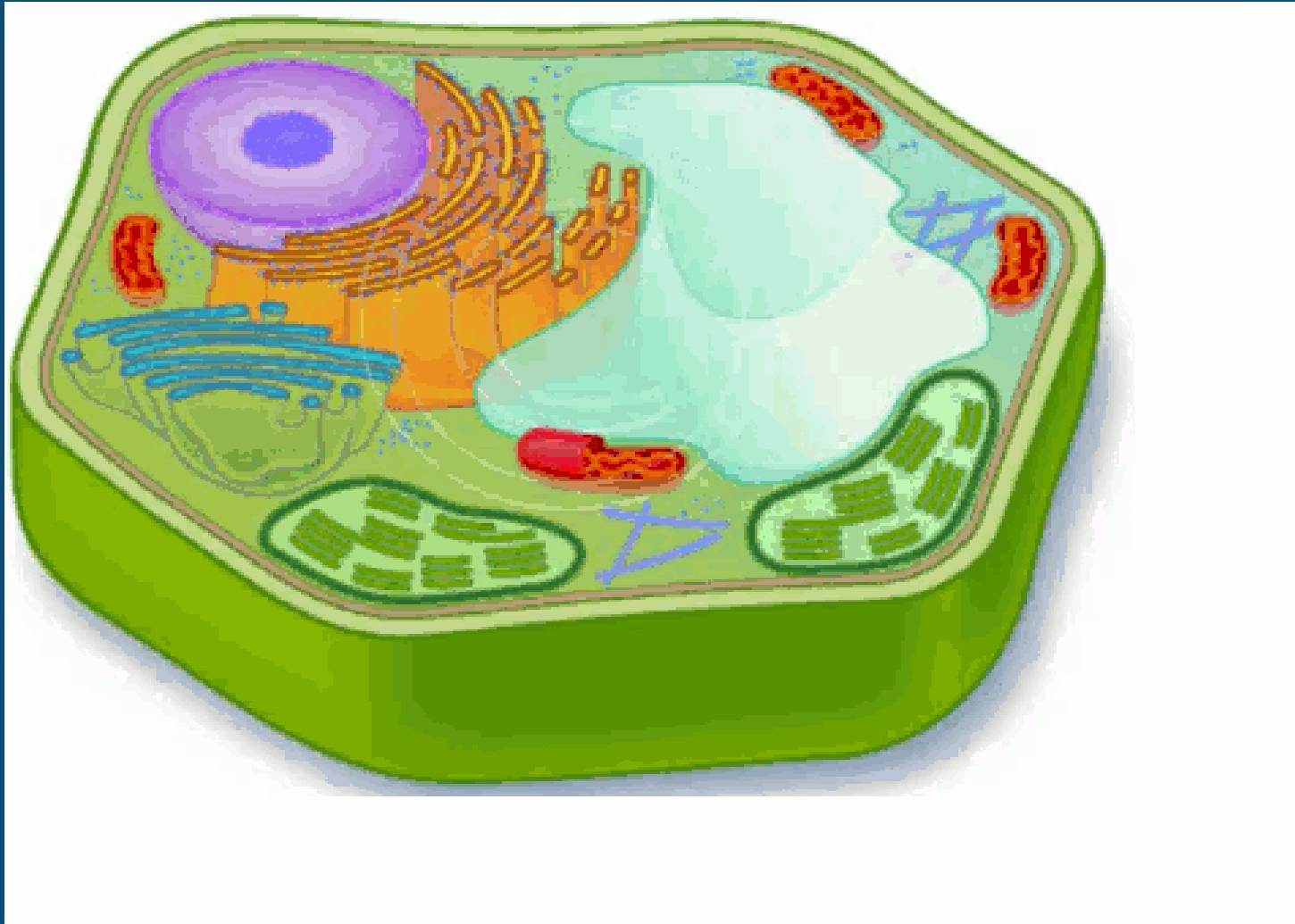


Nucelus



What is Cell?

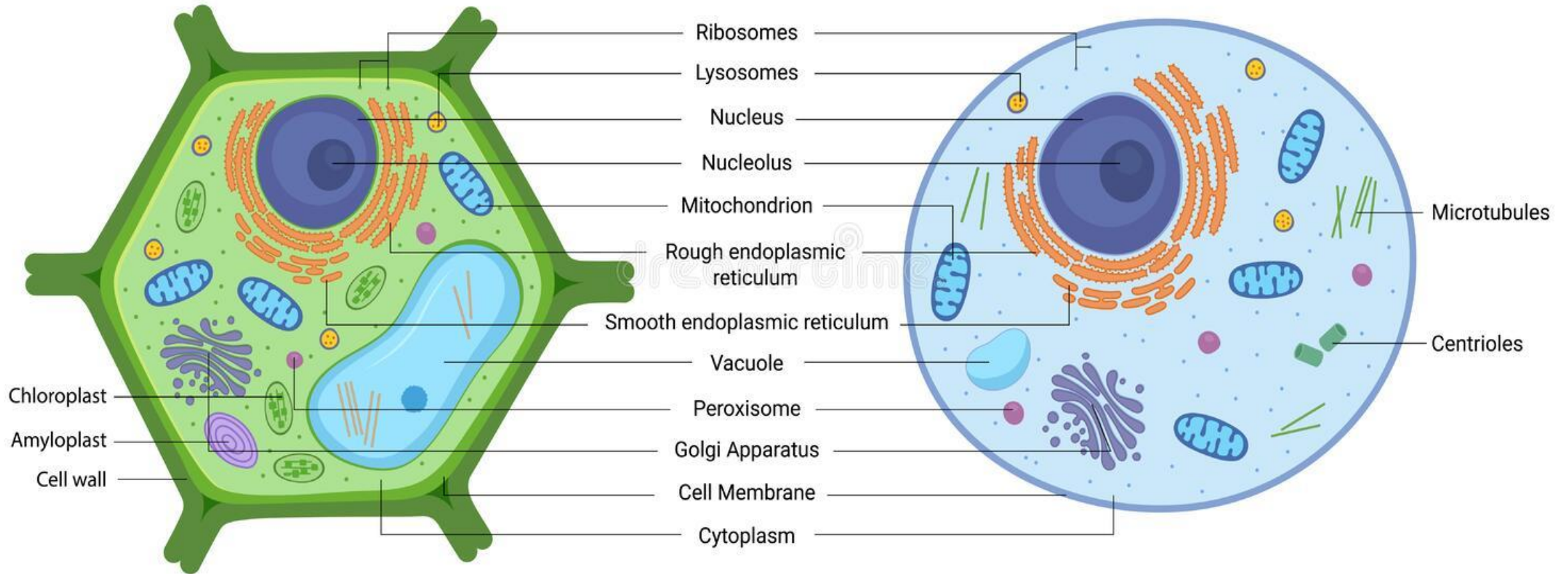
- ❖ The cell can be defined as the structural and functional unit of life.
- ❖ It is the smallest unit that can carry out all activities of life.
- ❖ Cells are building blocks of complex multicellular organisms.

STRUCTURE OF A GENERALIZED CELL

- ❖ A cell consists of the following basic components:
- ❖ 1. Plasma membrane, also a cell wall in plant cell.
- ❖ 2. Cytoplasm, containing cell organelles.
- ❖ 3. Nucleus, with nuclear or chromatin material.

PLANT CELL

ANIMAL CELL



Nucleus

❖Discovery:

❖Presence of cell nucleus was reported in 1831 by Robert Brown.

❖Location:

❖In animal cells, it generally occupies the central space.

❖While in the case of plant cells it is pushed towards periphery due to the presence of a large vacuole.

❖Shape:

❖Nucleus may be irregular or spherical in shape.

❖Generally, the cells have one nucleus and are called mononucleate.

❖On the other hand, the cells with two nuclei are binucleate and with more than two as multinucleate.

Nucleus

- ❖ Nucleus is only visible when the cell is in non-dividing stage.
- ❖ It contains chromatin network and soluble sap called nucleoplasm.
- ❖ In dividing cells, the nucleus disappears and the chromatin material in it is replaced by chromosomes.
- ❖ The heredity material is in the form of chromosomes, which controls all the activities of the cell.
- ❖ **Chemical Composition of Nucleus:**
 - ❖ DNA, RNA and proteins including enzymes form the chemical composition of the nucleus.
- ❖ **Components of Nucleus:**
 - ❖ Nucleus consists of nuclear membrane, nucleoli, nucleoplasm and chromosomes.

Nuclear Membrane

- ❖ Nucleus is surrounded by a nuclear membrane which separates the nuclear material from the cytoplasm.
- ❖ The nuclear membrane is actually a nuclear envelope composed of two membranes.
- ❖ The outer membrane is at places continuous with the endoplasmic reticulum, while the inner membrane encloses the nuclear content. The outer and the inner membranes are continuous at certain points resulting in the formation of pores, **the nuclear pores**.
- ❖ The nuclear pores allow the exchange of materials between the nucleus and the cytoplasm. The number of nuclear pores is highly variable.
- ❖ The undifferentiated cells (such as eggs) have numerous pores (about 30,000 per nucleus), whereas differentiated cells such as erythrocytes have only 3 or 4 pores/nucleus.
- ❖ Each pore has a definite structure which controls the traffic of substances passing through them

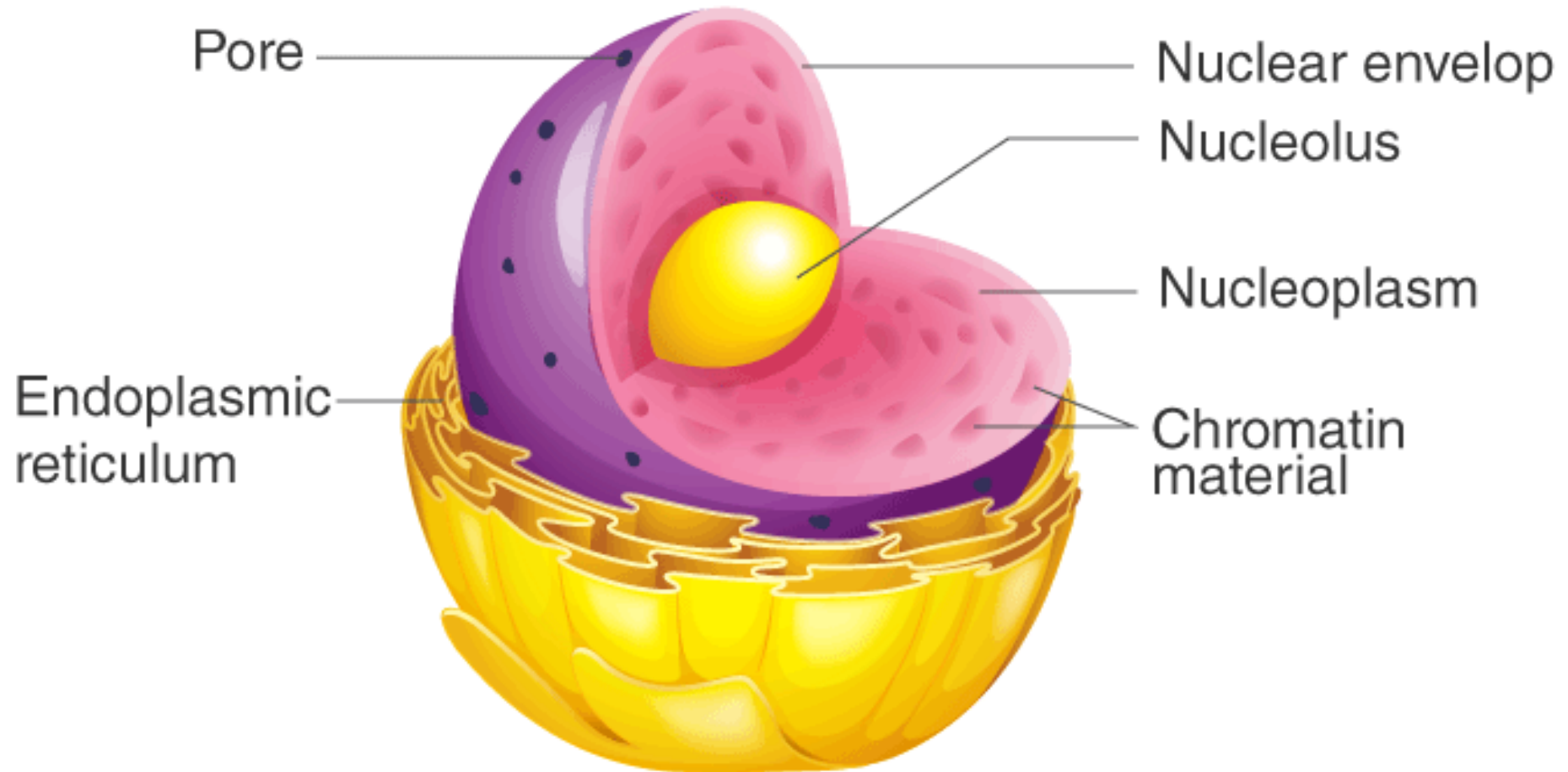
Nucleolus

❖ **Discovery:**

- ❖ Palade was the person who discovered Nucleolus.
- ❖ It is a darkly stained body within the nucleus, and is without any membranous boundary to separate it from the rest of the nuclear material.
- ❖ There may be one or more nucleoli in the nucleus. The ribosomal RNA (rRNA) is synthesized and stored in the nucleolus.
- ❖ It is composed of two regions,
 - ❖ **the peripheral granular area** composed of precursors of ribosomal subunits and **the central fibril area** consisting of large molecular weight RNA and rDNA. It is the nucleolus where ribosomes are assembled and are then exported to the cytoplasm via nuclear pores.

Nucleus

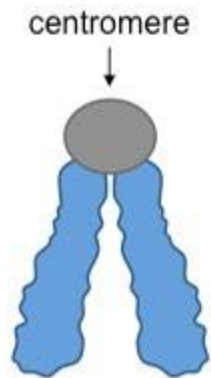
NUCLEUS



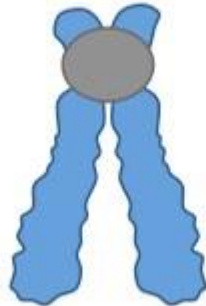
Chromosomes

- ❖ Chromosome are the thread like structures which appear during cell division.
- ❖ Nucleus is often deeply (darkly) stained with basic dyes because of the chromatin material. During cell division chromatin material is converted into darkly stained thread like structures known are chromosomes.
- ❖ Under a compound microscope, chromosomes appear to be made of arms and centromeres. Centromere is the place on the chromosome where spindle fibres are attached during cell division. Each chromosome consists of two identical chromatids at the beginning of cell division (chromatid is exact replica of the chromosome) which are held together at centromere.

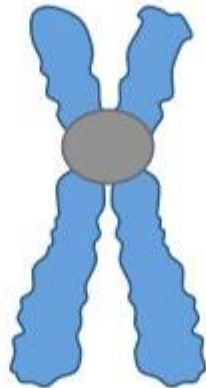
Chromosome Structure and Shapes



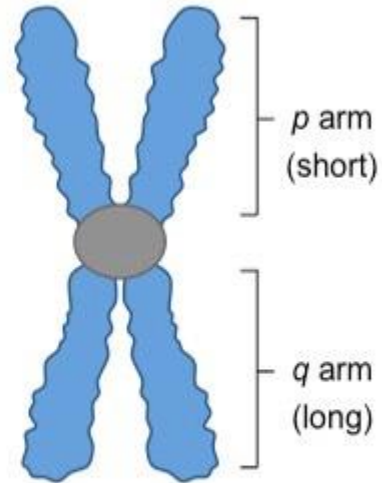
Telocentric
(not in humans)



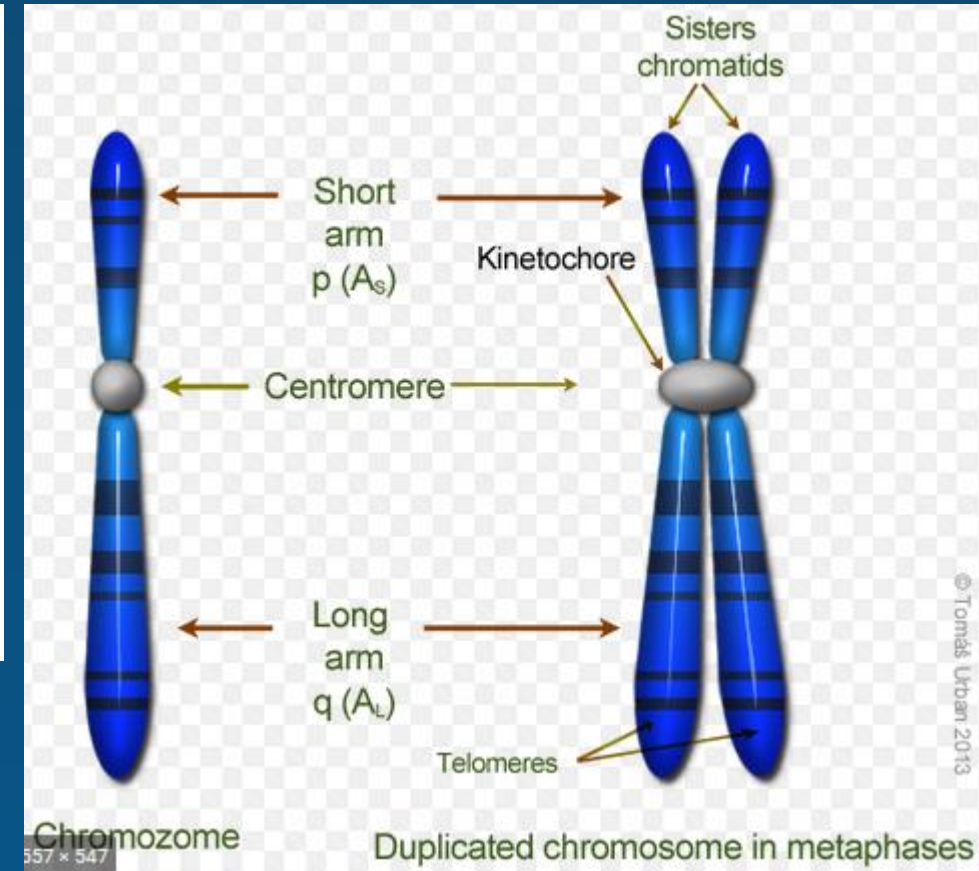
Acrocentric



Submetacentric



Metacentric



Chromosomes

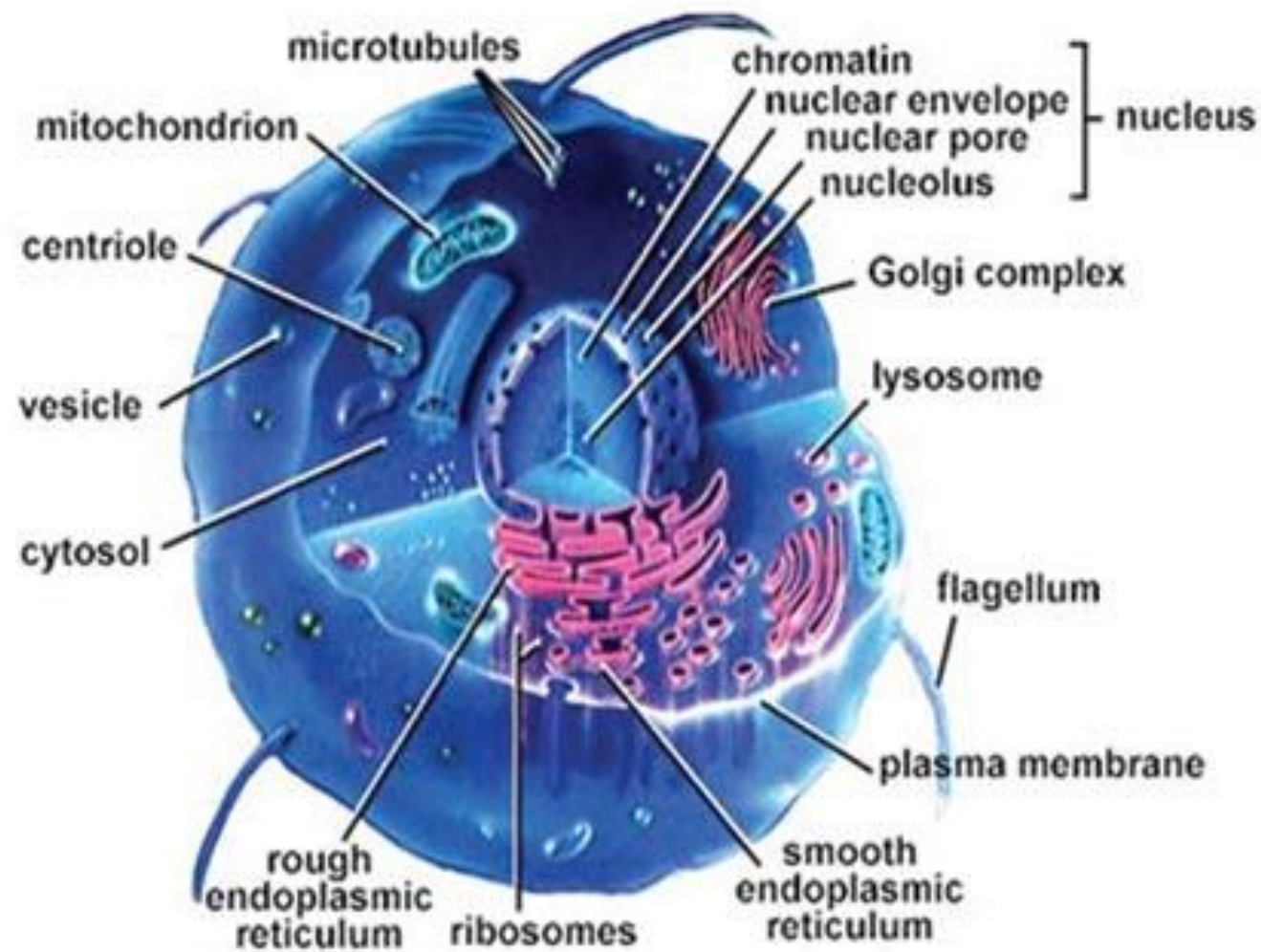
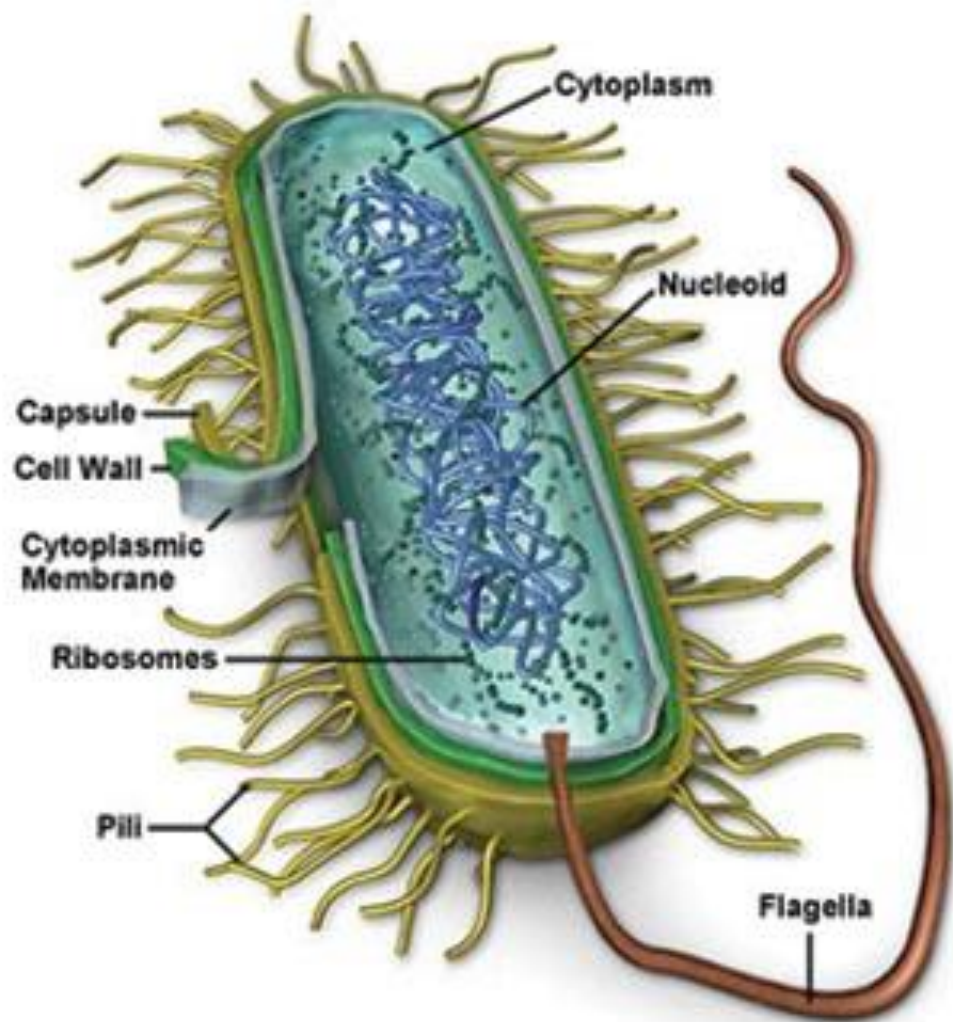
❖ Composition of Chromosomes:

- ❖ A chromosome is composed of DNA and proteins. All the information necessary to control the activities of the cell is located on the chromosomes in the form of genes, which are transferred from one generation to the other.
- ❖ The number of chromosomes in all individuals of the same species remains constant generation after generation. In man, each cell contains 46 chromosomes, frog cell has 26 and chimpanzee has 48 chromosomes. There are 8 chromosomes in the fruit fly, *Drosophila melanogaster*, 16 chromosomes in onion, 48 in potato, and 14 in garden pea.
- ❖ The number of chromosomes in normal body cells is diploid ($2n$), whereas haploid chromosome number (n) is present in germ cells, e.g. human sperms and eggs have 23, while those of *Drosophila* have 4 chromosomes.

	Prokaryotes	Eukaryotes
Type of Cell	Always unicellular	Unicellular and multi-cellular
Cell size	Ranges in size from 0.2 μm – 2.0 μm in diameter	Size ranges from 10 μm – 100 μm in diameter
Cell wall	Usually present; chemically complex in nature composed of peptidoglycan or murein.	When present, chemically simple in nature. In plants it is made up of cellulose.
Nucleus	Absent. Instead, they have a nucleoid region in the cell	Present
Nuclear Envelope	Absent	Present.
DNA	Circular and present without membrane	Linear and present in nucleus surrounded by nuclear membrane
Membrane bound organelles	Absent	Organelles like mitochondria, Golgi bodies, endoplasmic reticulum etc. are present.

	Prokaryotes	Eukaryotes
Ribosome	Small ribosomes (70 S)	Large ribosomes (80 S)
Cell division	Through binary fission	Through mitosis and meiosis..
Flagella	The flagella are smaller in size	The flagella are larger in size
Reproduction	Asexual	Both asexual and sexual
Example	Bacteria and Cyanobacteria	Plants, Animals, Fungi, Protists
Flagella	The flagella are smaller in size	The flagella are larger in size

❖ The most distinctive feature of the prokaryotic cell is its cell wall, composed of polysaccharide chains bound covalently to shorter chains of amino acids forming peptidoglycan or murein. The entire cell wall is often regarded as a single huge molecule or molecular complex called **sacculus**.

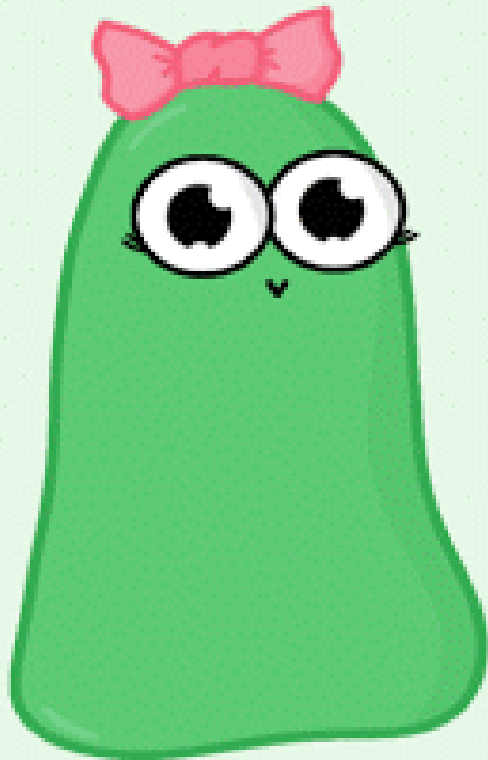


Prokaryotes

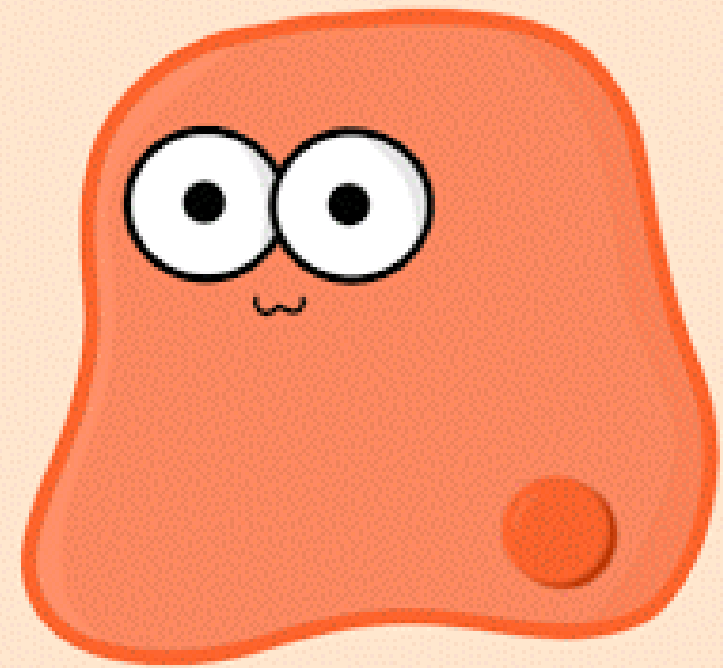
VS

Eukaryotes

Prokaryote vs. Eukaryote



Prokaryote



Eukaryote

THE END