Taxonomy, Classification and Dichotomous Key Lab

Background

Before the advent of modern, genetically based evolutionary studies, European and American biology consisted primarily of taxonomy or classification of organisms into different categories based on their physical characteristics and presumed natural relationship. The leading naturalists of the 18th and 19th centuries spent their lives identifying and naming newly discovered plants and animals. However, few of them asked what accounted for the patterns of similarities and differences between the organisms. This is not surprising since most naturalists two centuries ago held the view that plants and animals (including humans) had been created in their present form and that they have remained unchanged. As a result, it made no sense to ask how organisms have evolved through time. Likewise, it was inconceivable that two animals or plants may have had a common ancestor or that extinct species may have been ancestors of modern ones.

One of the most important 18^{th} Century naturalists was a Swedish botanist and medical doctor named Karl von Linné. He wrote 180 books mainly describing plant species in extreme detail. Since his published writings were mostly in Latin, he is known to the scientific world today as Carolus Linnaeus, which is the Latinized form he chose for his name.

In 1735, Linnaeus published an influential book entitled Systema Naturae in which he outlined his scheme for classifying all known and yet to be discovered organisms according to the greater or lesser extent of their similarities. This Linnaean system of classification was widely accepted by the early 19th century and is still the basic framework for all taxonomy in the biological sciences today.

The Linnaean system uses two Latin name categories, genus and species, to designate each type of organism. A genus is a higher level category that includes one or more species under it. Such a dual level designation is referred to as a binomial nomenclature or binomen (which means "two names" in Latin.) For example, Linnaeus described modern humans in his system with the binomen Homo sapiens, or "man who is wise." Homo is our genus and sapiens is our species.

Linnaeus also created higher, more inclusive classification categories. For instance, he placed all monkeys and apes along with humans into the order Primates. His use of the word Primates (from the Latin primus meaning "first") reflects the human centered world view of Western science during the 18th century. While it implied that humans were “primanry” - it also indicated that humans are animals.

While the form of the Linnaean classification system remains substantially the same, the reasoning behind it has undergone considerable change. For Linnaeus and his contemporaries, taxonomy served to rationally demonstrate the unchanging order inherent in Biblical creation. This static view of nature was overturned in science by the middle of the 19th Century by a small number of radical naturalists, most notably Charles Darwin. Darwin provided conclusive evidence that evolution of life forms has occurred. In addition, he proposed natural selection as the mechanism responsible for these changes.

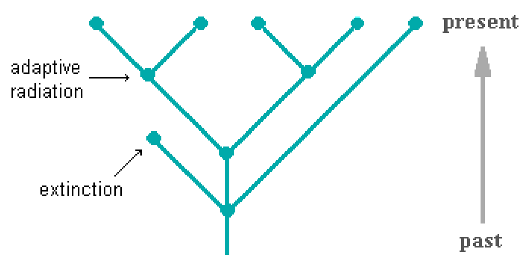
Late in his life, Linnaeus also began to have some doubts about species being unchanging. Crossbreeding resulting in new varieties of plants suggested to him that life forms could change somewhat. However, he stopped short of accepting the evolution of one species into another.

Since Darwin's time, biological classification has come to be understood as reflecting evolutionary distances and relationships between organisms. The creatures of our time have had common ancestors in the past. In a very real sense, they are members of the same family tree.

The great diversity of life is largely a result of branching evolution (adaptive radiation.) This is the diversification of a species into different lines as they adapt to new ecological niches and ultimately evolve into distinct species. Natural selection is the principal mechanism driving adaptive radiation.

Cladogram

A cladogram is a diagram used to show relationships among organisms. A cladogram is not an evolutionary tree because it does not show how ancestors are related to descendants or how much they have changed.

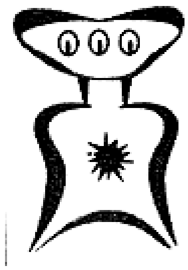
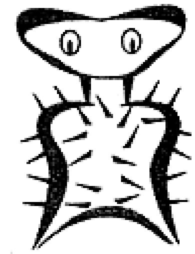
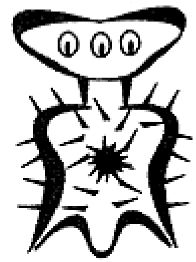


How can we classify? - Using a Dichotomous Key

1. Begin by observing the whole specimen you want to identify. Make notes about the specimen's habitat, etc.
2. Observe and note distinguishing features about the specimen such as: color; shape; texture; eyes; ears; body parts; etc.
3. Obtain a Dichotomous Key. Many different Dichotomous Keys have been developed for different specimens. These keys will ask a question about the specimen and your answer will lead to one of two alternative questions. Read both and decide which description bests fits your evidence and then move on to the next set of two alternatives given in the key.
4. Continue this method until you reach the final choice which will provide you with the answer as to what that specimen falls under; or perhaps – the discovery of a new species!

Recently, a space probe returned from the planet Pamishan with water samples. In these water samples, we have discovered quite a few new creatures. Use the Dichotomous Key on the next page to identify and classify them.

***Note**: These images are a mirror image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			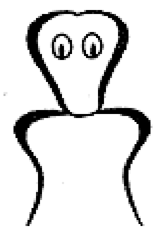	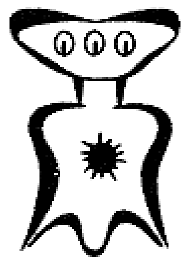
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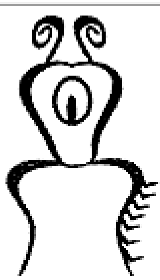			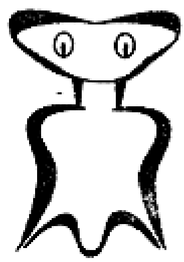	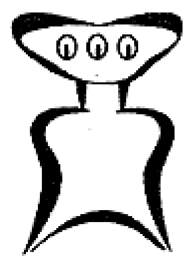
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		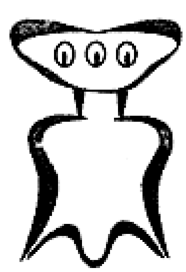		
16.	17.	18.	19.	20.

1.	a. The creature has a large wide head------------------------------	go to question 2
	b. The creature has a small narrow head----------------------------	go to question 11
2.	a. The creature has three (3) eyes------------------------------------	go to question 3
	b. The creature has two (2) eyes--------------------------------------	go to question 7
3.	a. There is a star in the middle of the creature's chest------------	go to question 4
	b. There is no star in the middle of the creature's chest----------	go to question 6
4.	a. The creature has spikes--	*Broadus hairus*
	b. The creature has no spikes---	go to question 5
5.	a. The creature has an arch-shaped bottom------------------------	*Broadus archus*
	b. The creature has an M-shaped bottom---------------------------	Broadus emmus
6.	a. The creature has an arch-shaped bottom------------------------	Broadus plainus
	b. The creature has an M-shaped bottom---------------------------	Broadus tritops
7.	a. The creature has spikes--	go to question 8
	b. The creature has no spikes---	go to question 10
8.	a. The creature has a star in the middle of its body--------------	Broadus hairystarus
	b. The creature has no star in the middle of its body--------------	go to question 9
9.	a. The creature has an arch-shaped bottom------------------------	Broadus hairyemmus
	b. The creature has an M-shaped bottom---------------------------	Broadus kiferus
10.	a. The creature's body is symmetrical-----------------------------	Broadus walter
	b. The creature's body is not symmetrical-------------------------	Broadus anderson
11.	a. The creature has no antennae-------------------------------------	go to question 12
	b. The creature has antennae--	go to question 14
12.	a. The creature has spikes on its face------------------------------	Narrowus wolfus
	b. The creature has no spikes on its face---------------------------	go to question 13
13.	a. The creature has no spikes anywhere----------------------------	Narrowus blankus
	b. The creature has spikes on the left leg--------------------------	Narrowus starboardus
14.	a. The creature has two (2) eyes------------------------------------	go to question 15
	b. The creature has one (1) eye-------------------------------------	Narrowus cyclops
15.	a. The creature has a mouth---	go to question 16
	b. The creature does not have a mouth-----------------------------	go to question 17
16.	a. The creature has spikes on its right leg-------------------------	Narrowus portus
	b. The creature has no spikes at all---------------------------------	Narrowus plainus
17.	a. The creature has spikes--	go to question 18
	b. The creature has no spikes---	Narrowus geoginia
18.	a. The creature has spikes on its head------------------------------	go to question 19
	b. The creature has spikes on its left leg---------------------------	Narrowus montanian
19.	a. The creature has spikes on its face------------------------------	Narrowus beardus
	b. The creature has spikes only on the outside edge of its head-	Narrowus fuzzus