

KINGDOMS OF THE LIVING WORLD

Traditionally, the living world was divided into two kingdoms, the plant kingdom and the animal kingdom. That was a satisfactory scheme for many years, and it still serves a lot of nonbiologists quite well. But as the science of biology developed, it became clear that two kingdoms were really not enough. The first problem arose with the realization that the unicellular (single-celled) organism called *Euglena* has chloroplasts and is capable of photosynthesis—distinctly plantlike characteristics—but also has a flagellum by which it can swim about like an animal. As time went on, other organisms were discovered with similar disconcerting combinations of plant and animal characteristics. In this century, the advance of biochemistry and the development of the electron microscope led to more biological facts that made two kingdoms entirely inadequate.

At the present time, the majority of biologists are agreed that the evidence supports the division of the world of living organisms into five kingdoms. Remember, though, that kingdoms are purely human inventions. No other living organism, as far as we can tell, cares a bit what kingdom it is in. As the future of biology unfolds, we may see evidence for division into more than five kingdoms. (Six, seven, and eight have already been suggested by various biologists.) It is even remotely possible that some facts will be discovered to bring us to unify two or more of today's five kingdoms into one. But it is not likely.

Color title A and the associated illustrations. Use light colors for this plate so as not to obscure details.

The *kingdom Monera* was created for the bacteria and cyanophytes (formerly called blue-green algae). They are all unicellular, but they have prokaryotic cells (Plate 32), which lack the nuclear envelope and the membrane-bounded organelles found in all other cells. Their ribosomes are distinctly different in size and composition, and they have peculiar molecules in their cell walls. Many of them also have peculiar metabolic pathways not found in any other group. Most biologists believe that the first living things on earth were probably single prokaryotic cells similar to today's monerans.

Color title B and the associated illustrations.

The *kingdom Protista* serves as the catch-all kingdom where we put things that don't fit well anywhere else. Nearly all protists are unicellular and, like all organisms

other than the monerans, they have eukaryotic cells similar to the animal and plant cells shown in Plates 30 and 31. Some are photosynthetic, some simply absorb nutrients from around them, and some ingest solid food. It is in this kingdom that we place *Euglena* and its relatives and two other groups of algae, the dinoflagellates and the golden brown algae. These are commonly referred to as the "algal protists" to distinguish them from the algae that are in the plant kingdom. The protist kingdom also includes *Paramecium*, a unicellular organism that propels itself rapidly through the water by means of several thousand cilia, and the amoeba, which changes shape constantly and flows around its food to engulf it.

Color title C and the associated illustrations.

The *kingdom Fungi* includes the yeasts, molds, mushrooms, and mildews, as well as many parasitic forms. Although the yeasts are unicellular, most other fungi consist of numerous long multicellular filaments. Their cells are eukaryotic, and because of their thick cell walls, fungi were once regarded as nonphotosynthetic plants. However, their cell walls usually contain a great deal of chitin, which is never found in plants but is the principal component of the exoskeleton (the outer covering) of insects and their relatives. Fungi live exclusively by absorbing nutrients, frequently secreting digestive enzymes onto their food source to break large molecules down into small ones that can be absorbed.

Color title D and the associated illustrations.

The *kingdom Plantae* includes all of the things that we generally recognize as plants, from mosses to pine trees and roses. The green, red, and brown algae are also included in this kingdom because most of their members are multicellular. Many of the green algae are unicellular, but they are biochemically most similar to plants. All the members of this kingdom have eukaryotic cells with cell walls made of cellulose.

Color title E and the associated illustrations.

Most of the members of the *kingdom Animalia* are familiar to you, but such things as sponges, sea anemones, and sea cucumbers, which you might not recognize as animals, are also included. All are multicellular, with eukaryotic cells that lack cell walls.

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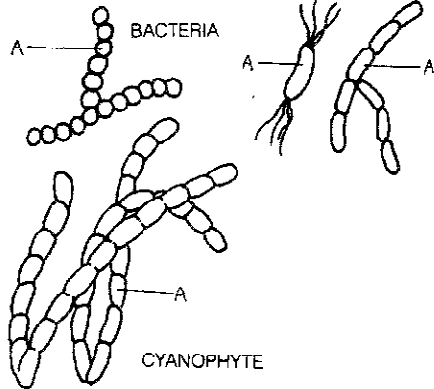
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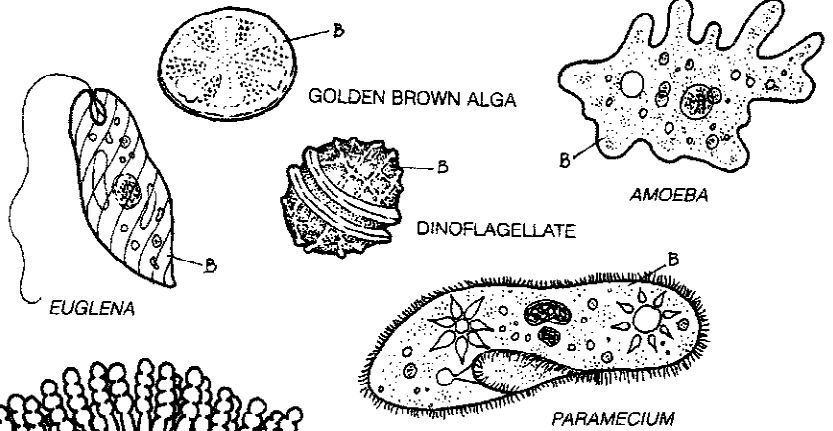
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KINGDOM MONERA

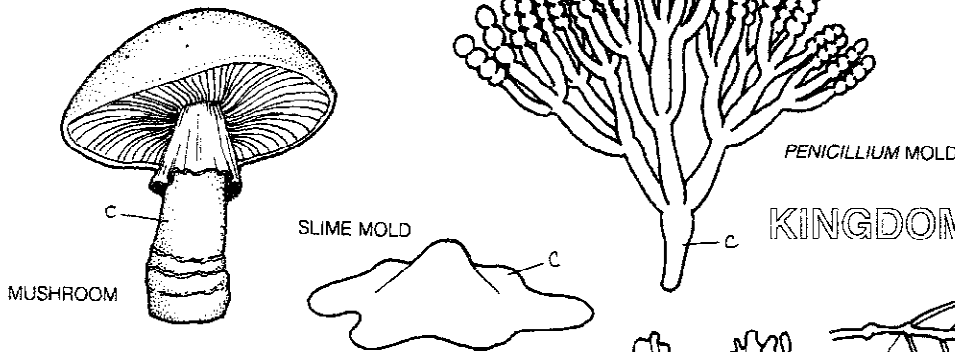
Eubacteria
Archaeobacteria — Two extra Kingdoms



KINGDOM PROTISTA

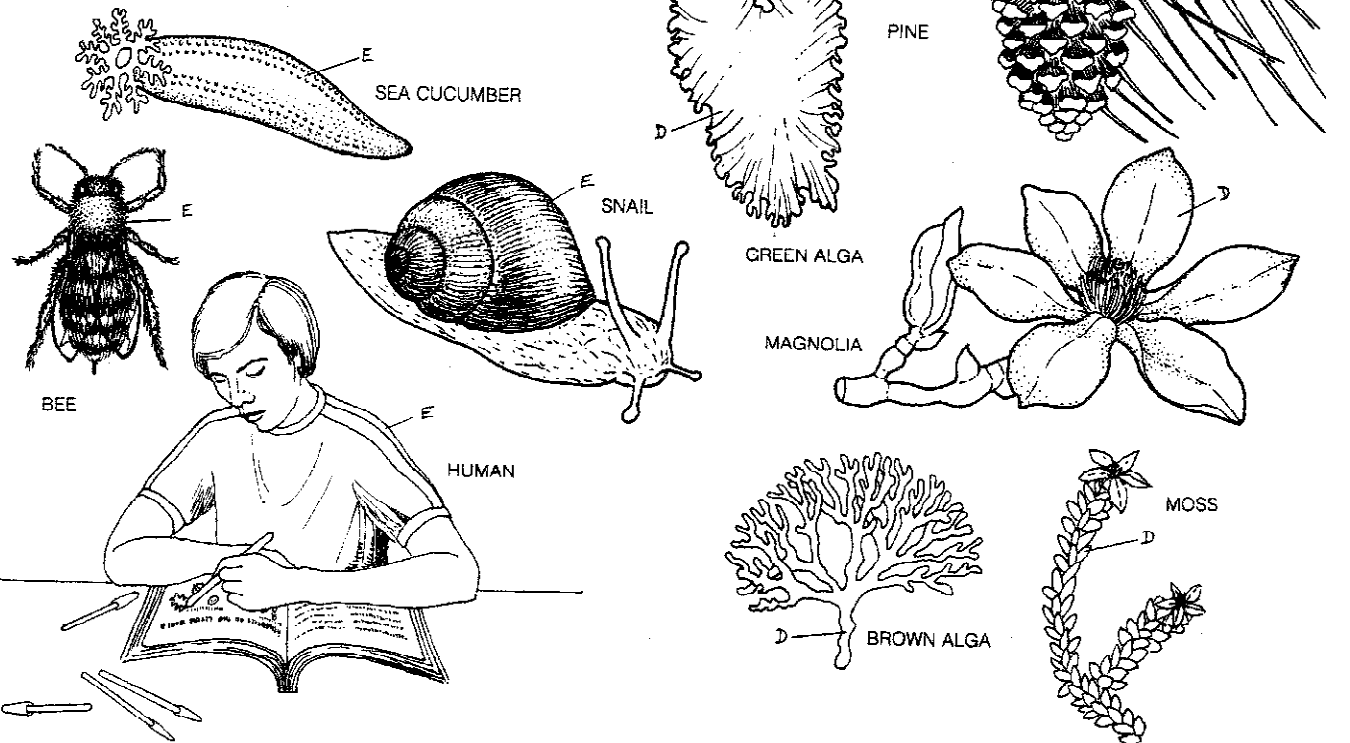


KINGDOM FUNGI



KINGDOM PLANTAE

KINGDOM ANIMALIA



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