

Taxonomy (Greek: orderly arrangement!)

- The science of classification
- Classification of living things
- The objective of taxonomy is;
 - 1) To classify living organisms establish the relationships between two group of microorganisms to differentiate them
 - 2) To provide a common reference for identification of organisms those have already been classified.
 - 3) To provide a basic tool for scientists as a universal language of communication

Taxonomy (Greek: orderly arrangement!)

- Taxonomy is the science of classifying and naming organisms.
- It involves organizing living organisms into hierarchical categories based on shared characteristics, such as species, genus, family, order, class, phylum, kingdom, and domain.
- This system helps scientists understand relationships between different organisms and track their diversity.
- The process of classification often involves examining physical traits, genetic data, and evolutionary history.
- The most well-known system of taxonomy is the **binomial nomenclature**, developed by **Carl Linnaeus**, where each species is given a two-part Latin name (genus and species).

The Three Domain Taxonomy

- Living organisms are currently classified into **three domains**. A domain can be divided into kingdoms.
- In this system, **plants, animals, and fungi** belong to the **Domain Eukarya**.
- **Bacteria** (with peptidoglycan) form a second domain.
- Archaea (with unusual cell walls) are placed in the **Domain Archaea**.

Phylogeny & Taxonomic Hierarchy

- Phylogeny is the evolutionary history of a group of organisms.
- The taxonomic hierarchy shows evolutionary, or phylogenetic, relationships among organisms.
- Bacteria were separated into the **Kingdom Prokaryotae** in 1968.
- Living organisms were divided into **five kingdoms** in 1969.

Phylogeny & Taxonomic Hierarchy

- Phylogeny is the study of the evolutionary history and relationships among species or groups of organisms. It traces how different species are related to each other through common ancestors, showing the evolutionary pathways that led to their current forms.
- Phylogenetic trees, or “family trees,” are used to visually represent these relationships, where **branches represent evolutionary lines** and **the nodes (intersections) represent common ancestors**.
- In essence, phylogeny helps scientists understand how species evolved over time and how they are connected through shared ancestry. It is closely related to taxonomy but focuses more on the evolutionary aspect, whereas taxonomy is more about classification based on shared characteristics.

A Phylogenetic Tree

- A phylogenetic tree is a diagram that shows the evolutionary relationships between different species or groups of organisms.
- The tree-like structure illustrates how species are related based on common ancestors, with branches representing different evolutionary paths. The branches connect to nodes, which represent common ancestors shared by the species or groups at the ends of the branches.
- The tree is often used to depict evolutionary history, with more recent species or groups located near the tips of the branches and older, more ancient ancestors at the base.

A Phylogenetic Tree

- Organisms are grouped into taxa according to phylogenetic relationships (from a common ancestor).
- Some of the information for eukaryotic relationships is obtained from the fossil record.
- Prokaryotic relationships are determined by rRNA sequencing.

rRNA Sequencing

- rRNA sequencing refers to the process of analyzing **ribosomal RNA (rRNA) genes** to determine evolutionary relationships between organisms.
- **Ribosomal RNA** is a component of the ribosome, **the molecular machine responsible for protein synthesis in cells**. It is present in all living organisms, and certain rRNA genes (like the **16S rRNA in bacteria** or **18S rRNA in eukaryotes**) evolve slowly over time, making them excellent markers for studying phylogenetic relationships.
- By sequencing these rRNA genes and comparing them across different organisms, scientists can create a genetic fingerprint that shows how closely or distantly related they are.
- Since rRNA is crucial for basic cellular functions and is **highly conserved across species**, it provides a reliable basis for **constructing phylogenetic trees** and **understanding the evolutionary connections between diverse organisms**.

Scientific Nomenclature

- According to scientific nomenclature, each organism is assigned two names, or a binomial: a genus and a specific epithet, or species.
- *Staphylococcus aureus*
- *Escherichia coli*
- *Salmonella enterica*
- *Bacillus anthracis*
- *Mycobacterium tuberculosis*
- *Brucella abortus*

Taxonomic Hierarchy

- An eukaryotic species is a group of organisms that interbreed with each other but do not breed with individuals of another species.
- Similar **species** are grouped into a **genus**; similar genera are grouped into a **family**; families, into an **order**; orders, into a **class**; classes, into a **phylum**; phyla, into a **kingdom**; and kingdoms, into a **domain**.

References

1. Quinn PJ, Markey BK, Leonard FC, FitzPatrick ES, & Fanning S (2011). *Veterinary Microbiology and Microbial Disease*. 2nd Ed., Wiley-Blackwell.
2. Tortora GJ, Funke BR, Case CL (2019). *Microbiology, An Introduction*. 13rd Edition, Pearson Education Inc.