

Classification of Organisms: Student Background

Read the following background information and then answer the questions that follow.

Biologists have identified more than 1.5 million different species on Earth. This is only a fraction of what scientists believe the total number could be – anywhere from 5 million to 100 million. Because of this abundance and diversity, scientists organize species with similar characteristics into groups based on their structure, function, and relationships. This is known as taxonomy or taxonomic classification.

The current system of classification is based on the hierarchical system of Swedish scientist Carolus Linnaeus. Linnaeus grouped organisms based on common physical characteristics. See Fig. 1 below.

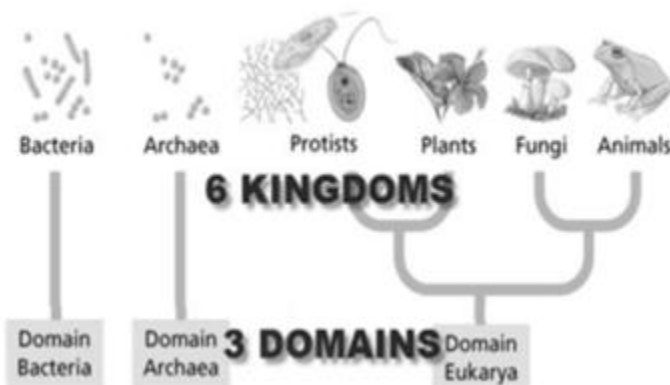


Fig 1. Note that there are 3 Domains: Bacteria, Archaea, and Eukarya. Domain Bacteria has only one Kingdom: Bacteria. Domain Archaea has only one Kingdom as well: Archaea. Domain Eukarya, however, has 4 kingdoms. Plants, Animals, Fungi and Protists.

Organisms can be classified into groups based on:

- **Their cellular structure:** whether they have defined nuclei or not (eukaryotes versus prokaryotes), or if their entire body is made up of one cell (unicellular) or many cells (multicellular).
- **Organisms function:** For example, organisms that make their own food are known as autotrophs (like plants and trees). Organisms that need to consume other organisms to get the nutrients they need to survive are known as heterotrophs (like Humans and Animals).
- **Organism Reproduction:** There are two ways in which organisms reproduce: Sexually, where it gets genetic information from two parents (like dogs, cats, cows). In this case, the organism will get half of its genetic information from the female and half from the male. The second way that organisms reproduce is through Asexual reproduction. In this case, the organism will get all its genetic information from one parent. See Fig. 2 below.

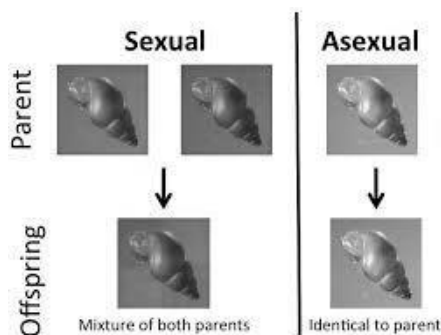
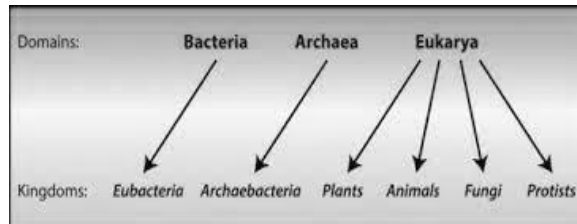


Fig. 2. The image to the left shows Sexual Reproduction, where the organism (offspring) gets genetic information from both parents and Asexual Reproduction where the organism (offspring), gets all its genetic information from one parent. In essence a clone.

In 1990, a scientist named Carl

Woese used ribosomes (a structure inside of cell that make proteins) to prove that all organisms can be placed into one of three domains: Bacteria, Archaea, and Eukarya. The Bacteria and Archaea domains consist of prokaryotes. This means that on the cellular level, they do not have defined nuclei – that is, their nuclei have no cell membrane or wall. Many members of the domain Archaea live in extreme environments (high heat, salt, or acid), such as hot springs, while members of the domain Bacteria are found all over Earth and are what we think of when we hear the word bacteria. The domain Eukarya (sometimes also spelled Eukaria) consists of anything that could be classified as a eukaryote, meaning that their cells have defined nuclei with cell membranes.

The three domains (Bacteria, Archaea, and Eukarya) are currently divided into six smaller groups known as kingdoms.



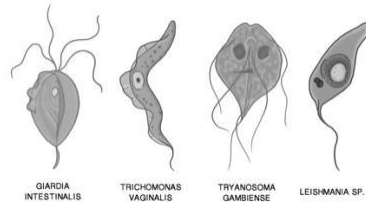
The Domain Bacteria has only one Kingdom, the kingdom Bacteria. These organisms are prokaryotes (single- celled) that cannot live in extreme environments.



The Domain Archaea has only one kingdom, the Kingdom Archaea. These organisms are also prokaryotes that often live in extreme environments such as deep thermal vents on the ocean floor, highly acidic environments. These organisms are also known as extremophiles

The Domain Eukarya consists of four Kingdoms: Protista, Plantae, Fungi, and Animalia.

Kingdom Protista: Consists of eukaryotic organisms that are primarily unicellular and other simple, multicellular relatives, such as slime mold or algae.



Kingdom Plantae: Eukaryotes that are multicellular and are autotrophs (make their own food). This includes mosses, trees, and flowering plants.



Kingdom Fungi: Eukaryotes that are heterotrophs (get food from other sources) and get their nutrients by decomposing organic matter, like mushrooms or molds.

Kingdom Animalia: Consists of multicellular, heterotrophic, eukaryotes. This group includes insects, reptiles, birds, and mammals.

Using the characteristics described previously (cellular structure, organism structure and reproduction), scientists have been able to classify organisms into Kingdoms and Domains.



One may wonder why there are separate Kingdoms and Domains for Archaea and Bacteria, for both types of organisms are prokaryotic, produce Asexually, and have no defined nuclei. The reason for this twofold: A) differences in genetic makeup that allow Archaea to survive in very harsh environments which most bacteria cannot do and B) some types of Archaea have characteristics of Eukaryotes.

With 86 percent of all species yet to be identified (out of an estimated 8.7 million species), our views on classification of organisms will continue to evolve and change.

Adapted from:

<http://biology.about.com/od/evolution/a/aa041708a.htm>

<https://flexbooks.ck12.org/cbook/ck-12-biology-flexbook-2.0/section/5.10/primary/lesson/linnaean-classification-bio/>

<https://www.nationalgeographic.com/science/article/110824>

Background Questions

1. What is used to classify organisms?
2. What are the three Domains?
3. What are the six kingdoms and in which domain do they belong?
4. Is it possible that the classification of organisms as we know it today, can change? Why or why not. Explain your reasoning.