Scientists believe the debris crashing into Earth came from the movement of other large planets.



Asteroids are rocky remnants of leftovers from the formation of the solar system. They are most often found orbiting the sun between Mars and Jupiter.

The Horseshoe Crab

Scientists estimate horseshoe crabs have been on Earth for about 450 million years. This is longer than almost any other animal species still alive today! Despite their name, horseshoe crabs aren't actually crabs—they are arthropods, which makes them more closely related to scorpions and spiders.



One horseshoe crab can lay about 4,000 eggs in a single cluster. Each year, the mother can lay about 100,000 eggs.

Classification

Scientists have identified more than one million species on Earth, and they predict that there are many millions more that have yet to be discovered. To make sense of the great variety of life, all life-forms are organized into groups using a system based on shared characteristics called classification.

Ancestors

Taxonomy is the science of identifying, describing, and classifying all life on Earth into different groups of creatures that are related to one another. All individuals of a particular group share a class or order evolved from a common ancestor who lived long ago. A small group, such as a genus, has only a few species, and their common ancestor probably lived relatively recently. A phylum is a bigger group that contains hundreds of thousands of species, and their single common ancestor lived long ago.



A type of feathered dinosaur is the ancestor of the birds around today.



Binomial System

Scientists created a binomial system to give every species a scientific name made of two words. The first word is called the generic name. It is the name of the genus the species belongs to. The second word is the specific name, which is a unique name for that species. Many of the words used in taxonomy are based on old languages, such as Latin and ancient Greek. They often describe the group in some way. For example, bats belong to an order called Chiroptera, which means hand wings. Humans belong to the *Homo sapiens* species, meaning wise human.

Taxonomy divides life into a series of groups called taxons, which go from broader to more specific. The most specific grouping is species.

The human species is part of a larger genus called *Homo*. There used to be other species in this genus, such as *Homo erectus* and *Homo neanderthalensis*, but they have died out.

The *Homo* genus belongs to a family, Hominidae, that it shares with other great apes: chimpanzees, gorillas, and orangutans.

The Hominidae family is one of several in the Primate order, which also includes monkeys, lemurs, and gibbons.

Primates are members of the Mammalia class, along with whales, lions, and mice.

Mammals are one class of the phylum Chordata, which includes anything with a backbone, such as reptiles, birds, and fish.

The animal phyla combine to make up the Animalia kingdom. There are several other kingdoms of life on Earth, which include life-forms such as plants, fungi, and bacteria.

TAXON	HUMAN	CHIMPANZEE	BLUE WHALE	SNAKE
Species	<i>sapiens</i>	<i>troglodytes</i>	<i>musculus</i>	<i>naja</i>
Genus	<i>Homo</i>	<i>Pan</i>	<i>Balaenoptera</i>	<i>Naja</i>
Family	Hominidae	Hominidae	Balaenopteridae	Elapidae
Order	Primates	Primates	Artiodactyla	Squamata
Class	Mammalia	Mammalia	Mammalia	Reptilia
Phylum	Chordata	Chordata	Chordata	Chordata
Kingdom	Animalia	Animalia	Animalia	Animalia



HALL OF FAME

Carl Linnaeus 1707–1778

The taxonomy system was originally organized by Swedish plant scientist Carl Linnaeus in 1735. Linnaeus established the same set of taxons we still use today, but he didn't understand the process of evolution. Instead, he grouped organisms according to how they looked. This led to early mistakes, such as grouping whales and dolphins as kinds of fish—though he later changed this.

DID YOU KNOW? Taxonomists have shown that the fungal kingdom is more closely related to the animal kingdom than it is to the plant kingdom.

Bacteria

Among the smallest and oldest types of life are bacteria. Fossil remains show that these microscopic organisms were living on Earth almost four billion years ago. Bacteria are far too small to see without powerful microscopes. They live in all habitats, from the depths of the ocean to the peaks of the highest mountains. Bacteria even live underground and float around in the air.

Bacteria evolved at a time when the conditions on Earth were very extreme. Today, they can be found living in places where no other life-forms can survive, such as in hot springs.

Single Cells

A single bacterium has a body made of one cell, which measures about 2 millionths of a meter (2 μm). The cell is surrounded by a membrane and a rigid cell wall. Inside the cell, there is a complex mixture of deoxyribonucleic acid (DNA) and other chemicals of life. Most bacteria cells are spherical or rod-shaped, but a few have a twisted shape. They sometimes grow into clusters made up of several cells.

Cyanobacteria are blue-green algae that float in the ocean as plankton. It is estimated that for every human on Earth, there are three trillion cyanobacteria in the sea.



Ruth Ella Moore
1903–1994

In 1933, Ruth Ella Moore became the first Black American woman to earn a degree in biology. She worked on the germs that caused tuberculosis—a lung disease that is still one of the biggest killers today. Moore also showed that gum disease and rotting teeth are caused by bacteria in the mouth that eat the remains of sugary foods.

HALL OF FAME



The colors in water come from the microbes living there and their waste chemicals.

Good and Bad Bacteria

Some bacteria cause illness, such as an upset stomach and sore throat. They can be treated with germ-killing drugs called antibiotics. Bacteria can also infect wounds and damage the body, and so they must be cleaned away with antiseptics. However, bacteria in some foods, such as yogurts and pickles, do not cause harm. They add acids to make these foods taste the way they do. These food bacteria are even useful to the body because they help with digestion. In fact, there are billions of bacteria living inside your intestines right now!



When bacteria turn the sugars in milk into lactic acid, it makes yogurt. This gives the sharp taste and creates the gooey mixture.

Archaea are microbes found in hot springs. These small organisms look a lot like bacteria and have been around for just as long. However, archaea have a distinct metabolic system. So, they form a separate kingdom.