

Scientific Classification

Scientific classification or biological classification refers to how biologists group and categorize extinct and living species (a group whose members can interbreed). Modern classification has its roots in the system of **Carolus Linnaeus**. Linnaeus grouped species according to shared physical characteristics. These groupings have been revised since Linnaeus to improve consistency with the Darwinian principle of common descent.

EARLY SYSTEMS

The earliest known system of classifying forms of life comes from the Greek philosopher **Aristotle** (384-322 BC) who classified animals based on their means of transportation (air, land, or water).

In 1172 **Ibn Rushd** (Averroes), who was a judge in Seville, translated and abridged Aristotle's book "de Anima" which was then translated into Latin by Mitchell the Scott.

The exploration of parts of the New World next brought descriptions and specimens of many novel forms of animal life. In the latter part of the 16th century and the beginning of the 17th careful study of animals commenced and was gradually extended until it formed a sufficient body of knowledge to serve as an anatomical basis for classification.

Jan Swammerdam (1637 - 1680), a Dutch naturalist and microscopist, was among the first to recognize cells in animals and was the first to see red blood cells. **Robert Hooke** (1635 - 1702), an English scientist, discovered the cellular structure of cork.

John Ray (1627 - 1705) was an English naturalist who published important works on plants, animals, and natural theology. His classification of plants in "Historia Plantarum" was an important step towards modern taxonomy. Ray classified plants according to similarities and differences that emerged from observation.

Two years after John Ray's death **Carolus Linnaeus** (1707-1778), the Swedish botanist who proposed the modern system of biological nomenclature, was born. His great work, the "Systema Naturae", ran through twelve editions during his lifetime (1st ed. 1735). He is best known for his introduction of a method of modern classification; he created systematic zoology and botany in their present form.

Linnaeus adopted Ray's conception of species, but he made the concept a practical reality by insisting that every species must have a unique Latin binomen, that is, a double name — the first half to be the name of the genus, common to several species, and the second half to be a single word, which is called the specific epithet or species. This convention is now referred to as **binomial nomenclature**.

Before Linnaeus, long many-worded names had been used, sometimes with one additional adjective, sometimes with another, so that no true names were fixed and accepted. Linnaeus'

system made it easy to identify unambiguously any given species of plant or animal. He proceeded further to introduce into his system a series of groups: genus, order, class.

THE QUICK FACTS ABOUT: LINNAEUS SYSTEM

The Linnaeus System works by placing each organism into a layered hierarchy of groups. Each group at a given layer is composed of a set of groups from the layer directly below. Simply knowing the two-part scientific name makes it possible to determine the other six layers.

The groupings (taxa) of taxonomy from *most general to most specific are:*

- Kingdom (Monera or Protista or Plantae or Fungi or Animalia)
- Phylum (animals) or Division (plants)
- Class
- Order
- Family
- Genus
- Species

These groups can be remembered using several **mnemonics**, for instance:

KINGDOM, PHYLUM, CLASS, ORDER, FAMILY, GENUS, SPECIES

- Kings Play Chess On Funny Green Squares.
- King Phillip Came Over For Good Spaghetti.

(The first letter of each word in the sentence is the first letter of each classification group listed in the correct order.)

In order to illustrate these groups, let's look at the classification of a few animals.

GROUP NAME	ORGANISM				
	HUMAN	CHIMPANZEE	HOUSE CAT	LION	HOUSEFLY
KINGDOM	Animalia	Animalia	Animalia	Animalia	Animalia
PHYLUM	Chordate	Chordate	Chordate	Chordate	Arthropoda
CLASS	Mammal	Mammal	Mammal	Mammal	Insect
ORDER	Primates	Primates	Carnivora	Carnivora	Diptera
FAMILY	Hominidae	Pongidae	Felidae	Felidae	Muscidae
GENUS	Homo	Pan	Felis	Felis	Musca
SPECIES	sapiens	troglodytes	domestica	leo	domestica
Scientific Name	<i>Homo sapiens</i>	<i>Pan troglodytes</i>	<i>Felis domestica</i>	<i>Felis leo</i>	<i>Musca domestica</i>

SCIENTIFIC CLASSIFICATION - MODERN DEVELOPMENTS

The general approach Linnaeus took to classifying species and many of his taxonomic groups have remained standard in biology for at least two centuries. It is now generally accepted that classification should reflect the Darwinian principle of common descent. Such groups are called **monophyletic**.

SCIENTIFIC CLASSIFICATION – ADDITIONAL EXAMPLES

HUMANS	CABBAGE
KINGDOM: Animalia PHYLUM: Chordata SUBPHYLUM: Vertebrata SUPERCLASS: Gnathostomata CLASS: Mammalia ORDER: Primata SUBORDER: Haplorhini FAMILY: Hominidae GENUS: Homo SPECIES: Homo sapiens	KINGDOM: Plantae PHYLUM: Tracheophyta SUBPHYLUM: Pteropsida CLASS: Angiospermae ORDER: Dicotylodoneae FAMILY: Brassicaceae GENUS: Brassica SPECIES: Brassica oleracea
YELLOW MOREL MUSHROOM	COMMON POND AMEBA
KINGDOM: Mycota PHYLUM / DIVISION: Eumycota SUBPHYLUM / SUBDIVISION: Ascomycotina CLASS: Dicsomycetes ORDER: Pezizales FAMILY: Morchellaceae GENUS: Morchella SPECIES: Morchella esculenta	KINGDOM: Protista SUBKINGDOM: Protozoa PHYLUM: Sarcomastigophora CLASS: Sarcodina SUPERORDER: Loboda ORDER: Granulopodea FAMILY: Amoebidae GENUS: Amoeba SPECIES: Amoeba proteus

Sources:

http://www.absoluteastronomy.com/encyclopedia/s/sc/scientific_classification.htm

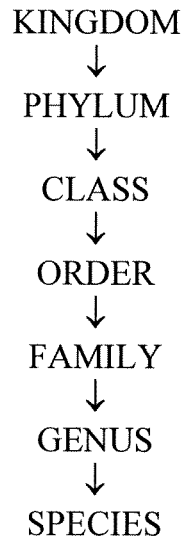
<http://faculty.fmcc.suny.edu/mcdarby/Animals&PlantsBook/History/02-Explaining-Life-Classification.htm>

<http://www.earthlife.net/kingdom.html>

SCIENTIFIC CLASSIFICATION OVERVIEW

- ◆ Scientists classify organisms into a hierarchy of groups based on evolutionary relationships.
- ◆ The field of biology that identifies and classifies organisms is called taxonomy.

Scientists use seven basic levels of classification



Most taxonomists use a five kingdom system of classification.

1. MONERA
2. PROTISTA
3. FUNGI
4. PLANTAE
5. ANIMALIA

NAMING ORGANISMS

Scientists name organisms using binomial nomenclature.

Genus name + species name

- ◆ The genus name is capitalized.
- ◆ The species name is not capitalized
- ◆ Both names are in *italics* or underlined.

BASIS FOR CLASSIFICATION

1. Taxonomists now use **phylogenetic** trees to show **evolutionary relationships** among biological groups.
2. According to the theory of evolution, all organisms are descendents of a common ancestor – the first cell. All organisms, living or extinct, are related to some degree.
3. When classifying organisms, early scientists were limited to features they could observe. Today's scientists also use fossil records and biochemistry to classify relationships.
4. **DICHOTOMOUS KEYS** – used for identifying organisms. A dichotomous key lists specific observable traits of many organisms. For each trait, the key lists two contrasting options. By picking the options that match an organism's features, you can identify the organism.
5. Taxonomists estimate 1.5 to 12 million different species on earth today. ⇒ **BIODIVERSITY**
6. **EXTINCTION** is a natural byproduct of evolution. However, the rate of extinction has been higher in recent years than at almost any other time in Earth's history.

THE SIX KINGDOMS OF LIFE



There have been many classification schemes developed through time, changing from 2 kingdoms to 3 to 4 and to the present 6 kingdom system. Don't be surprised if this changes again. There are many organisms that we simply don't know enough about. The five kingdom system (taught in Biology 11 courses) has been replaced by 6 kingdom system at higher levels.

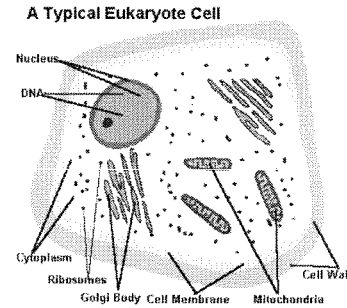
- Plant - Animal
- Plant - Animal - Fungi
- Microorganisms - Plant - Animal - Fungi
- Bacteria - Protista - Plant - Animal - Fungi
- Bacteria - Archaea - Protista - Plant - Animal - Fungi

PROKARYOTES AND EUKARYOTES

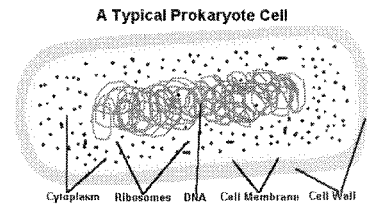
The six kingdoms of living things are divided into two major groups, **Prokaryotes** and **Eukaryotes**. There are two prokaryote kingdoms and four eukaryote kingdoms.

There are huge fundamental differences between the ways these two groups go about living. Here is just the briefest of distinctions.

Eukaryotes have a separate membrane bound nucleus, numerous mitochondria and other organelles such as the Golgi Body within each of their cells. These areas are separated off from the main mass of the cell's cytoplasm by their own membrane in order to allow them to be more specialised. The nucleus contains all the Eukaryote cell DNA for instance and the Mitochondria are where energy is generated. The exception to this rule are red blood cells which have no nucleus and do not live very long.



Prokaryotes do not have a nucleus, mitochondria or any other membrane bound organelles. In other words neither their DNA nor any other of their metabolic functions are collected together in a discrete membrane enclosed area. Instead everything is openly accessible within the cell, though some bacteria have internal membranes as sites of metabolic activity these membranes do not enclose a separate area of the cytoplasm.



THE SIX KINGDOMS

The next level down of classification is into Kingdoms, older books will teach that there are 2 Kingdoms, Plants and Animals but a more modern understanding is to use 6 Kingdoms

Unfortunately Botanists, Mycologists and Zoologists, who study the three kingdoms you will be most concerned with, do not always use the same terminology below kingdom level, though much of it is the same. Here you will find a brief description of each Kingdom which will link, in time, to more information, including more terminology.

Kingdom	When Evolved	Structure	Photosynthesis
Prokaryotes:-			
Bacteria	3 to 4 billion years ago	Unicellular	Sometimes
Archaea	3 to 4 billion years ago	Unicellular	No
Eukaryotes:-			
Protista	1.5 billion years ago	Unicellular	Sometimes
Fungi	1 billion years ago	Unicellular or Multicellular	No
Animalia	700 million years ago	Multicellular	No
Plantae	500 million years ago	Multicellular	Yes

Refer to pages 834-839 for descriptions of the phyla, classes and orders of the 5 kingdom system.