Classification of Living Things

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VOCABULARY – Write the term next to the definition. You will need to know these terms to understand the classification of living things:

autotrophic eukaryotic heterotrophic motile colony	multicellular prokaryotic sessile unicellular

1. capable of locomotion (can move from place to place)_____

2. not capable of locomotion (movement) _____

4. composed of only one cell_____

5. a cell that does not have a membrane-bound nucleus_____

6. a cell that does have a nucleus_____

7. a number of individual cells that exist as a closely associating group_____

8. can synthesize (make) organic compounds (food) from inorganic materials

_____

 9. must ingest (eat) pre-formed organic materials (food) from its environment

_____

THE NAME GAME

Every recognized species on earth (at least in theory) is given a two-part scientific name. This system is called "binomial nomenclature." Carolus Linnaeus (1707–1778) introduced the concept of binomial nomenclature in his great work called *Systema Naturae* (1st edition in 1735). In this book, nature was divided into three kingdoms: mineral, vegetable, and animals. Linnaeus also established five ranks: class, order, genus, species, and variety.
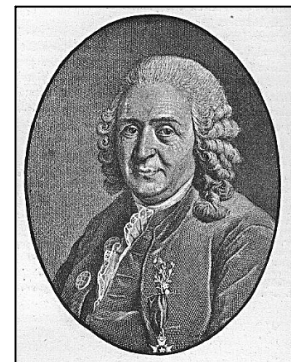

Carolus Linneaus

CLASSIFICATION- IT CHANGES!

Since the time of Linneaus, binomial nomenclature has grown considerably, and additional taxonomic ranks have been added. In fact, the classification of living things is constantly changing (even right now!). As our knowledge increases and our tools for investigation (like DNA analyses) become better, there are often changes in how we describe an organism from a taxonomic point of view.

Until the 1990's, five kingdoms were described: Monera, Protista, Fungi, Plant, and Animal. Then, in 2006, an entirely new classification was developed based upon a new discovery. Dr. Carl Woese and other scientists began to find evidence for a previously unknown group of prokaryotic organisms. These organisms lived in **extreme** environments - deep sea hydrothermal vents, "black smokers", hot springs, the Dead Sea, acid lakes, salt evaporation ponds - environments that scientists had never suspected would contain a profusion of life! Because they appeared prokaryotic, they were considered bacteria and named "**archaebacteria**" ('ancient' bacteria). However, it became obvious from biochemical characteristics and DNA and RNA sequence analyses that there were **numerous** differences between these archaebacteria and other bacteria. Before long, it was realized that these archaebacteria were **more closely related** to the eukaryotes (including ourselves!) than to bacteria. Today, these bacteria have been renamed **Archaea**. To accommodate the Archaea, systematists (specialists in taxonomy) devised an evolutionary model of classification with a level higher than a kingdom, called a domain. The three domains are **Archaea** (prokaryotes of extreme environments, like the archaebacteria), **Bacteria** (most of the known prokaryotes), and **Eukarya** (eukaryotes, including Protista, Fungi, Plantae and Animalia).
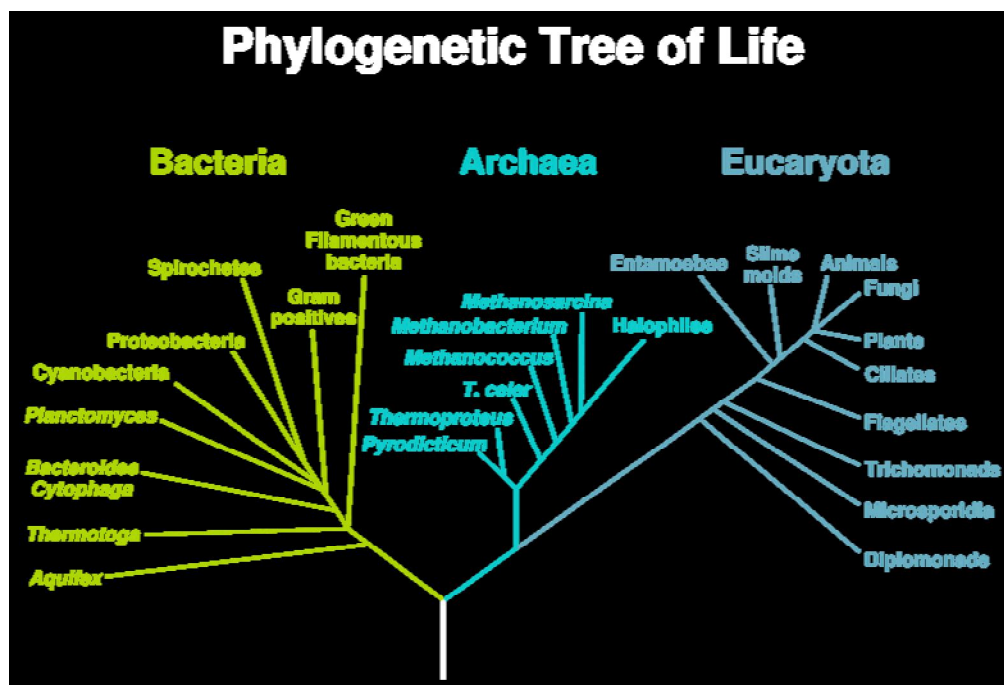
The newest form of classification using the three domains includes many different kingdoms. The original kingdom of Monera was split between the two domains Bacteria and Archaea, while the domain Eukarya includes the previously described kingdoms of Protista, Fungi, Plant, and Animal.

DOMAIN NAME	KINGDOM NAME	KEY CHARACTERISTICS	EXAMPLES
BACTERIA	**?**	Unicellular Prokaryotic	N-Fixing Bacteria Blue-green Algae Gram Positive Bacteria Spiral Bacteria Intracellular Parasites
ARCHAEA	**CRENARCHAEOTA EURYARCHAEOTA KORARCHAEOTA**	Extreme Environments Unicellular Prokaryotic	Thermophiles Methanogens Halophiles Hot Springs Microbes
EUKARYA	**PROTISTA**	Mostly unicellular Eukaryotic Some colonial	*Amoeba* *Paramecium* *Euglena* **Algae**
	FUNGI	Mostly multicellular Eukaryotic Heterotrophic Sessile	Mushrooms Molds & Mildews Yeast (unicellular)
	PLANT	Multicellular Eukaryotic Autotrophic Sessile Cell walls made of Cellulose	Moss Ferns Flowering Plants Bushes Trees
	ANIMAL	Multicellular Eukaryotic Heterotrophic Motile Specialized sense organs	Insects Jellyfish Crabs Fish Birds Lions, Tigers, Bears (oh my !)

Da Kine Philip Came Over For Good Spaghetti

A domain then, is the largest group. Within a domain are the kingdoms. Within a kingdom you have organisms that share certain characteristics. At the same time, organisms in the same kingdom can be very different from one another. For example humans, frogs, eagles, sharks, jellyfish, earthworms, grasshoppers, and sea urchins are all animals, and yet they are all quite different from each other. The groups (from largest to smallest) are:

Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species

These groups can be remembered using this pneumonic :

Da **K**ine **P**hilip **C**ame **O**ver **F**or **G**ood **S**paghetti

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

Can you come up with your own pneumonic to remember these groups? Write the pneumonic down below:

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**
DOMAIN	Eukarya	Eukarya	Eukarya	Eukarya	Eukarya
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	*Homo sapiens*	*Pan troglodytes*	*Felis domestica*	*Felis leo*	*Musca domestica*

NOTES :

1) All 5 of the organisms are classified as animals because they are multicellular, have eukaryotic cells, are heterotrophic, & capable of moving (motile)

2) The human, chimp, cat & lion have enough similar characteristics that they are put in the same phylum & in the same class too

3) The defining characteristics of each subgroup (as you go down a column) become more & more specific. The shared characteristics of the members of a kingdom are broad, the shared characteristics of members of a species are very specific.

4) In order for two organisms to be in the same "small" group, they must also be in all the same "big" groups above it. For example : if two organisms are in the same ORDER, they <u>must</u> be in the same class, phylum & kingdom. Even though the cat & the housefly have the same species group name (domestica), they CAN'T BE the same species because they are not in the same genus, family, order, etc. In fact, that last group name (species) doesn't really mean anything all by itself. The correct, full species name is the organism's two-part scientific name (see #5).

5) **REALLY IMPORTANT:** Every organism is given a scientific name which consists of its genus name (1st) & species name (2nd). This is called binomial nomenclature (bi-nomial = 2-names) & is attributed to Carolus Linnaeus (remember him?). So a human's scientific name is *Homo sapiens*, a lion's is *Felis leo*, a house cat's is *Felis domesticas*, etc. In a SCIENTIFIC NAME, the genus name should be capitalized & the species name lowercase, & both should be either *italicized* or <u>underlined</u>.

6) The closer the evolutionary relationship between two organisms, the more groups they have in common. So, of the five organisms in this chart, the cat & lion are most closely related (they are classified together in the first 6 groups). A human is more related to a chimp (4 groups in common) than to a lion (only 3 common groups).

TIME FOR SOME QUESTIONS ABOUT CLASSIFICATION!

1) Which choice lists the groups in order of decreasing variety?

      A. species, genus, family, phylum
      B. genus, species, kingdom, phylum
      C. kingdom, phylum, genus, species

2) Which choice is most closely related to *Acer rubrum*?

      A. *Rubrum acer*
      B. *Acer saccharum*
      C. *Quercus acer*
      D. *Quercus rubrum*

3) Which is an acceptable way to write the scientific name for humans?

      A. *Homo Sapiens*
      B. <u>Homo Sapiens</u>

C. homo sapiens

D. *Homo sapiens*

4) Which is true of two plants that belong in the same genus ?

A. they must be in the same family

B. they must be the same species

C. they must be the same color

D. they can't be in the same phylum

5) Who originated the system of binomial nomenclature ?

A. Darwin

B. Linnaeus

C. Hooke

D. Aristotle

Box Out!

ACTIVITY
Determine the order of classification using nested cardboard boxes. Each cardboard box should be labeled with a level of classification (i.e. Kingdom), and nest within the next largest classification (i.e. Domain).

MATERIALS
- 8 nested boxes
- Labels for each level of classification
- Labels for the levels of classification for a human
- Tape

PROCEDURE
1. As a class, determine the order of classification using the labels
2. Adhere the label onto the box that matches the level of classification
3. Nest the boxes with the labels into the correct order based on size

Nice job! Now, let's try the same exercise using the classification of YOU!

4. Determine the correct order of classification for humans using the labels
5. Adhere the label onto the box that matches the level of classification
6. Nest the boxes with the labels into the correct order based on size.

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Website: www.hawaii.edu/gk-12/evolution. Duplication for educational purposes only.

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****Labels for BOX OUT activity: Print and cut out separately.******

Domain	Eukarya
Kingdom	Animalia
Phylum	Chordate
Class	Mammal
Order	Primates
Family	Hominidae
Genus	<u>Homo</u>
Species	<u>sapiens</u>