

# **Lec. Two**

# **Prokaryotic**

# **and Eukaryotic Cell**

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# Introduction

**\*The cell was first seen by Robert Hooke in 1665** using a primitive, compound microscope. He observed very thin slices of cork and saw a multitude of tiny structures that he resembled to walled compartments of a monk. Hence, named them cells. Hooke's description of these cells was published in Micrographia.

**The cell** is the smallest unit of a living system and fall in the microscopic range of 1 to 100  $\mu\text{m}$ . They attain various shapes and sizes to attain variety of functions.

# Cell Theory

Pioneering work by Theodor Schwann, Matthias Jakob Schleiden on cells, gave birth to the cell theory. Their theory states:

1. All living things are made of cells.
2. Cells are the basic building units of life.
3. New cells are created by old cells dividing into two.

\*Viruses are exception to the cell theory

# The Essential component of Living Cell

1. Nucleic acids deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).
2. Ribosomes
3. Cell membrane
4. Mitochondria or Mesosomes (Chondrioids in prokaryotes)

# Classification of cells

Any living organism may contain only one type of cell either **A. Prokaryotic cells**; **B. Eukaryotic cells**.

## **Prokaryotic cells:**

Prokaryote: an organism whose cell lack a membrane enclosed nucleus .

Mycoplasma, virus, bacteria and cyanbacteria(blue-green algae) are prokaryotes.

Most prokaryotes are unicellular, exceptions being myxobacteria which have multicellular stages in their life cycles.

They are membrane bound mostly unicellular organisms lacking any internal membrane bound organelles. Though prokaryotes lack cell organelles they harbor few internal structures, such as the cytoskeletons, ribosomes. Membranous organelles are known in some groups of prokaryotes, such as vacuoles or membrane systems devoted to special metabolic properties, e.g., photosynthesis or chemolithotrophy. In addition, some species also contain protein-enclosed microcompartments, which have distinct physiological roles (carboxysomes or gas vacuoles).

# The Characteristics of Prokaryotes

- 1.The absence of a membrane around the nuclear material.
- 2.The absence of clearly defined membrane limited organelles like mitochondria, chloroplast, Golgi complex and lysosomes.
- 3.The genetic material is located on a single chromosome which consists of a circular double strand of DNA.
- 4.The basic protein-histones, which are one of the most important constituents of chromosomes of eukaryotic cells, are absent in prokaryotic chromosomes.

5. The absence of nucleolus and mitotic apparatus.
6. The cell wall is non-cellulosic, being formed of carbohydrates and amino acids.
7. The plasma membrane which lies below the cell wall is produced into the cytoplasm and acts as the mitochondrial membrane carrying respiratory enzymes.
8. The cytoplasm neither exhibits streaming nor the amoeboid move-ment.



# Morphology of prokaryotic cells

Prokaryotic cells have various shapes; the four basic shapes are:

Cocci - spherical

Bacilli - rod-shaped

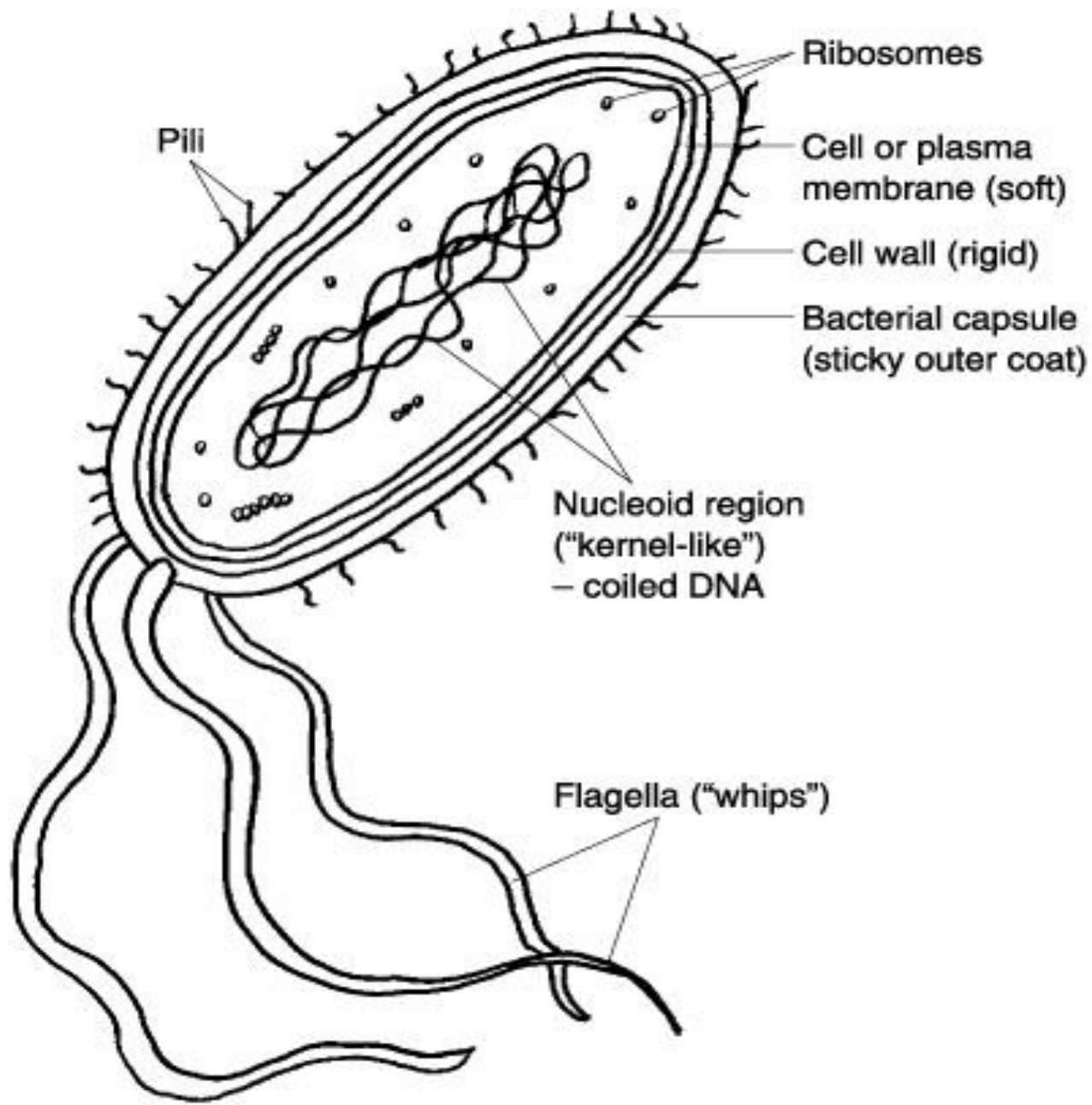
Spirochaete - spiral-shaped

Vibrio - comma-shaped

# Cell organization of prokaryotes

From inner to outer :

1. Cytoplasm which contains a variety of components
2. Plasma membrane
3. Periplasmic space with periplasm
4. Cell wall
5. Slime layer or capsule
6. Flagella and pili



# Eukaryotes

Eukaryote is an organism with complex cells, or a single cell with a complex structure.

## Characteristics

1. cytoskeleton composed of microtubules , microfilaments , and intermediate filaments , which play an important role in defining the cell's organization and shape.
2. Eukaryotic DNA is divided into several linear bundles called chromosomes , which are separated by a microtubular spindle during nuclear division. In these cells the genetic material is organized into chromosomes in the cell nucleus .

3.They belong to the taxa Eukaryota.

4.All species of large complex organisms are , including animals, plants and fungi and most species of protista microorganisms.

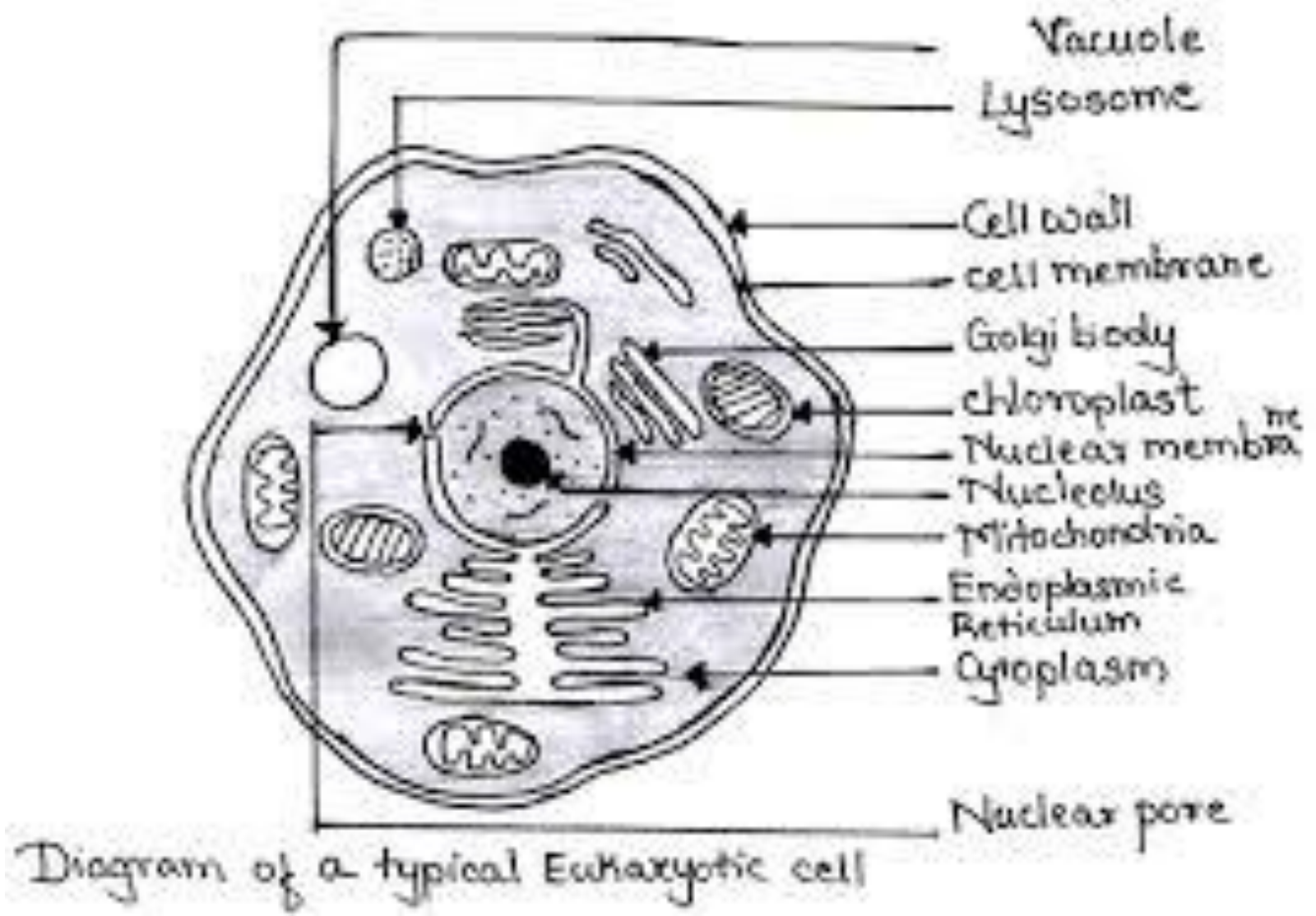
5.Eukaryotes appear to be monophyletic (organisms that form a clade) and make up one of the three domains of life.

6.Eukaryotic cells are much larger than prokaryotic cells. Range between 10 to 100 micrometers.

# Classification of Eukaryotes

The eukaryotes are composed of four kingdoms:

- Kingdom Protista
- Kingdom Fungi
- Kingdom Plantae
- Kingdom Animalia



## Prokaryotes

- Bacteria & archaea
- Lack a nucleus, one circular chromosome, no nuclear membrane
- No histones
- 70S ribosomes
- No organelles
- Peptidoglycan cell walls most bacteria (archaea cell walls are not PG)
- Divide by binary fission



## Eukaryotes

- Fungi, protozoa, algae, helminths
- True nucleus, several linear chromosomes, in nuclear membrane
- Histones
- 80S ribosomes
- Organelles
- Polysaccharide cell walls (if any) / sterols in cell membranes
- Divide by mitosis

