### Invertebrates

Of the million or more animal species in the world, more than 90% are invertebrates. Invertebrates don't have an internal skeleton made of bone. Many invertebrates have a fluid-filed hydrostatic skeleton, like the Jelly fish or worms. Others have a hard outer shell like insects and crustaceans. There are many type of invertebrates. The most common invertebrates include the protozoa, annelids, echinoderms, mollusks and arthropods.

## **Types of cells**

All cells can be divided into two large categories. A eukaryotic cell, or eukaryote, is a large, complex cell that contains a membrane bound compartment called a nucleus. The nucleus contains DNA within chromosomes. A prokaryotic cell, or prokaryote, is a very small, simple cell that lacks a nucleus. Its DNA is a single, circular molecule that is not enclosed in a membrane bound compartment.

| Prokaryote                      | Eukaryote                |
|---------------------------------|--------------------------|
| No nucleus                      | Nucleus                  |
| No membrane-bound organelles    | Many organelles          |
| 1-10 μm in size                 | <b>2-1000</b> μm in size |
| Only bacteria and Cyanobacteria | All other cells          |

# **Classification of living things**

Humans have been classifying organisms for thousands of years. Greek philosopher Aristotle grouped animals according to their physical similarities. Aristotle's classification included some of the groups recognized today, such as the mammals. In the middle Ages, herbalists used plants to treat disease and needed to know how to identify which plants were poisonous and which had healing powers. Herbalists produced manuals of plant types, known as "herbals".

Today biologists classify organisms not by their usefulness but by their physical, chemical, and behavioral similarities. These similarities reveal evolutionary relationships. The science of classifying living things is called **taxonomy**.

Like the system of naming organisms, the system of classification was derived by Linnaeus. Linnaeus wrote a huge encyclopedia of life, the *Systema Naturae* (system of nature). This work described all organisms then known. It classified living things into a hierarchy in which individuals are assigned to groups, groups are collected into large groups, and these large groups are part of still large groups. A similar system is used in the U. S. Army.

The smallest group in biological classification is the **species**. Similar species are collected into a **genus**. Similar genera are united into a **family**. Similar families are combined into an **order**. Similar orders are collected into a **class**. Similar classes are united into a **phylum**. Finally, similar phyla are collected into a **kingdom**. The term **division** is substituted for phylum in classification of plants, bacteria, and fungi.

#### What is a species?

Biologists have traditionally defined a **species** as a group of organisms that are able to interbreed with each other to produce fertile offspring and that usually do not reproduce with members of any other groups. This definition works well for most animals and many plants. For example, the horse and the zebra belong to different species. Although they can mate, the resulting offspring, the "zebroid" is sterile. Reproductive barriers between sexually reproducing species are not always perfect. **Hybrids** are offspring that result from interbreeding by individuals of different species.

## **Kingdoms of life**

In 1969, Robert H. Whittaker described a system of classification that distinguished between kingdoms according to cellular organization and mode of nutrition (figure 1). According to this system, members of the kingdom Monera are the bacteria and the cyanobacteria. They are distinguished from all other organisms by being **prokaryotic** (table 1) Members of the kingdom **Protista** are eukaryotic and consist of single cells or colonies of cells. This kingdom includes *Amoeba, Paramecium*, and many others. Members of the kingdom **Plantae** are eukaryotic, multicellular, and photosynthetic. Plants have walled cells and are usually non motile. Members of the kingdom **Fungi** are also eukaryotic and multicellular. They also have walled cells and are usually non motile. Mode of nutrition distinguishes fungi from plants. Fungi digest organic matter extracellularly and absorb the breakdown products. Members of the kingdom **Animalia** are eukaryotic and multicellular, and they usually feed by ingesting other organisms or parts of other organisms. Their cells lack walls and they are usually motile.

In recent years, new information has challenged the five kingdom classification system. For the first two billion years of life on the earth, the only living forms were prokaryotic microbes. Fossil evidence from this early period is scanty; however, molecular studies of variations in base sequences of ribosomal RNA from more than two thousand organisms are providing evidence of relationship rooted within this two-billion-year period. The emerging picture is that the five previously described kingdoms do not represent distinct evolutionary lineages



Figure Classification of organisms