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The National
Orthodox School
Shmaisani

# PROKARYOTES VERSUS EUKARYOTES

*Objectives :*

*- Describe the function of the main structures of prokaryotic cells*

*- Learn how to draw a diagram showing the structure of prokaryotic cells*

*- Describe the function and the main structures of the eukaryotic cells*

*- Learn how to draw a diagram showing the structure of eukaryotic cells*

*- Compare and contrast the structure of prokaryotic and eukaryotic cells*

Resources :

Student book pages 2, 3,4,5

https://www.youtube.com/watch?v=RQ-SMCmWB1s video 1

https://www.youtube.com/watch?v=192M4oDLTdc video 2

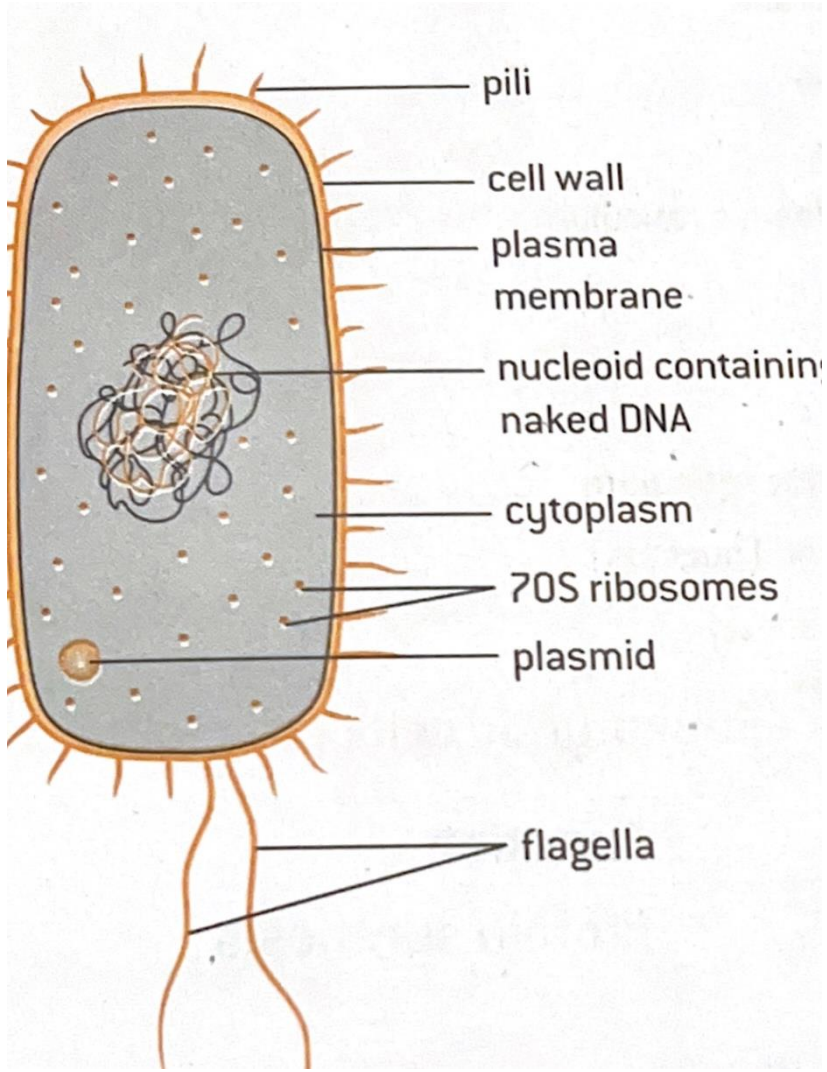
Living organisms can be divided into two main groups based on the presence or absence of a nucleus and membrane-bound organelles: prokaryotes and eukaryotes .

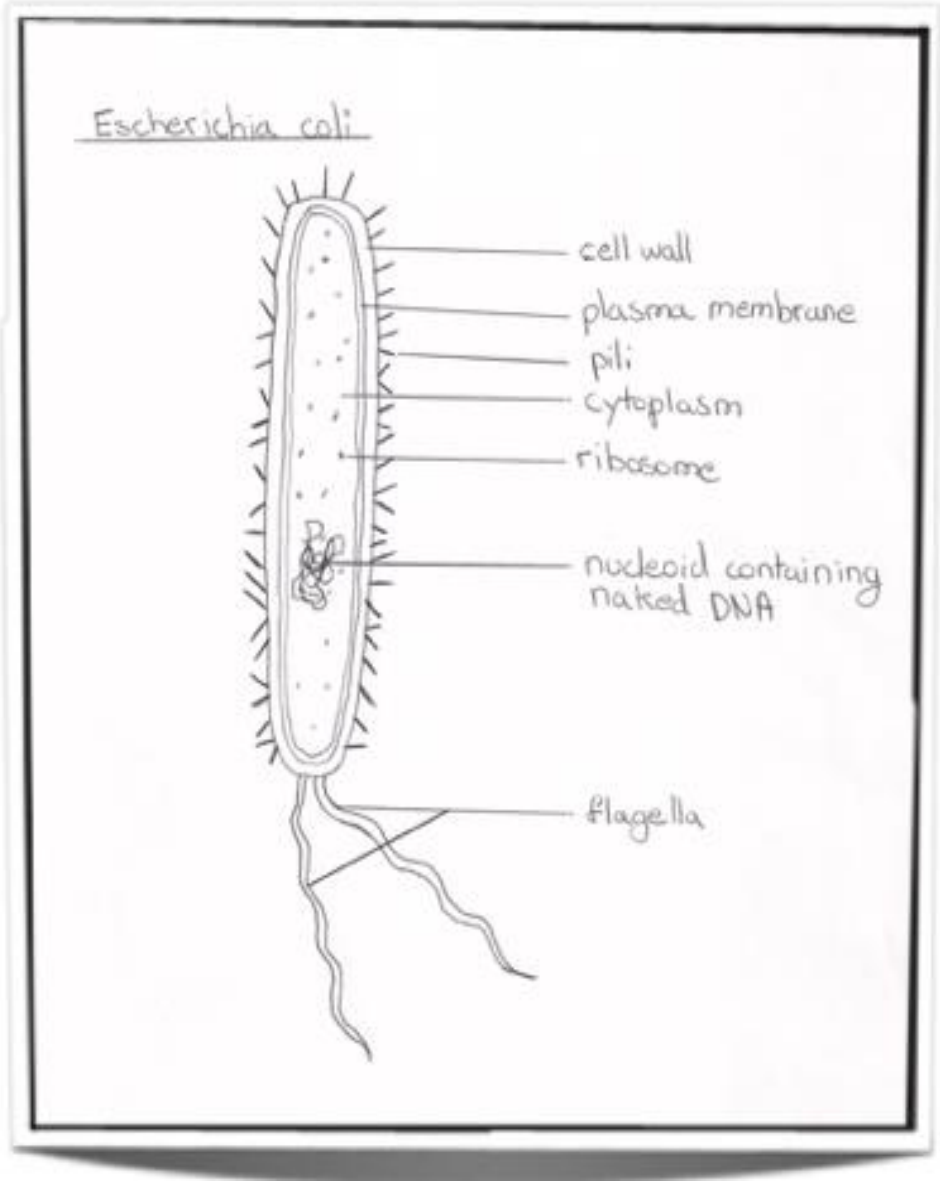
Prokaryotic cells have a simple structure as they lack a nucleus and membrane-bound organelles. The genetic material (DNA) is not enclosed inside a nucleus but rather found in a region called the nucleoid. Prokaryotes include bacteria and archaea (ancient bacteria)

Escherichia coli (E. coli) is an example of a bacterium.

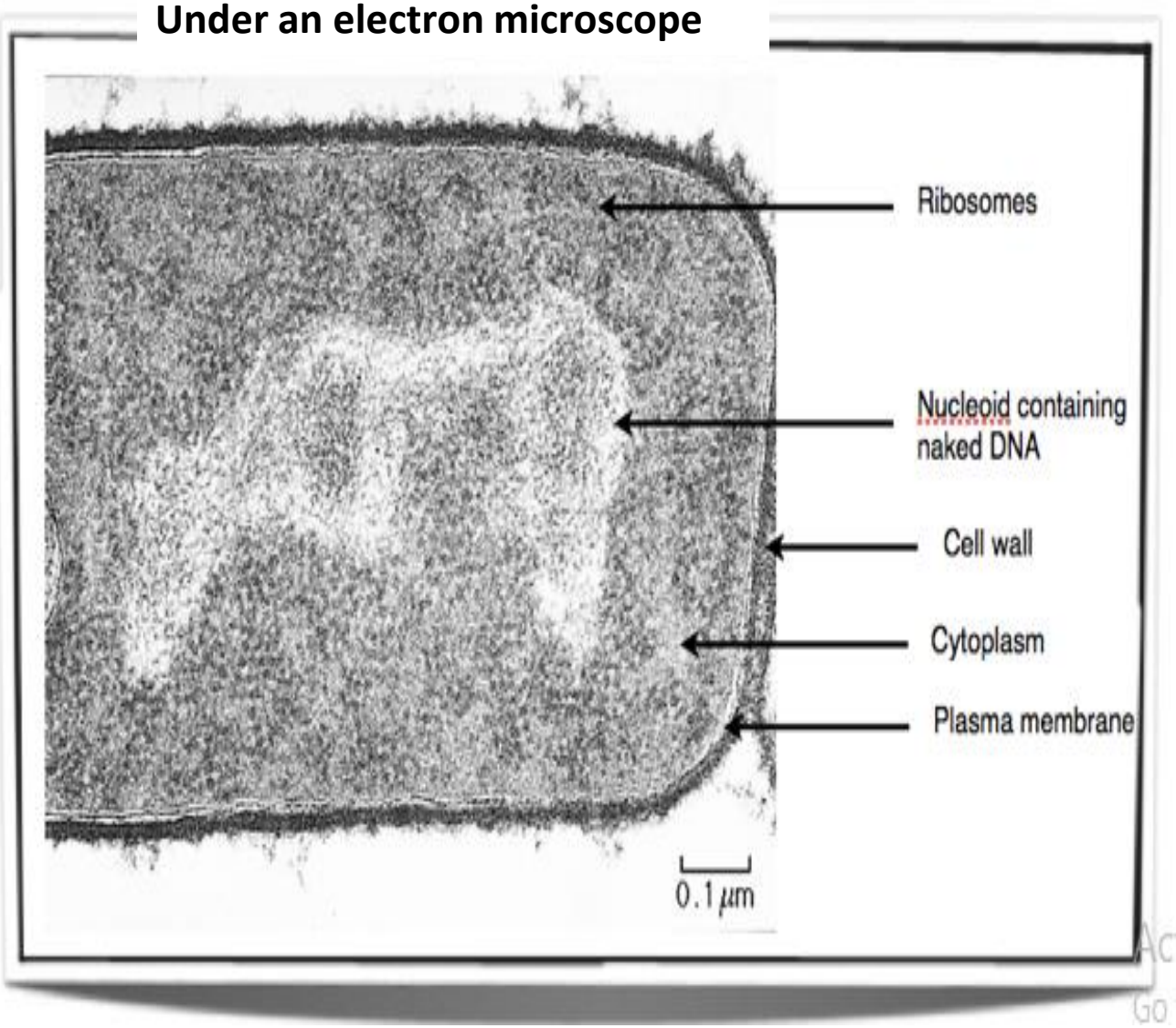
*How to draw*

https://www.youtube.com/watch?v=L5ZOQy29Vec

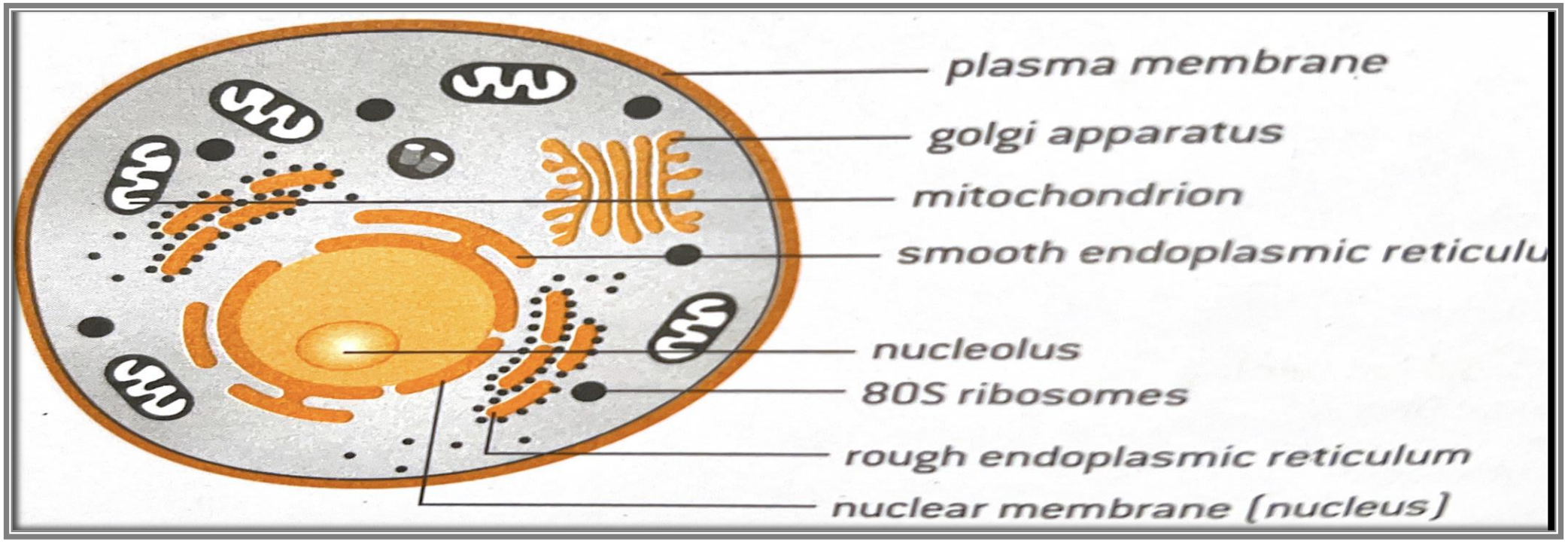


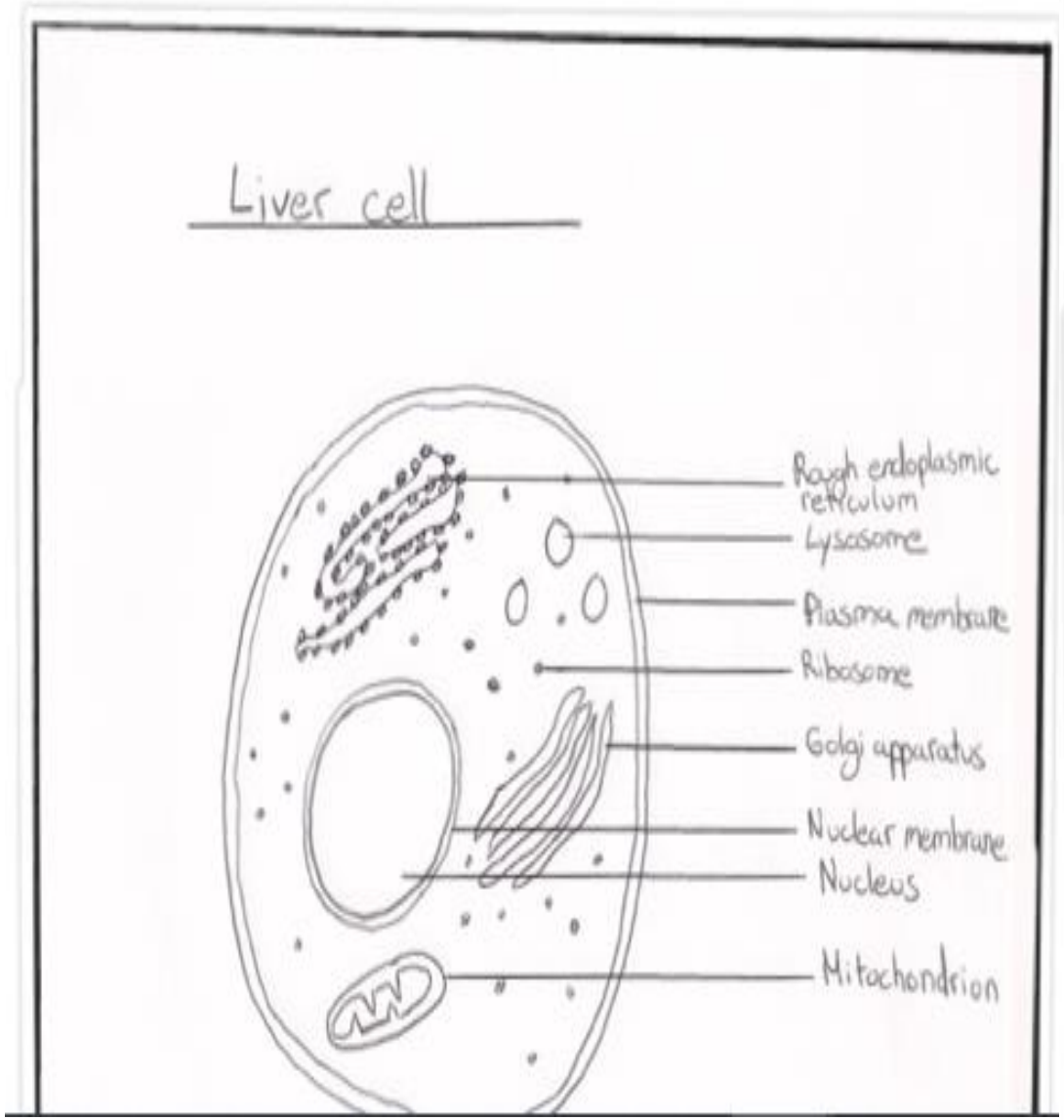



**Under an electron microscope**



Eukaryotic cells are more complex than prokaryotic cells as they contain a **nucleus and membrane-bound organelles**. The genetic material (DNA) is enclosed in a nucleus. Eukaryotes include plants, animals, fungi and protists. Eukaryotes may be unicellular or multicellular. An amoeba is an example of a unicellular eukaryote. Animals and plants are examples of multicellular eukaryotes.



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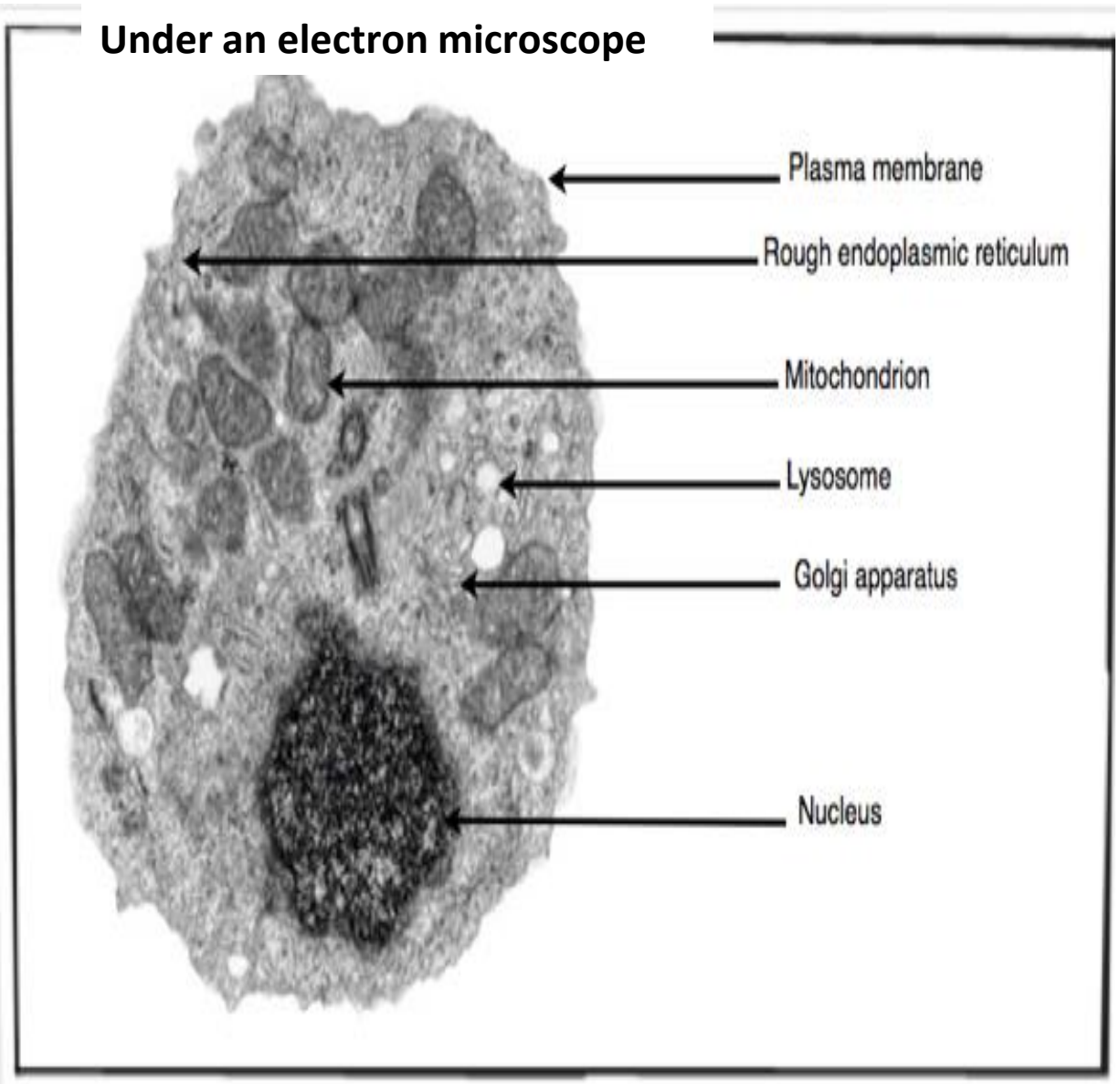


**Table 2.** The function of the main structures of prokaryotic cells

| Structure | Description | Function |
|---|---|---|
| **Cell wall** | Made of peptidoglycan (a polysaccharide) | Maintains the shape of the cell and prevents the cell from bursting |
| **Plasma membrane** | A selectively permeable membrane | Controls the substances moving into and out of the cell |
| **Cytoplasm** | A gel-like substance enclosed within the cell | Contains enzymes to catalyse chemical reactions taking place inside the cell |
| **Pili** | Hair-like structures found on the surface | Help bacteria to adhere to each other for the transfer of DNA from one cell to another by a process called conjugation |
| **Flagella (singular flagellum)** | A whip-like structure | Helps bacteria move around |
| **Ribosomes** | 70S type | Protein synthesis |
| **Nucleoid** | A region containing the naked DNA | Contains the DNA which holds the genetic information that controls the cell |
| **Plasmid** | A small ring of DNA | Helps bacteria adapt to unusual situations such as antibiotic resistance |

*Eukaryotic cells* are more complex than prokaryotic cells as they contain a nucleus and membrane-bound organelles. The genetic material (DNA) is enclosed in a nucleus. Eukaryotes include plants, animals, fungi and protists.

Eukaryotes
https://www.youtube.com/watch?v=rABKB5aS2Zg

Table 3. The function of the main structures of eukaryotic cells [animal cells]

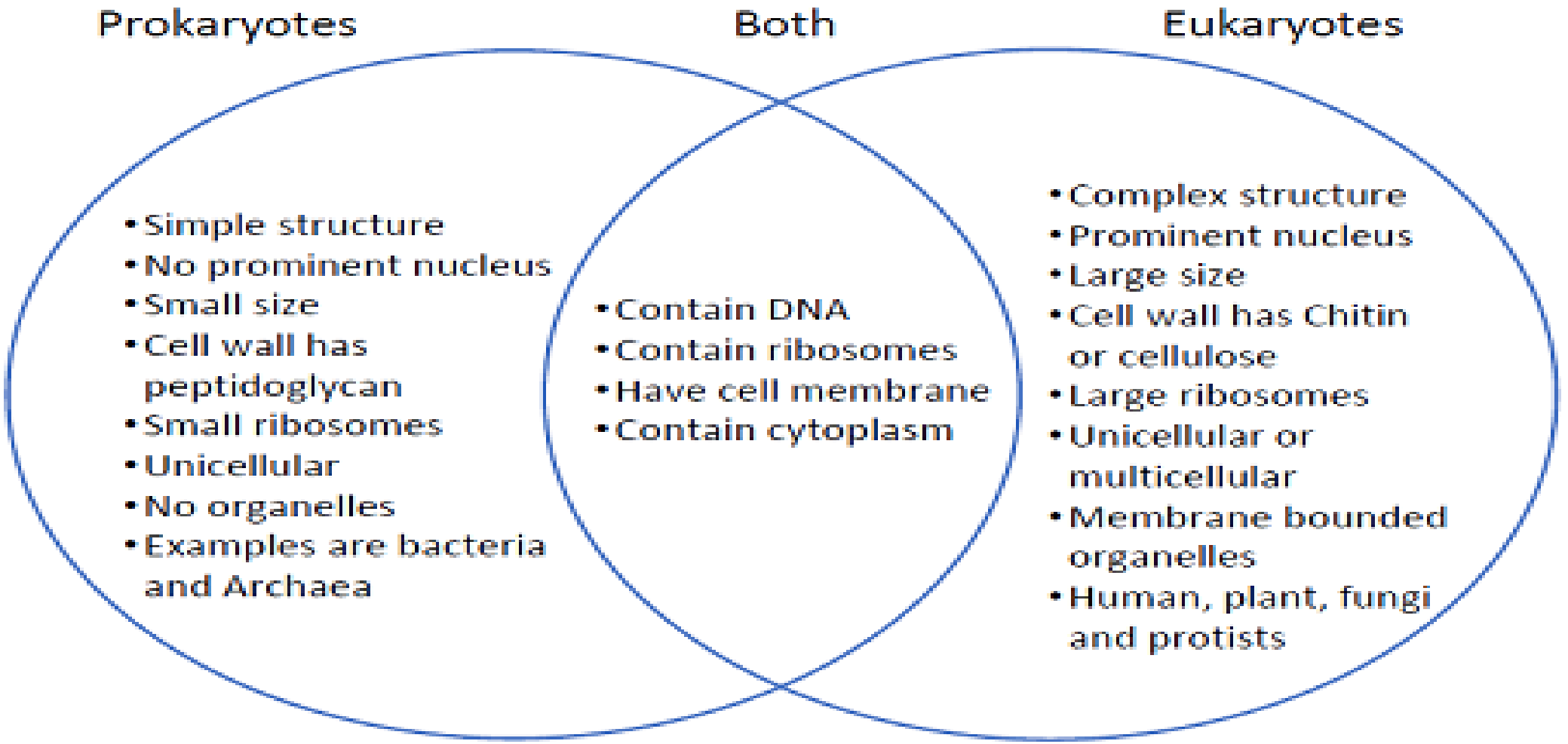
| Structure | Description | Function |
|---|---|---|
| **Ribosomes** | Found either as 70S or 80S. Could be found free in the cytoplasm or attached to the rough endoplasmic reticulum | Protein synthesis |
| **Smooth endoplasmic reticulum** | No ribosomes on the surface | Lipid synthesis and transport |
| **Rough endoplasmic reticulum** | A network of tubules that extend from the nucleus to the rest of the cell | Protein synthesis and transport |
| **Lysosome** | Contains many enzymes | Digests waste structures within the cell such as dead organelles and foreign particles |
| **Golgi apparatus** | Consists of many flattened sacs stacked on top of each other. Has two sides, the cis side, which receives products from endoplasmic reticulum. The trans side, which is the side through which vesicles are released | Processing of proteins received from the rough endoplasmic reticulum. This includes packaging and modifying proteins to be used either inside the cell or excreted outside the cell |
| **Mitochondrion** | Contains its own ribosomes and DNA. It is made of two membranes: an outer membrane and an inner membrane that is folded inward to increase surface area | Production of ATP in aerobic respiration |
| **Nucleus** | It is surrounded by a porous double membrane | Contains the genetic material [DNA] which hold the genetic information that controls the cell |
| **Nucleolus** | Found inside the nucleus | Ribosomes synthesis |

**Centriole** → **Assemble microtubules for the spindle in mitosis**

Table 5. Differences between prokaryotic cells and eukaryotic cells

| Feature | Prokaryotic cells | Eukaryotic cells |
|---|---|---|
| **Nucleus** | No nucleus | Have nucleus |
| **DNA** | Found in the cytoplasm in a region named the nucleoid.<br>Circular DNA<br>Single strand | DNA found in the nucleus enclosed in a nuclear envelope.<br>Linear DNA<br>Double helix |
| **Mitochondria** | No mitochondria | Have mitochondria |
| **Ribosomes** | 70S (smaller) | 80S (larger) |
| **Membrane-bound organelles** | No membrane-bound organelles | Membrane-bound organelles such as Golgi apparatus and the endoplasmic reticulum |
| **Plasmid** | May have plasmid | No plasmid |
| **Size** | Small < 10 µm | Large > 10 µm |
| **Complexity** | Simple | Complex |

# Venn Diagram of Prokaryotes and Eukaryotes



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# Thank you