How Scientists Classify Plants and Animals

For centuries, biological scientists have worked to classify earth's organisms in a manner that would help us understand how both the present and the extinct species relate to each other. What are the similarities? What are the differences? How, for instance, does a Desert Poppy relate to a Desert Willow? How does a Ladybird Beetle relate to a Mule Deer? How does a modern desert Rock Squirrel relate to the extinct Ice Age Wooly Mammoth?

In 1753, a Swedish scientist, Carl Linnaeus, devised a system for grouping, classifying and naming organisms on the basis of shared physical characteristics, which would serve as a measure of biological relationships. Since then, his successors have refined and expanded his system many times. While some have devised other kinds of systems, many use the system derived from Linnaeus' original idea for classifying organisms. They now recognize five "Kingdoms" of living organisms:

1. Plantae (the plants),

2. Animalia (the animals),

3. Fungi (for instance, toadstools and mushrooms),

4. Monera (bacteria and blue-green algae), and

5. Protista (for instance, microscopic organisms called protozoa).

The first two kingdoms, the plants and the animal – and our current focus – form principal links in earth's food chains, including those of our deserts.

How the System Works

In the system founded by Linnaeus, the plant and animal Kingdoms include categories of organisms known, by the scientific names, as:

- Phyla
- Classes
- Orders
- Families
- Genera
- Species

Each of the categories from the Phyla through the Genera includes groups with increasingly closely shared physical characteristics. The final category, Species, includes organisms that all have very similar physical characteristics. In the custom established by Linnaeus, scientists still call a species by the name of the Genus (singular of Genera), capitalized, and the Species,

uncapitalized. For instance, they call the American Black Bear an Ursus americanus (the animal's Genus and Species).

Ladybird Beetle, an invertebrate.

As a game, imagine that you and a brother each own jackets that have the shared physical characteristics of red color, zip-up fronts and waist-lengths, with each garment having a hood and three pockets. You both hang your virtually identical red jackets randomly in a closet that you share with other brothers and your sisters.

First, think of all the garments hanging in the closet as a Kingdom of "Clothes." How would you classify and name your red jackets?

First, the Kingdom of Clothes would include Phyla called Shirts, Pants, Dresses, Blouses, Skirts and Coats.

The Phylum (singular of Phyla) of the Coats could include Classes called Blazers and Jackets.

The Class called Jackets could include Orders of Brown Jackets, Blue Jackets and Red Jackets.

The Order of the Red Jackets might include Families of Button-up Jackets and Zip-up Jackets.

Praying mantis, a famous invertebrate predator

The Family of red Zip-up Jackets could include Genera of virtually identical Long Jackets – with no hoods and no pockets – and virtually identical Waist-length Jackets – with hoods and three pockets.

The Genera of Waist-length Jackets would include a Species with the shared physical characteristics of red color, zip-up fronts and waist-lengths, with each garment having a hood and three pockets.

This Species, of course, would be the jackets belonging to you and your brother. You might call the Species the Hooded zip-up (the Genus and Species) in accordance with the convention established by Linnaeus.

You might find the identification and naming of your jackets made more complex, of course, should another brother own one that is virtually identical to yours except that his has one extra pocket and some blue trim. Would his rank as the same species with slight variations or a different species with distinctive differences? Scientists often find relatively small differences between otherwise similar species, raising significant problems in classifying and naming organisms.

Spider web, with spider, another invertebrate, waiting almost hidden in hole.

Classifying Plants

What makes plants – the producers – distinctive from other organisms, specifically, the animals?

Most members of the Kingdom of the plants, unlike the members of the Kingdom of the animals, manufacture their own food through photosynthesis (See Part II: The Desert Food Chain: Photosynthesis). They have no ability to move independently. They lack specialized tissues such as muscles, nervous systems and digestive chambers. While biological scientists often disagree about just where to place the plants, leading to considerable confusion, they typically all use plant tissues and seed structures as criteria for classification.

Moss, on the left, a non-vascular plant.

For example, scientists may place plants into two broad categories, one for those with “vascular” tissues and another for those with “non-vascular” tissues. The vascular tissue plants, for instance, Desert Poppies and Desert Willows, can conduct liquids, including water, from the roots through the plant stems and leaves. Non-vascular plants, specifically, the mosses, which typically grow near desert springs or seeps, cannot conduct liquids, relying instead on the surrounding moisture to meet their needs for water.

Globemallow, a plant classified as vascular because it can conduct water from its roots up through its stems.

Scientists may otherwise classify plants on the basis of seeds. Some plants, for instance, the Pinyon Pines that grow at some of our higher desert elevations, produce uncovered seeds that develop within the plant’s cones. Other plants such as the desert grasses and some flowering plants produce seeds each with a single embryonic (unborn) leaf. Still others, for instance, the prickly pear cacti, flower and produce fruit with seeds each with two embryonic leaves. Ferns plus some “allied” plants such as the Horsetails, among the more primitive plants, reproduce from spores rather than seed.

Other scientists may rank plants, not only on the basis of tissue and seeds, but also on the basis of “stature” in the plant world, including in our deserts, for instance, the cacti, yuccas, agaves, grasses, shrubs and the annuals.

Scientists’ range of approaches to classifying and ranking plants reflects the boggling complexity of the Kingdom Plantae.

Fish, a vertebrate, portrayed on stone by a Native American of the desert

Classifying Animals

What makes animals – the consumers – distinctive from plants?

A Red-tail Hawk, a vertebrate and a predator.

First, animals, unlike typical plants, eat other organisms to survive. Most animals, unlike plants, can move themselves from place to place. They can seek refuge from high heat and prolonged droughts. They have specialized tissues such as muscles, nervous systems and digestive systems. They tend to fit more neatly than the plants into the classification system.

As another game, consider how you might classify and name (scientifically) your dog.

First, scientists have divided the Kingdom of the animals into two main groups, or Phyla: the invertebrates (those with no backbones) and vertebrates (those with backbones).

Mule Deer, with a brand-new fawn. The mother mule deer shows the hardships of living in the desert. A vertebrate mammal, she will nurse her fawn.

The Phylum of invertebrates includes various Classes with creatures such as insects (including the Ladybird Beetle), spiders, centipedes, snails, worms and many more animal organisms that do not have spines.

The Phylum of vertebrates include Classes such as reptiles, amphibians, fish, birds and mammals (including the Mule Deer, Rock Squirrel and the extinct Wooly Mammoth). Your dog, of course, would belong to the Phylum of the vertebrates and the Class of the mammals, which nurse their young and typically bear fur.

The Class of the mammals includes, for a few examples, Orders such as Proboscidea (elephants), Perissodactyla (horses and donkeys), Rodentia (rats and mice), Primates (monkeys) and Carnivora (dog-like animals, cat-like animals, bears, skunks and badgers).

Worldwide, the largely meat-eating Carnivora Order consists of some 11 Families, according to the University of Michigan's Animal Diversity Web site. These include, as a few examples, the Families of the Canidae, or the dog-like animals; the Felidae, or cat-like animals; and Ursidae, or the bears.

The Family of the Canidae includes the Genus of the Canis, which includes Species of the dogs, wolves and coyotes.

Scientific names of representative Species names are, for the dog, Canis familiaris; for a Red Wolf, Canis rufus; for a Gray Wolf, Canis lupus; and for a Coyote, Canis latrans.

You would, therefore, classify your dog, in the Kingdom of the animals, as a vertebrate, a mammal, a meat-eater, a wolf-and coyote relative, and a domesticated Canis Species. Scientifically, you would name him as a Canis familiaris, or a domesticated dog.

Vertebrate meat-eating mammal that is related to the wolves and the Coyote.

A Ways to Go

Since the 18th century, biological scientists have classified and named some 1.6 million organisms worldwide, including the representatives of all five Kingdoms. Faced with mind-numbing complexity, the scientists have been unable to reach a full agreement on classification systems or rankings within the existing systems. Meanwhile, they estimate that they may have another 10 to 30 million organisms to go.