

# Classification of Prokaryotes

- *Bergey's Manual of Systematic Bacteriology* is the standard reference on bacterial classification.
- A **group of bacteria derived from a single cell** is called a **strain**.
- Closely related strains constitute a bacterial species.

# Bergey's Manual of Systematic Bacteriology

- Bergey's Manual of Systematic Bacteriology is a comprehensive reference work that provides a detailed **classification and identification system for bacteria**. It is a critical resource for microbiologists, particularly those studying **bacterial taxonomy and systematics**.
- The manual is organized into volumes, each covering different groups of bacteria, based on their genetic, phenotypic, and physiological characteristics. It includes information on the **morphology, biochemical properties, genetics, and ecological roles** of various bacterial species. Bergey's Manual is used to help **identify bacterial species**, understand their **evolutionary relationships**, and **classify them within the broader context of microbial diversity**.
- The manual is continually updated to incorporate new research and discoveries, making it an essential tool for identifying and classifying bacteria in research and clinical microbiology. It provides a framework for understanding the diversity of bacteria and the principles of bacterial taxonomy.

# Classification of Eukaryotes

- **Eukaryotic organisms** may be classified into the **Kingdom Fungi, Plantae, or Animalia**.
- Protists are mostly **unicellular organisms**; these organisms are currently being assigned to kingdoms.
- Fungi are **absorptive chemoheterotrophs** that develop from spores.
- **Multicellular photoautotrophs** are placed in the **Kingdom Plantae**.
- **Multicellular ingestive heterotrophs** are classified as **Kingdom Animalia**.

# Viruses

- Viruses are not placed in a kingdom. They are **not composed of cells** and **do not have ribosomes**.
- A viral species is a **population of viruses with similar characteristics that occupies a particular ecological niche**.

# Bacterial Identification and Classification Methods

- Morphological characteristics (*Macroscopic & Microscopic Morphology*)
- Differential staining
- Biochemical tests (Rapid identification test systems)
- Serology (Slide agglutination & ELISA tests)
- Phage typing
- Fatty acid profiles
- Flow cytometry
- Nucleic acid amplification tests (PCR/RT-PCR/Real-Time PCR, etc.)
- DNA sequencing
- DNA fingerprinting
- Nucleic acid hybridization (Southern&Northern Blotting/Microarrays, etc.)

# Bergey's Manual of Determinative Bacteriology

- Bergey's Manual of Determinative Bacteriology (now often referred to as Bergey's Manual of Systematic Bacteriology in its more recent editions) is a reference work that provides **detailed information on the identification and classification of bacteria based on their observable characteristics**. This manual was originally designed to help microbiologists **identify unknown bacterial species, primarily through their physical, biochemical, and morphological traits**.
- The manual includes information on:
  - 1.**Morphology**: Size, shape, arrangement, and staining properties of bacterial cells.
  - 2.**Biochemical characteristics**: Enzymatic activities, metabolic capabilities, and reactions to different growth conditions.
  - 3.**Physiological characteristics**: Growth patterns, temperature tolerance, oxygen requirements, and more.
  - 4.**Ecological properties**: Environmental factors that influence bacterial growth.

- ***Bergey's Manual of Determinative Bacteriology*** is the standard reference for laboratory identification of bacteria.
- **Morphological characteristics** are useful in identifying microorganisms, especially when aided by **differential staining techniques**.
- The **presence of various enzymes**, as determined by **biochemical tests**, is used in identifying bacteria and yeasts.
- **Serological tests**, involving the **reactions of microorganisms with specific antibodies**, are useful in **determining the identity of strains and species**, as well as **relationships among organisms**. **ELISA** and **Western blotting** are examples of serological tests.
- **Phage typing** is the identification of bacterial species and strains by determining their **susceptibility to various phages**.

- **Fatty acid profiles** can be used to identify some organisms.
- **Flow cytometry** measures physical and chemical characteristics of cells.
- The **percentage of GC base pairs** in the nucleic acid of cells can be used in the classification of organisms.
- The **number and sizes of DNA fragments, or DNA fingerprints, produced by restriction enzymes** are used to determine genetic similarities.
- Single strands of DNA, or of DNA and RNA, from related organisms will hydrogen-bond to form a double-stranded molecule; this bonding is called **nucleic acid hybridization**.

- Nucleic Acid Amplification Techniques (NAATs) can be used to amplify a small amount of microbial DNA in a sample. The presence or identification of an organism is indicated by amplified DNA.
- **PCR, Southern blotting, DNA chips, and FISH** are examples of nucleic acid hybridization techniques.
- The sequence of bases in ribosomal RNA can be used in the classification of organisms.
- **Dichotomous keys** are used for identifying organisms. **Cladograms** show phylogenetic relationships among organisms.

# 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.