

Science on a Sphere: Attack of the Giant Cell

LESSON #: 5

TITLE: Are We Related?

OVERVIEW: Students play games to find out which organisms are most closely related.

KEY CONCEPTS: The degree of genetic relatedness of organisms may be expressed in their appearance. However, evolutionary trajectories have caused some organisms that are related to become quite physically different while others may look somewhat alike but may actually from very different ancestors.

GRADE LEVEL: 7

BENCHMARK(S):

SC7.4.4 Classify organisms according to their degree of relatedness.

TEACHER BACKGROUND:

Classic Linnean taxonomy is based on assumed genetic relationships of organisms based on their anatomy and physiology. It also takes into account geographic information. With the advent of more sophisticated techniques that are able to “crack” the genetic code of living things, some refinements have been made and we can answer more specific questions about the closeness or distance of genetic relationships and their ancestral relationships.

DURATION: 45 minutes

VOCABULARY:

Taxonomy: The scientific classification of organisms into specially named groups based either on shared characteristics or on evolutionary relationships as inferred from the fossil record or established by genetic analysis

Classification: The assignment of organisms to groups within a system of categories distinguished by structure, origin, etc. The usual series of categories is *kingdom, phylum* (or, esp. in botany, *division*), *class, order, family, genus, species*, and *variety*.

Kingdom: The highest classification into which living organisms are grouped in Linnean taxonomy, ranking above a phylum. One widely accepted system of classification divides life into five kingdoms: prokaryotes, protists, fungi, plants, and animals.

Phylum: A group of organisms ranking above a class and below a kingdom (e.g., Porifera, sponges); in Botany often the term Division is often used.

Class: A taxonomic category of organisms ranking above an order and below a phylum or division. In modern taxonomic schemes, the names of classes end in *-phyceae* for the various groups of algae, *-mycetes* for fungi, and *-opsida* for plants (as in *Liliopsida*, the class of plants also termed monocotyledons). The names of classes belonging to phyla of the animal kingdom, however, are formed in various ways, as *Osteichthyes* the bony fishes, *Aves*, the

birds, and *Mammalia*, the mammals, all of which are classes belonging to the subphylum Vertebrata (the vertebrates) in the phylum Chordata.

Order: A group of organisms ranking above a family and below a class (e.g., Proboscidea, elephant)

Family: A group of organisms ranking above a genus and below an order. The names of families end in *-ae*, a plural ending in Latin. In the animal kingdom, family names end in *-idae*, as in Canidae (dogs and their kin), while those in the plant kingdom usually end in *-aceae*, as in Rosaceae (roses and their kin).

Genus: A group of organisms ranking above a species and below a family. The names of genera are capitalized and written in italics. For example, *Periplaneta* is the genus of the American cockroach, and comes from the Greek for "wandering about."

Species: A group of organisms having many characteristics in common and ranking below a genus. Organisms that reproduce sexually and belong to the same species interbreed and produce fertile offspring. The species name is made up of two name; *Genus + specific epithet*. Species names are written italics *Tyrannosaurus rex*.

Specific epithet: The uncapitalized Latin adjective or noun that follows a capitalized genus name in binomial nomenclature and serves to distinguish a species from others in the same genus, as *saccharum* in *Acer saccharum* (sugar maple). Also called *trivial name*.

Prokaryotic organism: An organism of the kingdom Monera (or Prokaryotae), comprising the bacteria and cyanobacteria, characterized by the absence of a distinct, membrane-bound nucleus or membrane-bound organelles, and by DNA that is not organized into chromosomes.

Eukaryotic organism: Any organism having as its fundamental structural unit a cell type that contains specialized organelles in the cytoplasm, a membrane-bound nucleus enclosing genetic material organized into chromosomes, and an elaborate system of division by mitosis or meiosis, characteristic of all life forms except bacteria, blue-green algae, and other primitive microorganisms.

Convergence (convergent evolution): Evolution of similar adaptive traits in genetically unrelated organisms; for example, the wings of butterflies and the wings of birds.

Parallelism (parallel evolution): Evolution of similar adaptive traits in forms that were once related but then diverged, developing along similar lines.

MATERIALS NEEDED:

Printouts of pictures, labeled with Kingdom, Phylum or Division, Class, Order, Family, Genus, Species on the back. Make these ahead or have them be part of the students' assignment.

PROCEDURE:

Split the class into two groups. Each group researches the degree of relatedness of several different organisms (plants and animals) and gets an image of each (keep actual documentation & sources to prove facts). Make them as tricky as you can.

Bring images (put names of them, too) back to class and have a contest to see which team can put the other's organisms in the correct "order" of relatedness. Maybe simple linear model or use a scientific classification model as a framework (e.g., Kingdom, Phylum/Division, Class, Order, Family, Genus, Species).

Remember, physical characteristics resulting from parallel and convergent evolution may fool you into concluding actual genetic "closeness".

You might want to have levels of the game. Start with easy stuff, then crank up the difficulty for groups or individuals that pass the first levels.

RESOURCES:

Web:

<http://www.ucmp.berkeley.edu/help/taxaform.html>

<http://mclibrary.nhmccd.edu/taxonomy/taxonomy.html>

Print:

Keller, Rebecca (2005) *Real Science—4—kids, Biology Level 1*. Gravitas Publications, Albuquerque.