

## Microbiology Lec.2

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Location of microorganism in organism world : History of their classification

1- Before the discovery of microorganisms biologist classified all organism into major kingdoms

animal kingdom(Animalia )& plant kingdom (plantae );the differentiation was based on motility ,photosynthesis, green color.

2- Haekl s system : three kingdoms based on evolutionary relationships, which are : animalia , plantae , protista ( includes all microorganism ).

3- Five kingdoms system by Whittaker:

kingdom 1: Monera ( prokaryote)

kingdom 2: protista ( unicellular Eukaryote)

kingdom 3: include (animalia , plantae, fungi)

4-Carl woese classification system

1- Archaeobacteria 2- Eubacteria 3- Eukaryote

5- The general system of classification

1- Eukaryotes protista include

a. Algae b. protozoa c. fungi d. slime molds

2- Prokaryotes

a. Eubacteria b. Archaeobacteria c. cyanobacteria

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A microorganisms include bacteria, fungi, archaea, protists and viruses. The first of these four types of microorganisms may either be free-living or parasitic. Viruses can only be parasitic, since they always reproduce inside other living things.

Microorganisms live almost everywhere on earth where there is liquid water, including hot springs on the ocean floor and deep inside rocks within the earth's crust.

Microorganisms are critical to nutrient recycling in ecosystems, because they act as decomposers. Because some microorganisms can also take nitrogen out of the air, they are an important part of the nitrogen cycle. Pathogenic, or harmful, microbes can invade other organisms and cause disease.

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## Bacteria

**Bacteria** (sing. **bacterium**) are very small organisms. They are prokaryotic microorganisms. Bacterial cells do not have a nucleus, and most have no organelles

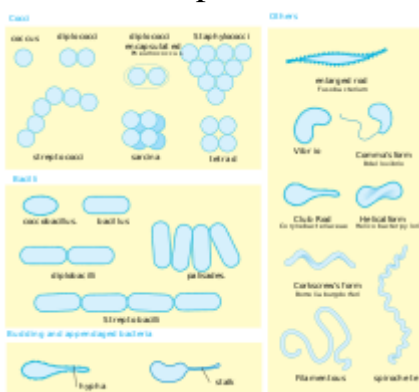
with membranes around them. Most have a cell wall. They do have DNA, and their biochemistry is basically the same as other living things. They are amongst the simplest and the oldest organisms. They function as independent organisms.

Almost all bacteria are so tiny they can only be seen through a microscope. Bacteria are made up of one cell, so they are a kind of unicellular organism. They are among the simplest single-celled organisms on Earth, and were one of the earliest forms of life. They include a number of extremophiles which live in extreme habitats.

Some bacteria can cause diseases, but others help us in everyday activities like digesting food (gut flora). Some even work for us in factories, producing cheese and yogurt.

## Shape

Bacteria vary widely in size and shape, but in general they are at least ten times larger than viruses. A typical bacterium is about 1  $\mu\text{m}$  (one micrometer) in diameter, so a thousand bacteria lined up would be one millimeter long. There are about five nonillion ( $5 \times 10^{30}$ ) bacteria on Earth. Bacteria are identified and grouped by their shapes. Bacilli are rod-shaped, cocci are ball-shaped, spirilla are spiral-shaped, and vibrio are shaped like a comma.



Different shapes of bacteria

## Pathogens

Pathogenic bacteria, the harmful kind, enter the human body from the air, water or food. Once inside, these bacteria attach themselves to or invade specific cells in our respiratory system, digestive tract or in any open wound. There they begin to reproduce and spread while using your body's food and nutrients to give them energy to help them reproduce

## Archaea

- The **Archaea** (or *Archea*) are a group of single-celled organisms. The name comes from Greek ἀρχαία, "old ones". They are a major division of living organisms.
- Archaea are tiny, simple organisms. They were originally discovered in extreme environments (extremophiles), but are now thought to be common to more average conditions. Many can survive at very high (over 80 °C) or very low temperatures, or highly salty, acidic or alkaline water. Some have been found in black smokers, oil wells, and hot vents in the deep ocean. Recent research has found ammonia-eating archaea in soil and seawater.
- In the past they had been classed with bacteria as prokaryotes (or Kingdom Monera) and named **archaebacteria**, but this classification is a mistake. The Archaea have an independent evolutionary history and show many differences in their biochemistry from other forms of life. They are now classified as a separate domain in the three-domain system. In this system, the three distinct branches of evolutionary descent are the Archaea, Bacteria and Eukaryota.
- Archaea are, like bacteria, prokaryotes: single-celled organisms that do not have nuclei and cell organelles of the eukaryote type

## Protist

**Protists** are single-celled eukaryotes which are organisms with a nucleus. The term **Protista** was first used by Ernst Haeckel in 1866.

It is a rather old-fashioned term which includes microorganisms from several distantly related phyla. Some are autotrophic (which means they make their own food by photosynthesis), and others are heterotrophic (which means they eat organic material).

Most protists are very small. They are made up of one or a few cells at most – they are microscopic and usually invisible to the naked eye. Some algae are protists, if they are single-celled.

Some protists cause diseases. *Plasmodium falciparum* causes malaria; sleeping sickness is also caused by a protist.

## Virus

is a microscopic parasite which can infect living organisms and cause disease. It can make copies of itself inside another organisms cells. Viruses consist of nucleic acid + a protein coat. Usually the nucleic acid is RNA; sometimes it is DNA.

Viruses reproduce by getting their nucleic acid strand into a prokaryote or eukaryote cell. The RNA or DNA strand then takes over the cell machinery to reproduce copies of itself and the protein coat. The cell then bursts open, spreading the newly created viruses. All viruses reproduce this way, and there are no free-living viruses.<sup>[1][2]</sup>

Viruses are much smaller than bacteria. They were not visible until the invention of the electron microscope. A virus has a simple structure. It has no internal cellular structure, no cell wall or cell membrane, just the protein coat that holds the string of nucleic acid.

With eukaryote cells, the virus' protein coat is able to enter the target cells via certain cell membrane receptors. With prokaryote bacteria cells, the bacteriophage physically injects the nucleic acid strand into the host cell.

Viruses have the following characteristics:

- Infectious particles, causing many types of disease;
- Contain nucleic acid core RNA or DNA;
- Surrounded by a protective protein coat;

When the host cell has finished making more viruses, it undergoes lysis, or breaks apart. The viruses are released and are then able to infect other cells. Viruses can remain intact for a long time, and will infect cells when the time and conditions are right.

**Fungi** are eukaryotes which means they have a defined nucleus and organelles. The cells are larger than prokaryotes such as bacteria. Fungal colonies can be visible to the human eye once they have achieved a certain level of growth, for example mould on bread. Fungi can be split into three main groups, 1) moulds which display thread-like (filamentous) growth and multicellular structures, 2) yeasts which are typically non-filamentous and can be single celled and 3) mushrooms which possess a fruiting body for production of spores.

**Algae** are a more difficult to define group of organisms, containing both prokaryotes and eukaryotes by some definitions. Unlike other microorganisms algae are typically photosynthesisers and are typically found in marine environments.