

Classification Notes

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There are a very large number of living species in the world and even more that are now extinct. Humans have always tried to label these living things by giving them names. We named living things for how they looked or what they did or what they smelled like etc but this wasn't very organised or scientific. So, we needed a better method to classify organisms into groups of similar organisms to better understand them.

Classification: the process of grouping living organisms based on their shared characteristics. It helps scientists organise and understand the diversity of life.

Taxonomy: the science of naming, defining, and classifying organisms based on shared characteristics.

Why did we need a classification system for organisms? As more and more organisms were discovered we needed to start putting them into categories to help us organise and better understand them.

Classification provides a universal language (**Latin**) for scientists, helps predict characteristics, and reveals evolutionary relationships.

Why was Latin used for the language of classification? Latin was used for classification because it was the scholarly language in Europe. It provided a universal, neutral way for scientists from different countries to communicate. Plus, Latin's "dead" status means the meanings of words don't change over time.

When classifying organisms, the most commonly used system is the Linnaean system of classification.

The Linnaean System

The Linnaean system, created by Carl Linnaeus, is a way to sort living things into groups. Each species is given a two-part Latin name, like *Homo sapiens* for humans. Organisms are placed into levels, from the biggest group to the smallest: **Kingdom, Phylum, Class, Order, Family, Genus, and Species**. This system helps scientists organise and understand the variety of life on Earth.

The figure below shows the breakdown of the Linnaean system of classification.

Kingdom → Phylum → Class → Order → Family → Genus → Species

Let's look at two examples of this being used 😊

Humans

Kingdom Animalia
Phylum Chordata
Class Mammalia
Order Primates
Family Hominidae
Genus *Homo*
Species *sapiens*

Dogs

Kingdom Animalia
Phylum Chordata
Class Mammalia
Order Carnivora
Family Canidae
Genus *Canis*
Species *familiaris*

We do **not** need to learn these. These are just examples for us to see how this system of classification would work.

Binomial Names

What is a binomial name? also known as scientific names, are a two-part naming system for organisms.

Binomial names are made of the genus name, which is always has a capital letter at the start and the species name, which is lowercase at the start. We can see from the above examples that the binomial name for humans was *Homo sapiens* and dogs was *Canis familiaris*.

The Linnaean system of classification has been in use for almost 300 years. Does this mean, with all of the advances in technology that we have made, that there is a newer more advanced system for classification? Yes there is. 😊

DNA (deoxyribonucleic acid) was discovered in the mid 1800's but we didn't understand its structure until 1953! Since then, we have made huge advances in understanding and using DNA. When we put this together with our advancements in genetics and evolution we created a more refined classification system, leading to more accurate groupings based on genetic relationships. We called it the three domain system.

So, we compare how genetically similar or different two or more organisms are 😊. Just for some comparison we humans share 97% of our DNA with Orangutans and 98.8% of our DNA with Chimpanzees.

The Three Domain System

The Three Domain System was put forward by Carl Woese. It classifies life into **Bacteria**, **Archaea**, and **Eukarya** based on genetic and molecular differences between organisms. Let's look at each 😊

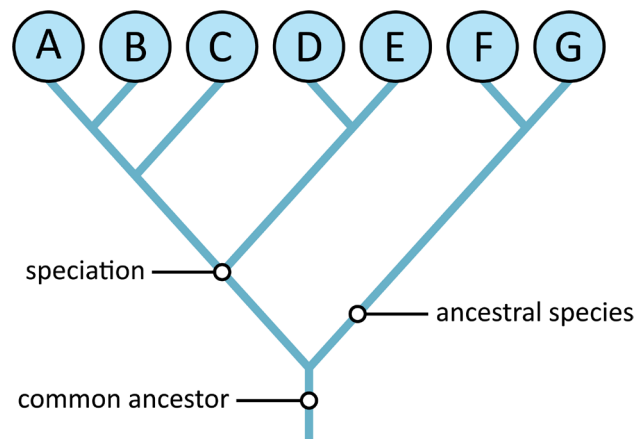
1. **Bacteria**: are prokaryotic, with no nucleus or membrane bound organelles and are found in pretty much every environment.
2. **Archaea**: are also prokaryotic and are often found in extreme environments like around volcanoes or thermal vents under the ocean. Basically, places where life shouldn't be able to survive but it does!
Note: organisms, like archaea, which live in extreme environments are often called extremophiles as they "love" extreme environments.
3. **Eukarya**: are eukaryotic organisms with a nucleus and organelles, these include plants, animals, fungi, and protists.

Evolutionary Trees

Now that we have all these organisms classified, how do we show how they are related to each other? Scientists use models called evolutionary trees.

An evolutionary tree: a diagram used to show how different organisms are related and how they have evolved from common ancestors.

The figure below shows a simplified evolutionary tree, where A, B, C, D, E, F and G represent different species.



When looking at a tree, the closer together two branches are, the more closely related the two organisms are!

How do scientists build these trees? To figure out where an organism belongs on the tree, scientists have to use different types of data depending on whether the organism is alive or extinct:

- **For living organisms**: scientists use current classification data like DNA analysis and physical characteristics.
- **For extinct organisms**: scientists use fossil data.

Exam note: because the fossil record is incomplete, it can sometimes be very difficult for scientists to figure out exactly where an extinct organism belongs on the evolutionary tree!