

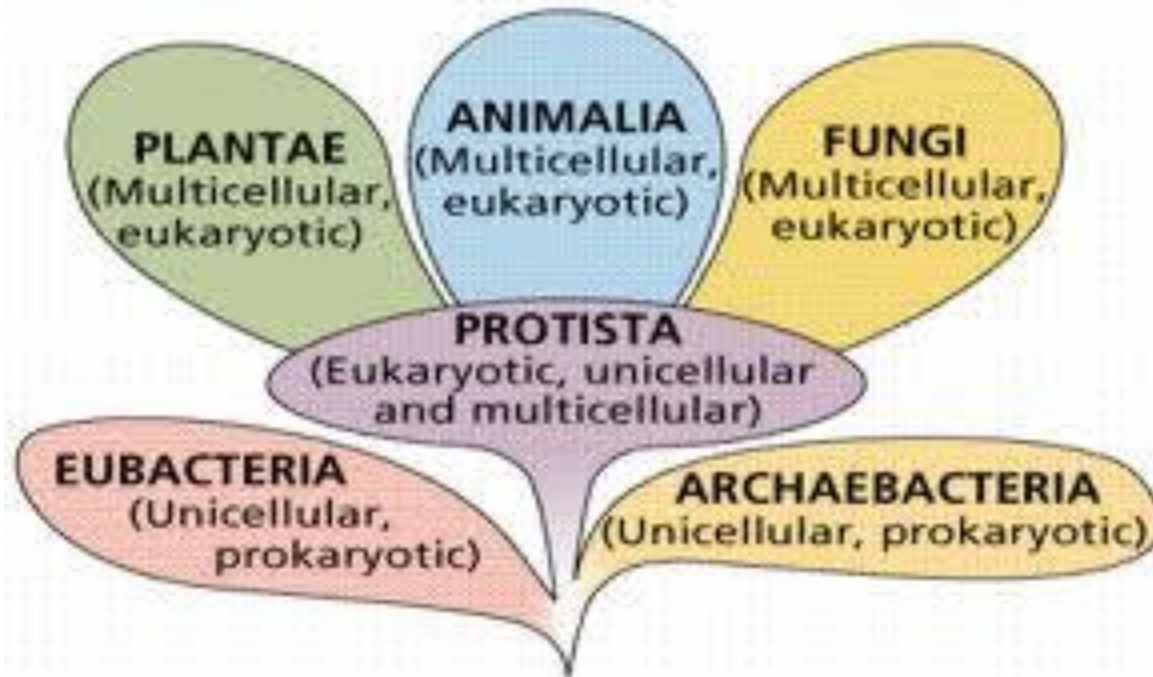
A.P. Biology

Sept. 20, 2017

Mr. Tesoro

- Homework Reminder: Next week we will begin our discussion of the structure and function of the plasma membrane.
- Do Now: All life on Earth depends on the contributions of bacteria. List some examples of bacteria that are beneficial to other living organisms.

Aim: What are the similarities and differences between prokaryotic and eukaryotic cells?

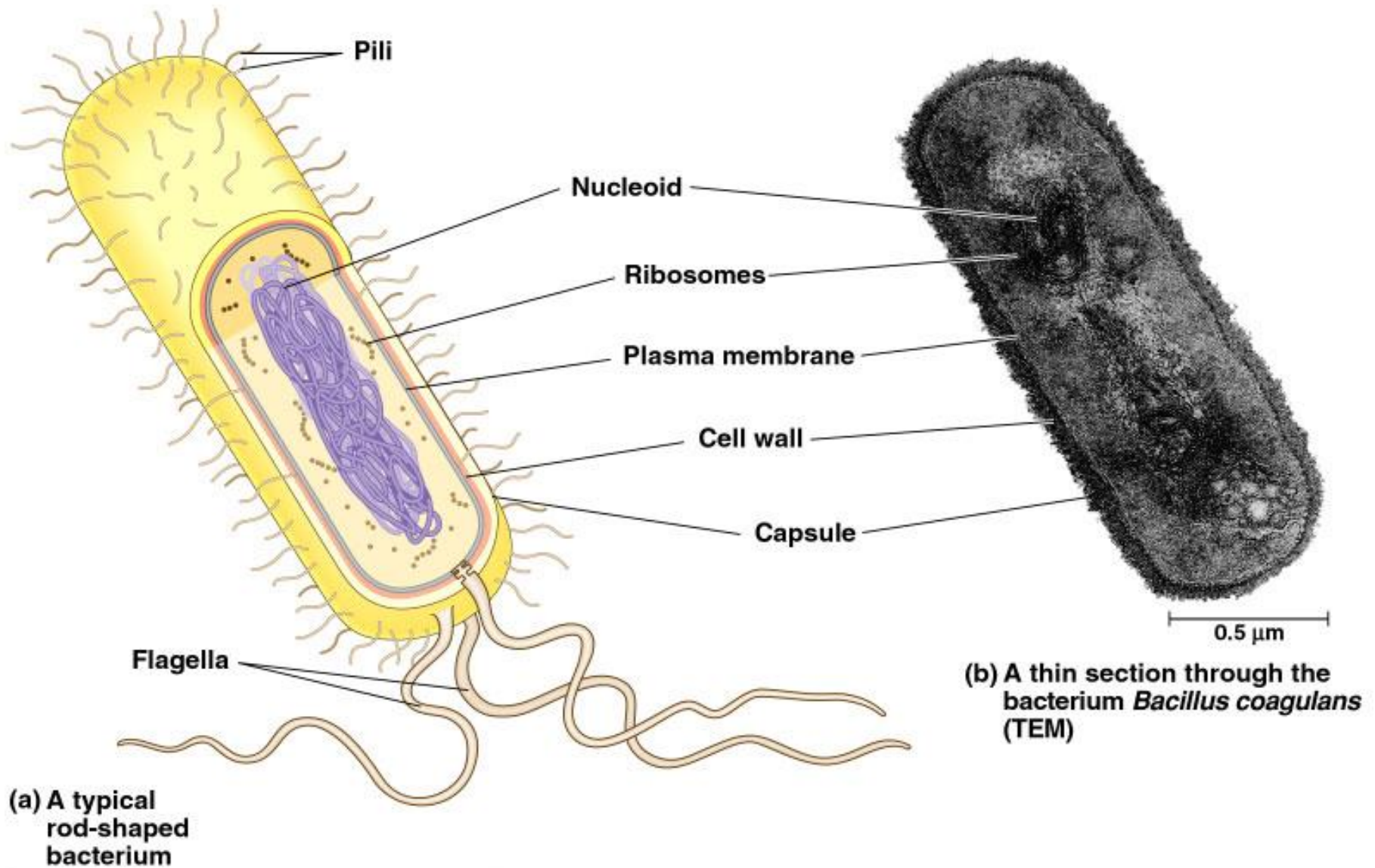


# 1. What are some structures that all cells share?

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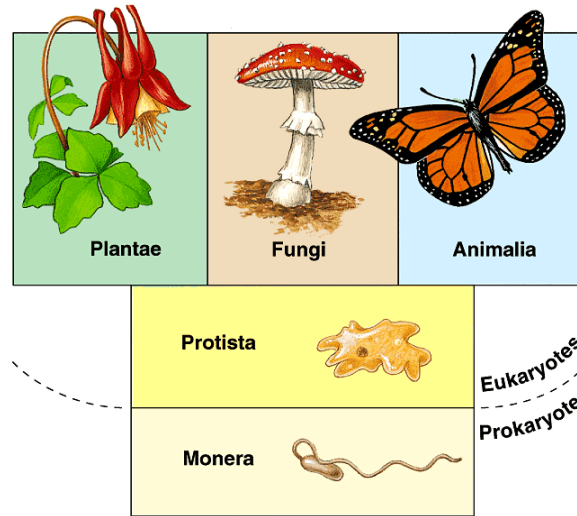
- All cells are surrounded by a *plasma membrane*.
- The semifluid substance within the membrane is the **cytosol**, containing the organelles.
- All cells contain chromosomes which have genes in the form of DNA.
- All cells also have *ribosomes*, tiny organelles that make proteins using the instructions contained in genes.

- In an eukaryotic cell, chromosomes are contained in a membrane-enclosed organelle, the *nucleus*.
- In a prokaryotic cell, the DNA is concentrated in the **nucleoid** without a membrane separating it from the rest of the cell.



**Fig. 7.4 The prokaryotic cell is much simpler in structure, lacking a nucleus and the other membrane-enclosed organelles of the eukaryotic cell.**

# The Major Lineages of Life



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(a) The five-kingdom system



(b) The three-domain system



(c) How many kingdoms?

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# What are prokaryote characteristics?

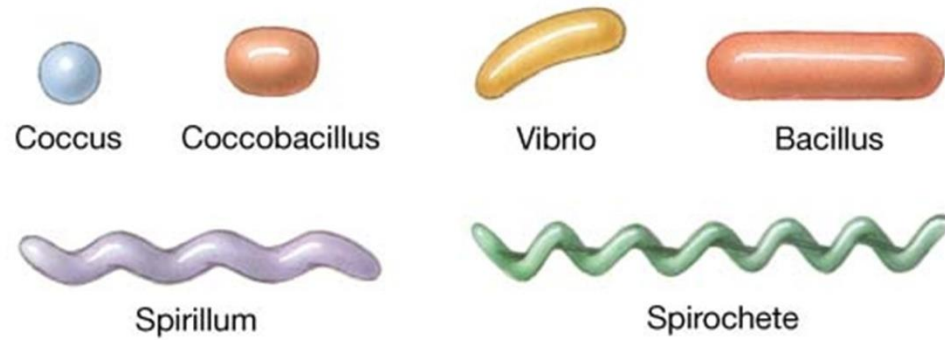
- Prokaryotes:
  - Lack nuclei
  - Lack many cell organelles
  - May contain plasmids (small circular pieces of DNA)
  - Cell walls lack cellulose and may contain peptidoglycans (polysaccharide)
  - Flagella contain flagellin and not tubulin

# Domain: Bacteria

- Eubacteria are ‘true bacteria’. Some are”
- Chemosynthetic – use hydrogen sulfide and have a purple or green color.
- Photosynthetic – cyanobacteria – use chlorophyll *a* and produce oxygen
- Gram + heterotrophs – have thick peptidoglycan cell walls.
- Gram - heterotrophs – have thin peptidoglycan cell walls covered with liposaccharides



# Domain: Bacteria



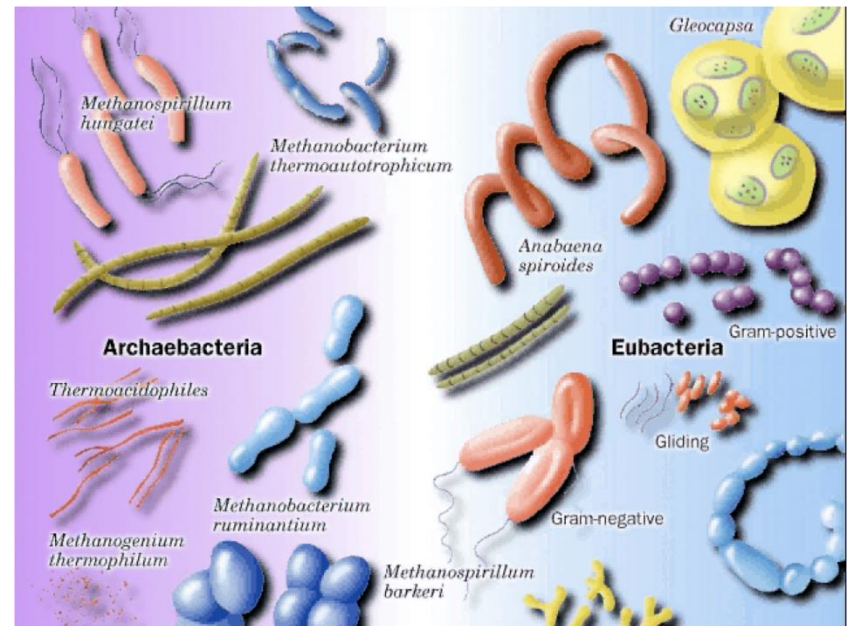
- Eubacteria come in three basic shapes:
  - a) bacilli – rod shaped (E. coli)
  - b) cocci - spherical (streptococcus)
  - c) spirilla – spiral (spirochetes)

ppdictionary.com

Some eubacteria are nitrogen fixing bacteria that convert nitrogen gas into nitrates (plant fertilizer). Others are nitrifying bacteria, changing nitrites to nitrates.

# Domain: Archaeobacteria

- Lack peptidoglycan in the cell wall
- Contain unusual branched lipids
- If photosynthetic, lack chlorophyll and contain bacteriorhodopsin.
- tRNA and rRNA are similar to eukaryotes
- May contain introns



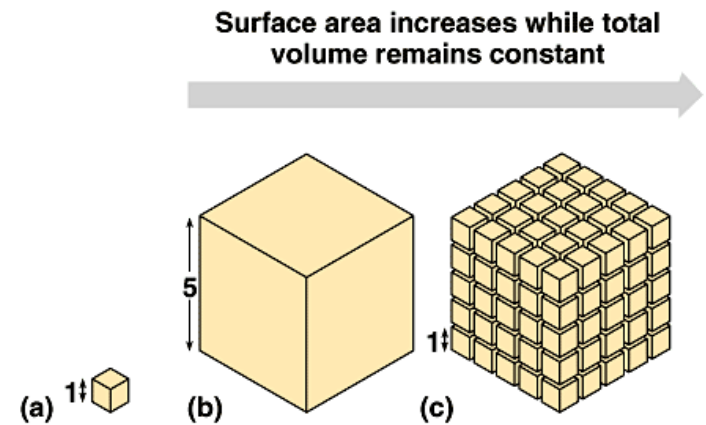
# Domain: Archaeobacteria

- Archaeobacteria live in extreme environments
- Methanogens - (bogs, swamps) produce methane gas
- Halophiles – live in high salt environments (Dead Sea, salted foods)
- Thermoacidophiles – hot springs, volcanic vents – chemoautotrophs using hydrogen sulfide for an energy source.

# Domain Eukarya

- In eukaryote cells, the chromosomes are contained within a membranous nuclear envelope.
- Within the cytoplasm of a eukaryotic cell is a variety of membrane-bounded organelles of specialized form and function.
  - These membrane-bounded organelles are absent in prokaryotes.

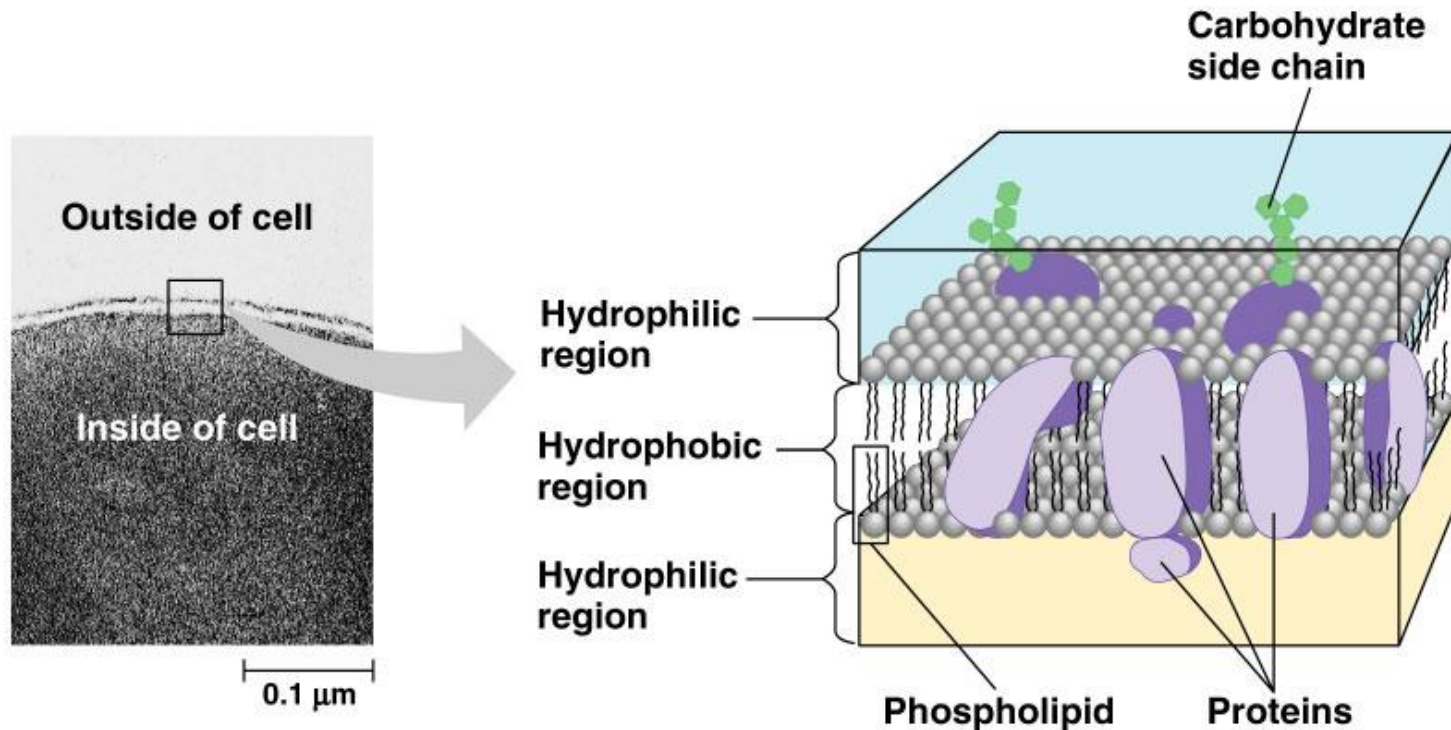
- Metabolic requirements set an upper limit to the size of a single cell.
- As a cell increases in size its volume increases faster than its surface area.
  - Smaller objects have a greater ratio of surface area to volume.



<b>Total surface area (height × width × number of sides × number of boxes)</b>	<b>6</b>	<b>150</b>	<b>750</b>
<b>Total volume (height × width × length × number of boxes)</b>	<b>1</b>	<b>125</b>	<b>125</b>
<b>Surface-to-volume ratio (area ÷ volume)</b>	<b>6</b>	<b>1.2</b>	<b>6</b>

**Fig. 7.5**

- The **plasma membrane** functions as a selective barrier that allows passage of oxygen, nutrients, and wastes for the whole volume of the cell.



(a) TEM of a red blood cell

(b) Structure of the plasma membrane

Fig. 7.6

- The volume of cytoplasm determines the need for this exchange.
- Rates of chemical exchange may be inadequate to maintain a cell with a very large cytoplasm.
- The need for a surface sufficiently large to accommodate the volume explains the microscopic size of most cells.
- Larger organisms do not generally have *larger* cells than smaller organisms - simply *more* cells.

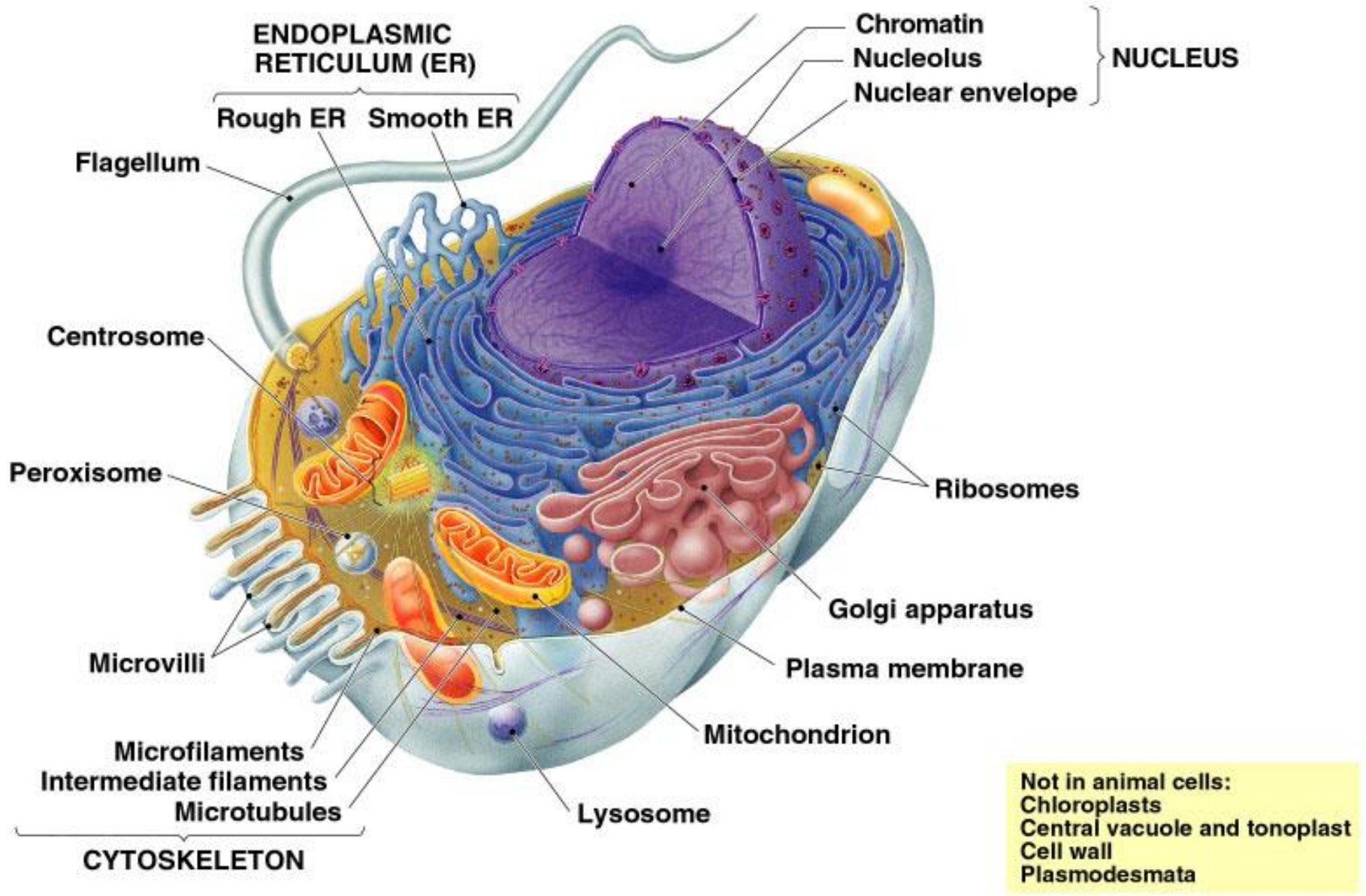
## 2. Internal membranes compartmentalize the functions of a eukaryotic cell

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- A eukaryotic cell has extensive and elaborate internal membranes, which partition the cell into compartments.
- These membranes also participate in metabolism as many enzymes are built into membranes.
- The barriers created by membranes provide different local environments that facilitate specific metabolic functions.



- The general structure of a biological membrane is a double layer of phospholipids with other lipids and diverse proteins.
- Each type of membrane has a unique combination of lipids and proteins for its specific functions.
  - For example, those in the membranes of mitochondria function in cellular respiration.



**Fig. 7.7**

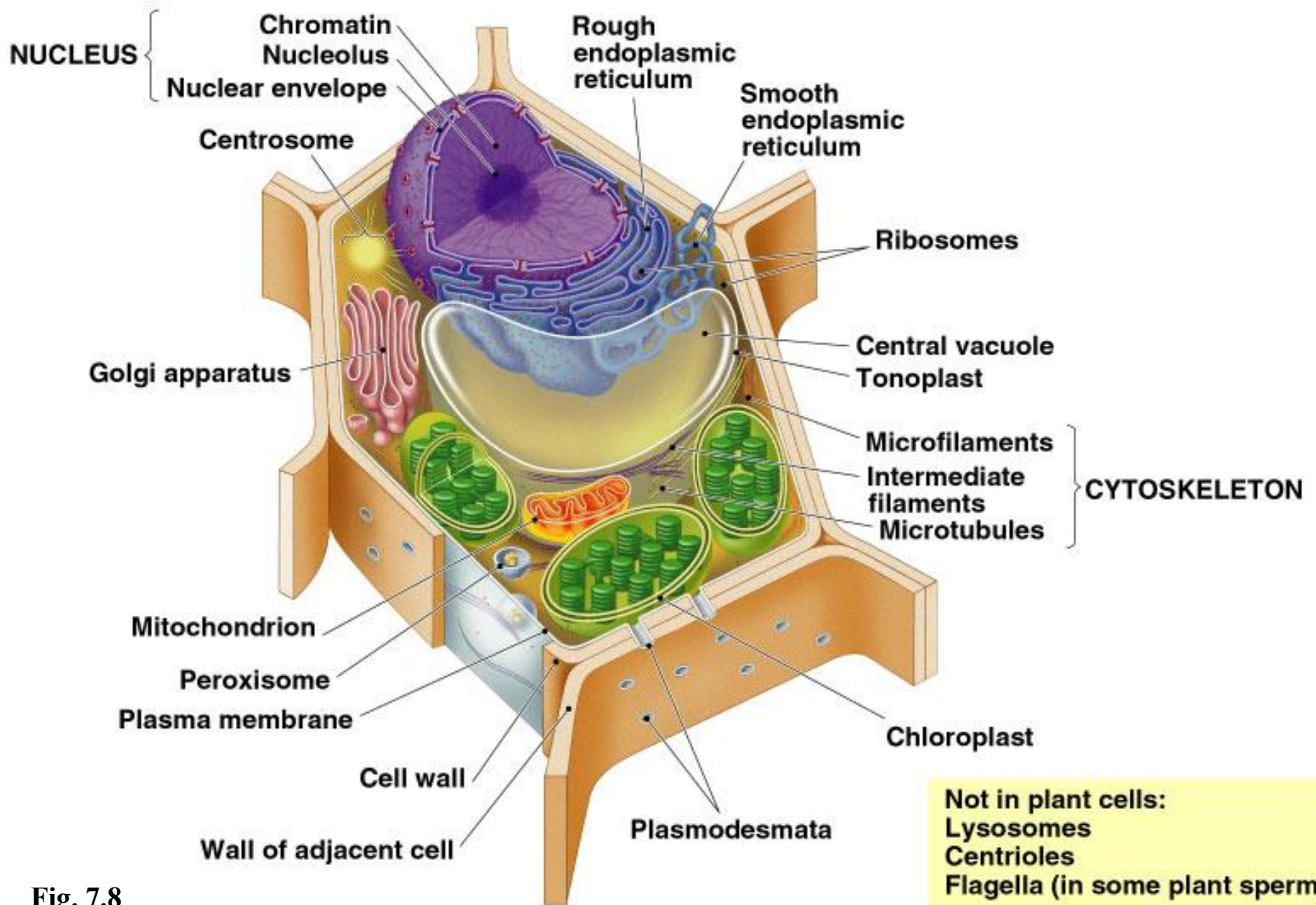


Fig. 7.8