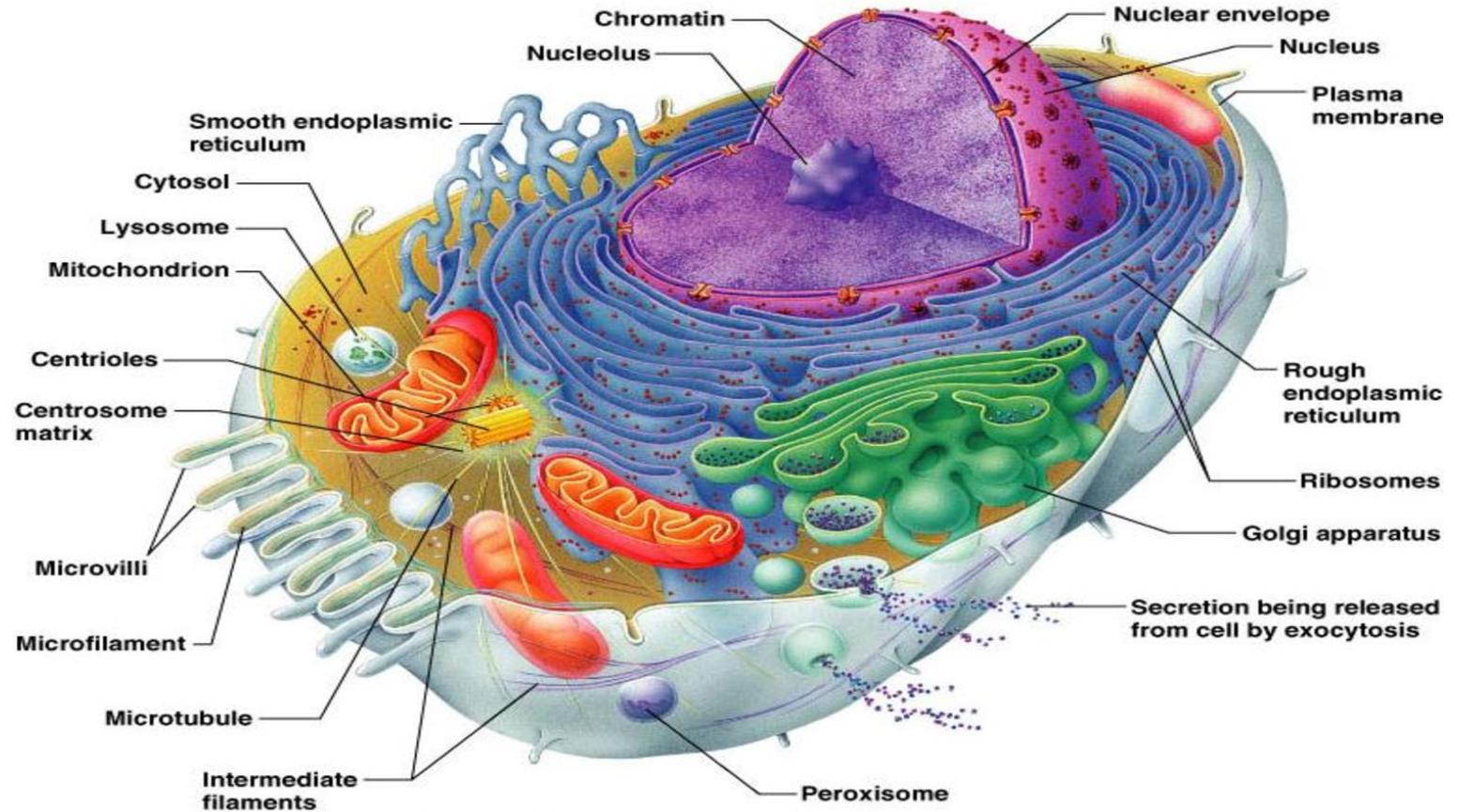
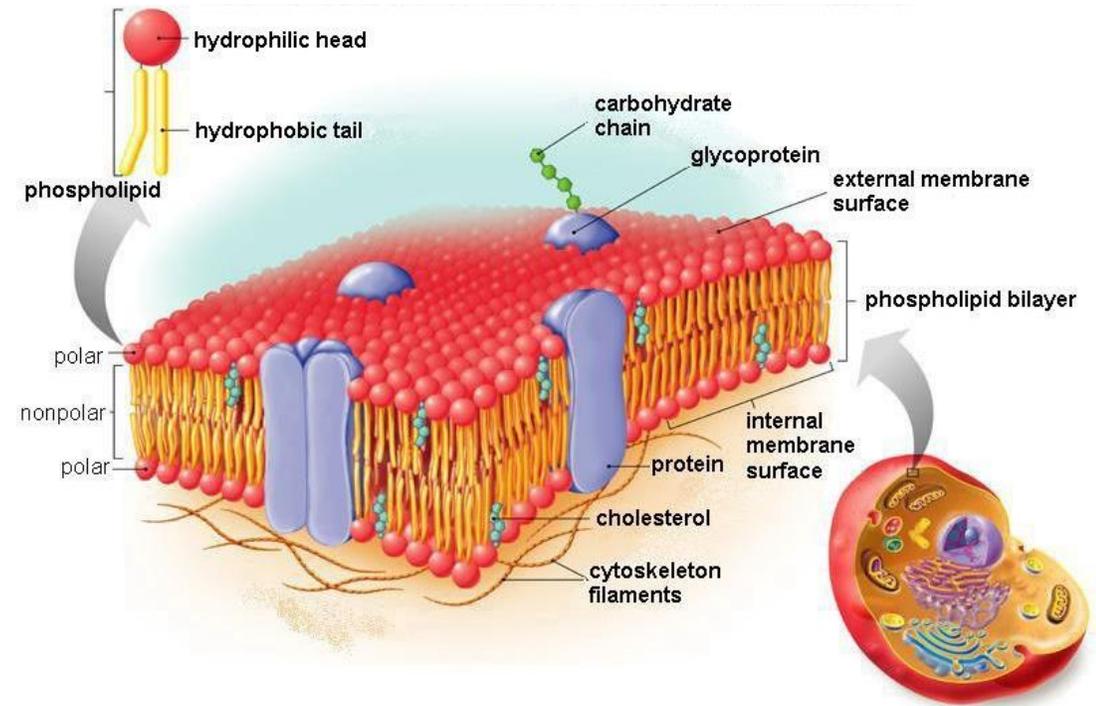


Lesson 7 Cellular organization



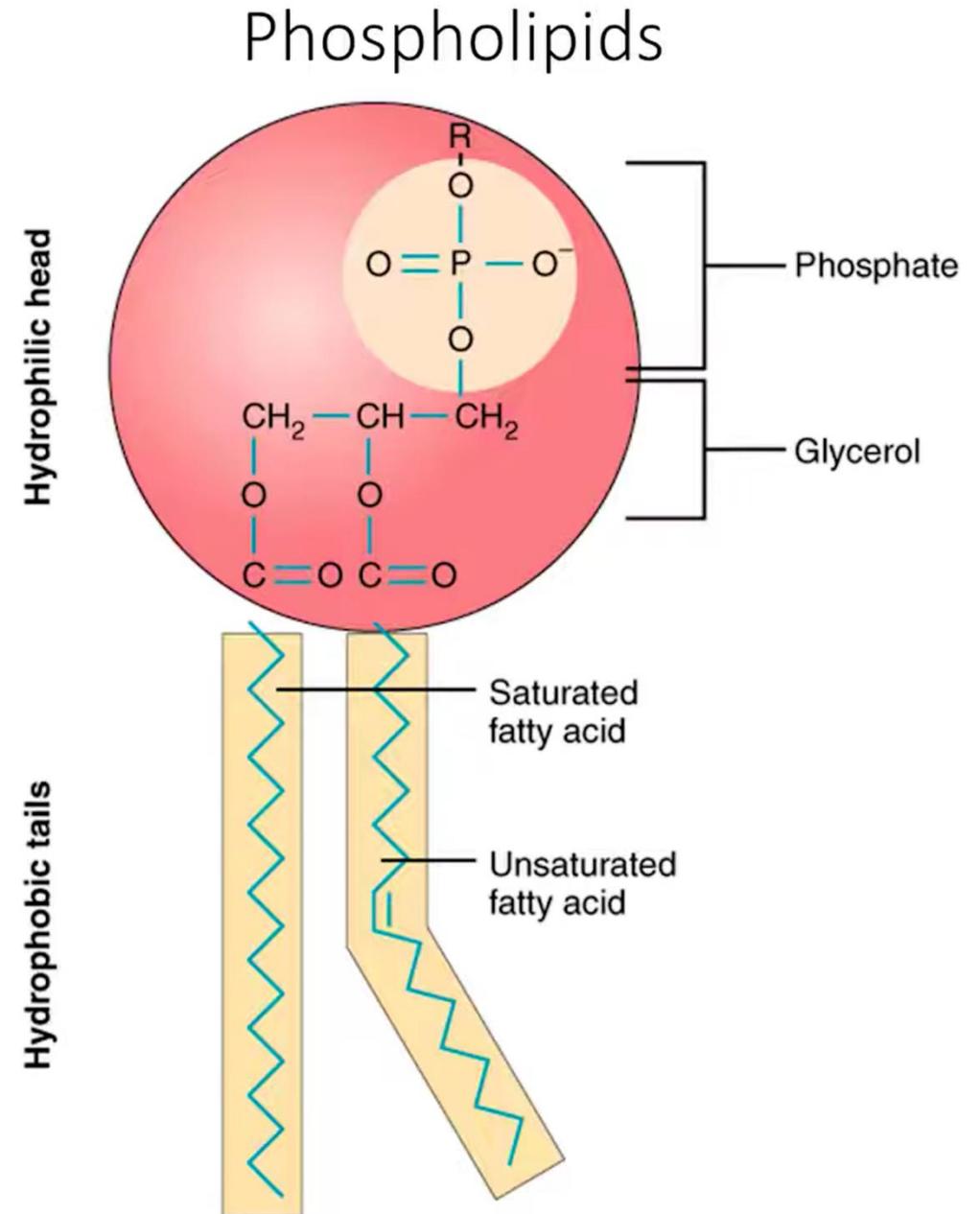
Cell membrane

- Cells are building blocks of life
- Cells are surrounded (protected) by a **plasma (or cell) membrane = highly hydrophobic amphipathic lipid bilayer**



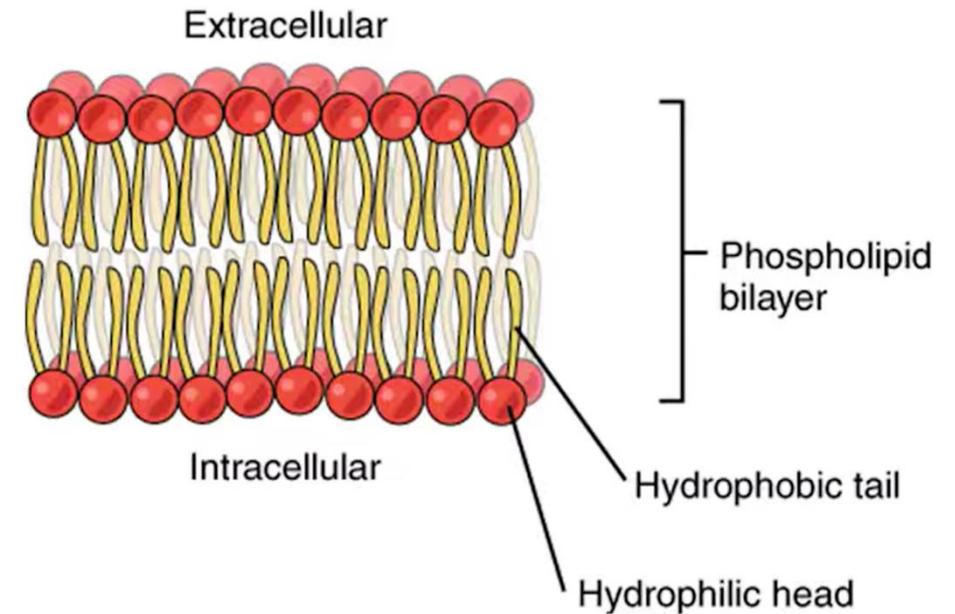
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- The main components of the cell membrane are **phospholipids**



Cell membrane

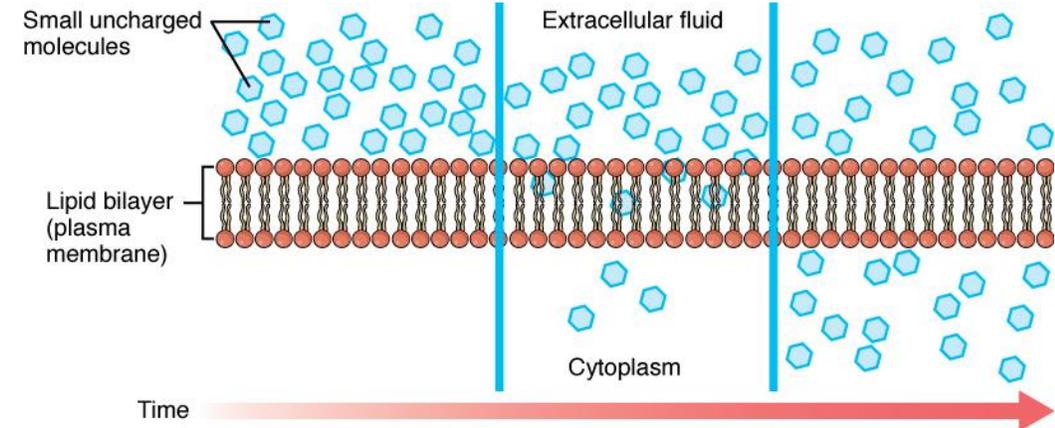
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- The main components of the cell membrane are **phospholipids**
- **Phospholipids spontaneously self-assemble into a phospholipid bilayer (or membrane)**



Phospholipid membrane (lipid bilayer)

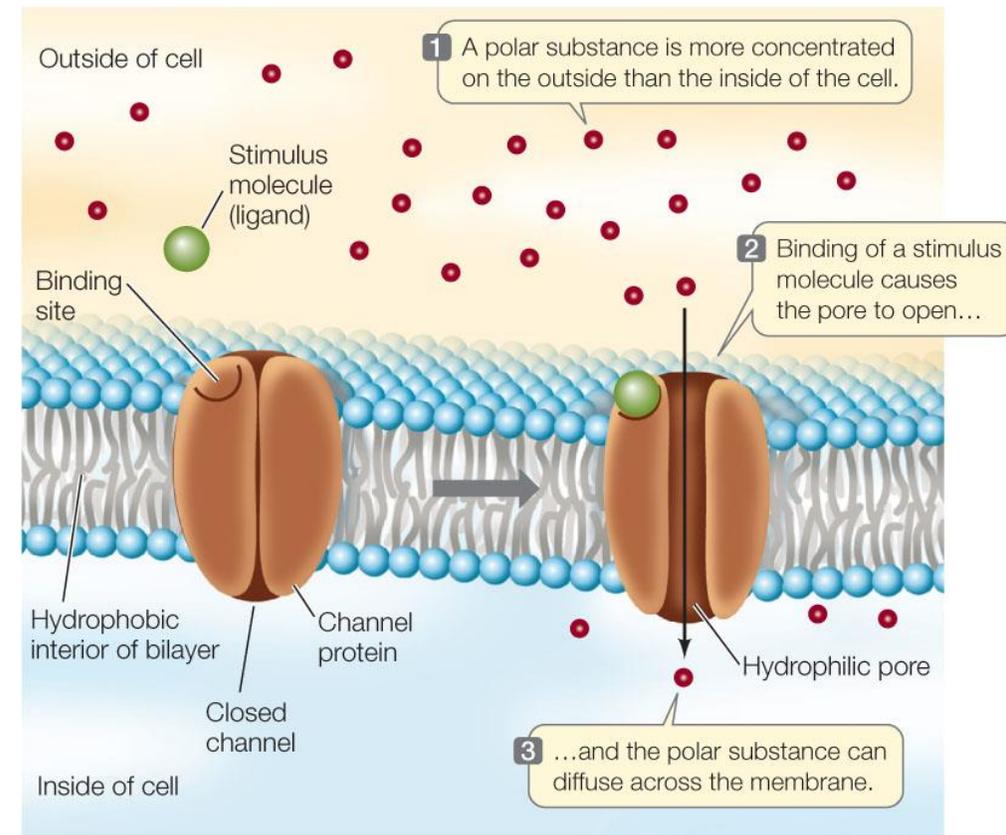
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- **Hydrophobic molecules can diffuse in & out the plasma membrane**



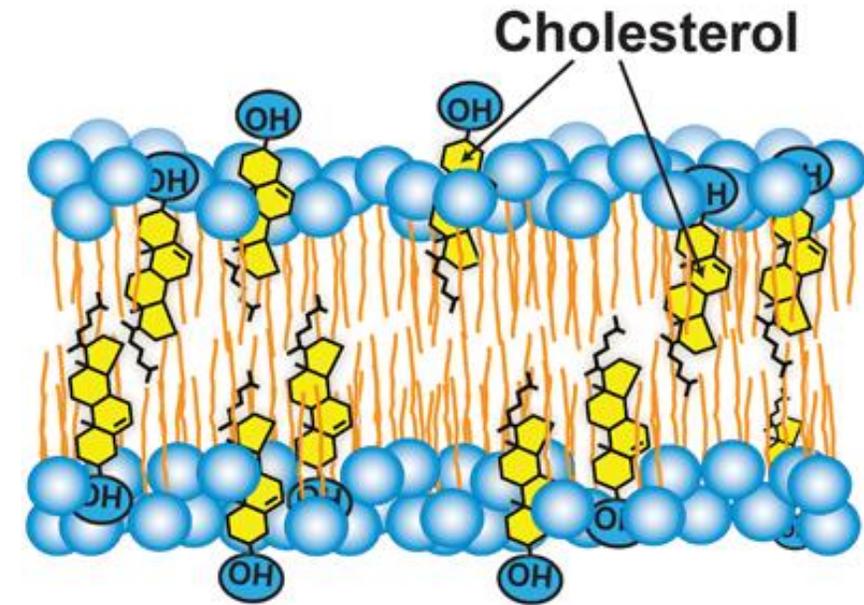
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- The main components of the cell membrane are **phospholipids**
- Phospholipids spontaneously self-assemble into a phospholipid bilayer (or membrane)
- Hydrophobic molecules can diffuse in & out the plasma membrane
- Particular structures like **channels or pores** allows polar molecules in & out the plasma membrane



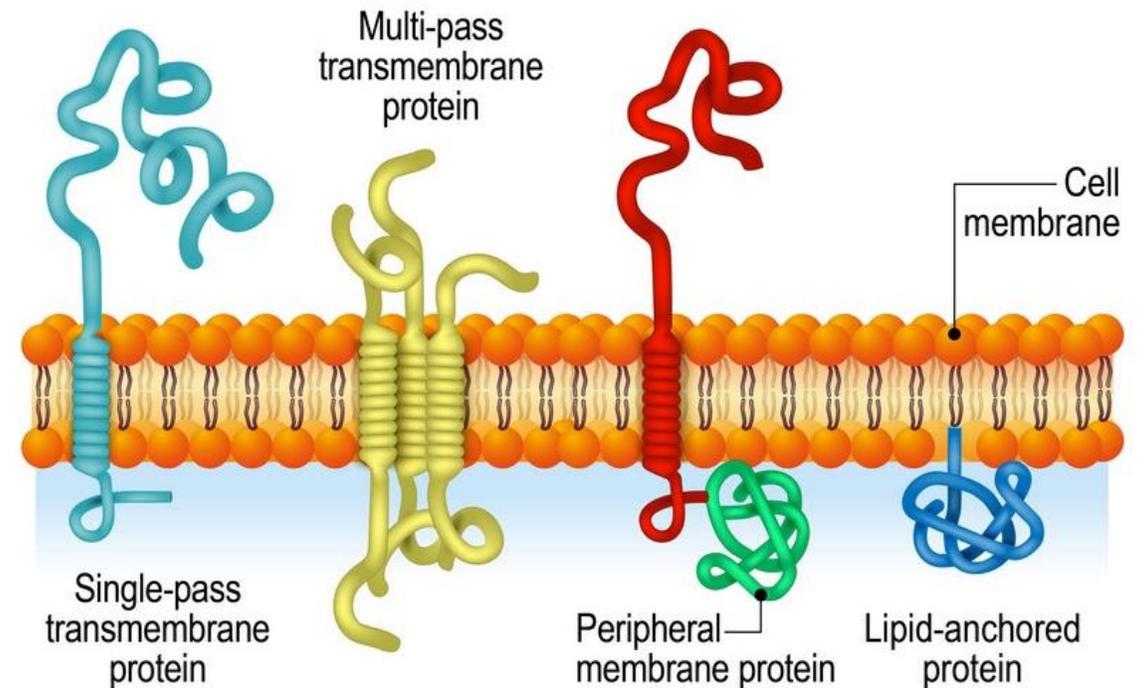
Cell membrane

- **Cholesterol** – a steroid (lipid)
→ membrane fluidity



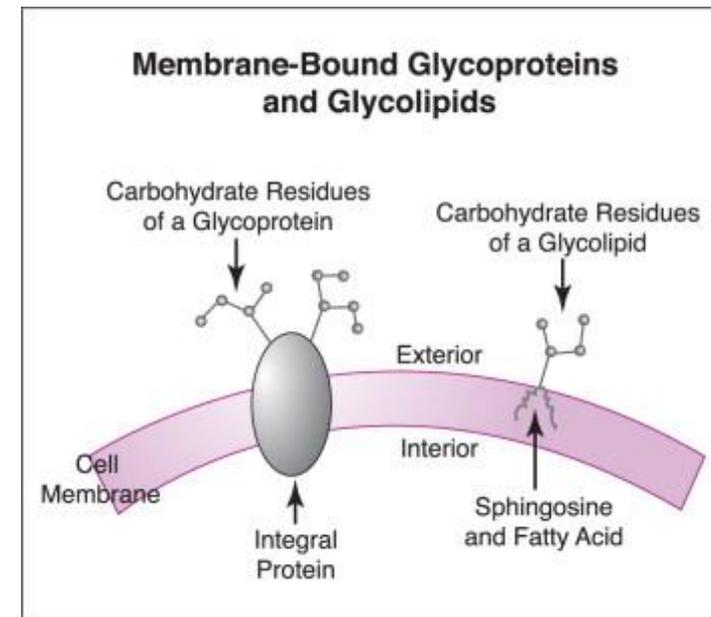
Cell membrane

- Cholesterol – a steroid (lipid) → membrane fluidity
- **Membrane proteins**
 - **Integral proteins** = span the entire width of the phospholipidic bilayer
 - **Peripheral proteins** = loosely bound to the exterior or interior membrane surfaces
- Both integral and peripheral proteins may serve as:
 - Enzymes
 - Structural attachments for the fibers of the cytoskeleton
 - Part of the cell's recognition sites

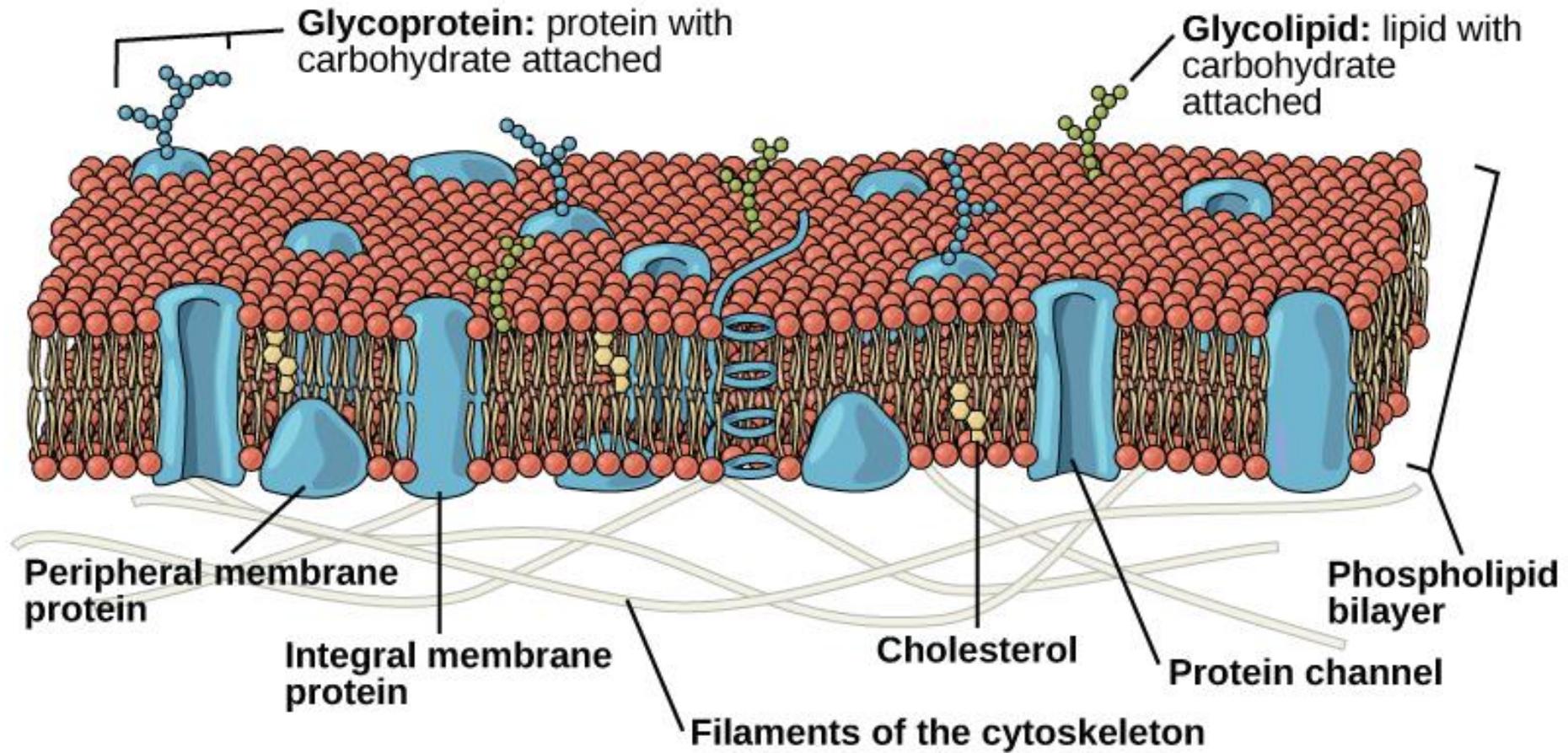


Cell membrane

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- **Carbohydrates**
 - always found on the exterior surface of cells
 - always bound to:
 - proteins → **glycoproteins**
 - lipids → **glycolipids**
- Along with peripheral proteins, carbohydrates form specialized sites on the cell surface that allow cells to recognize each other



The fluid mosaic model



Cell types

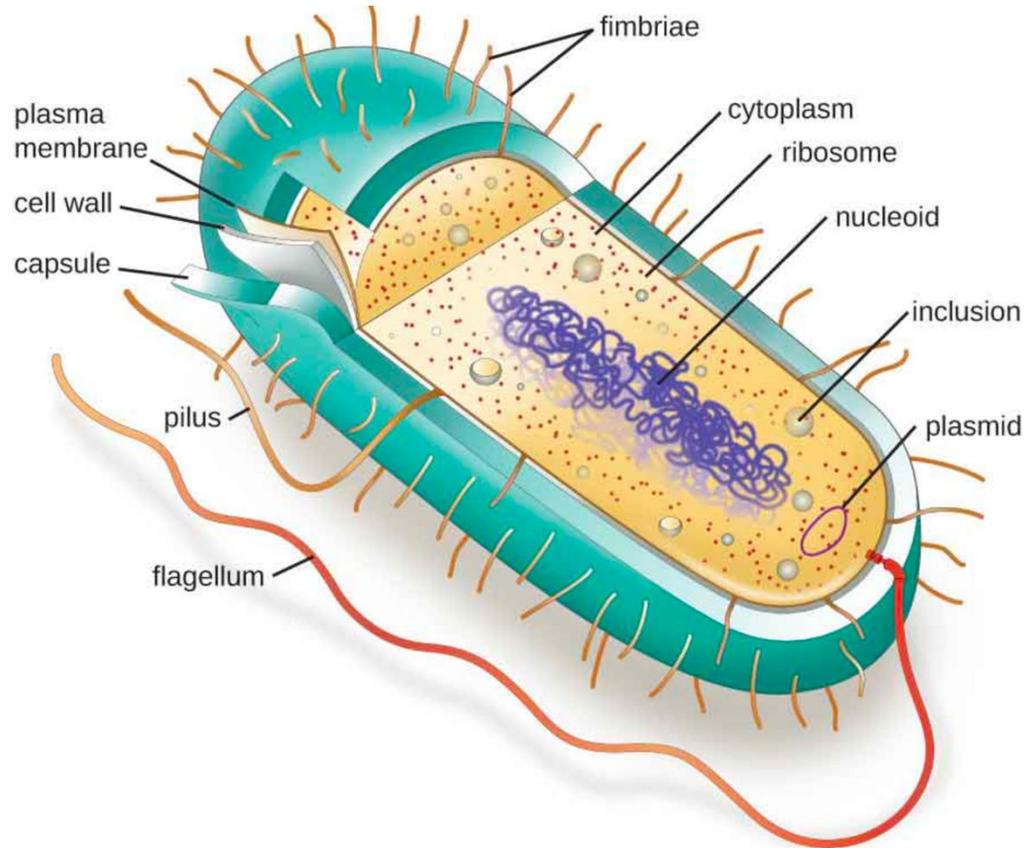
- There are about 200 different types of cells in a human body
- Each human cell type has a different
 - structure
 - size
 - shape
 - function (and organelles)



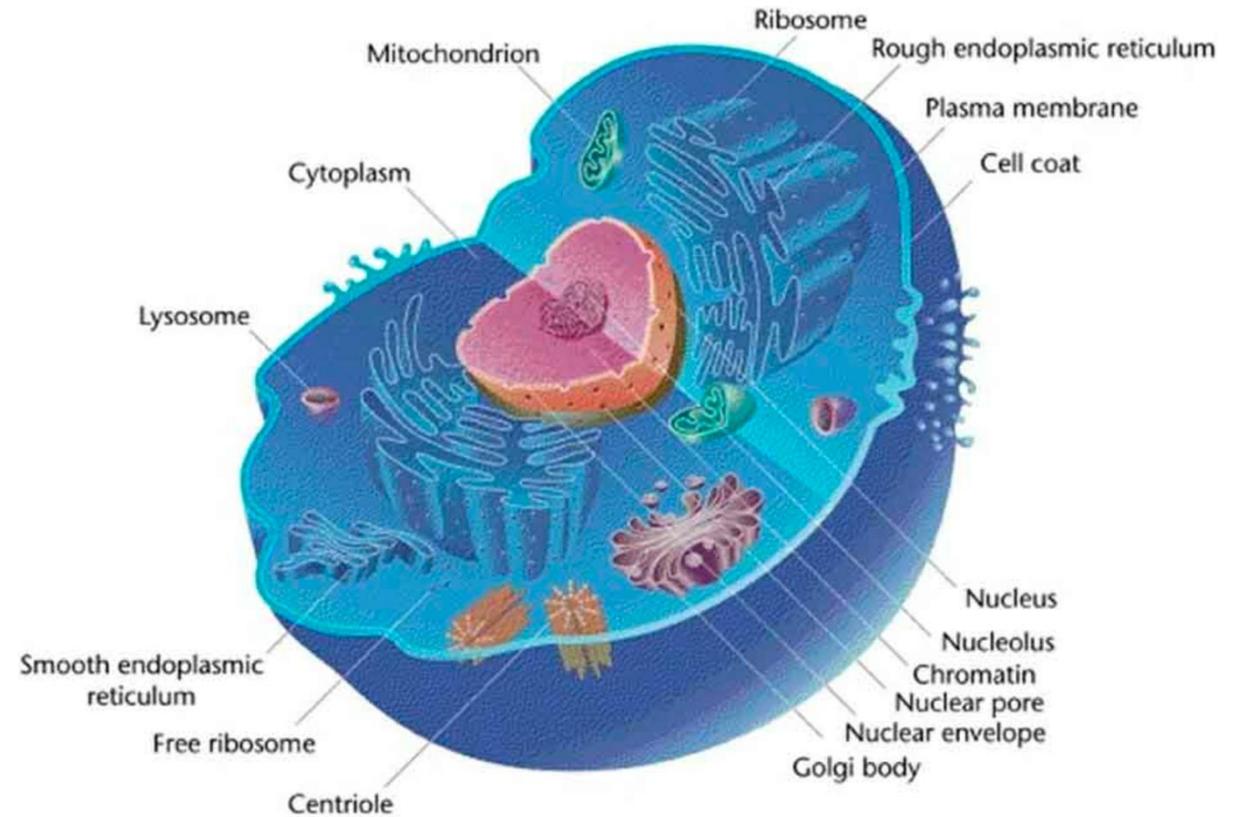
Many different cell types with different functions

Inside a cell

Prokaryotic cell



Eukaryotic cell

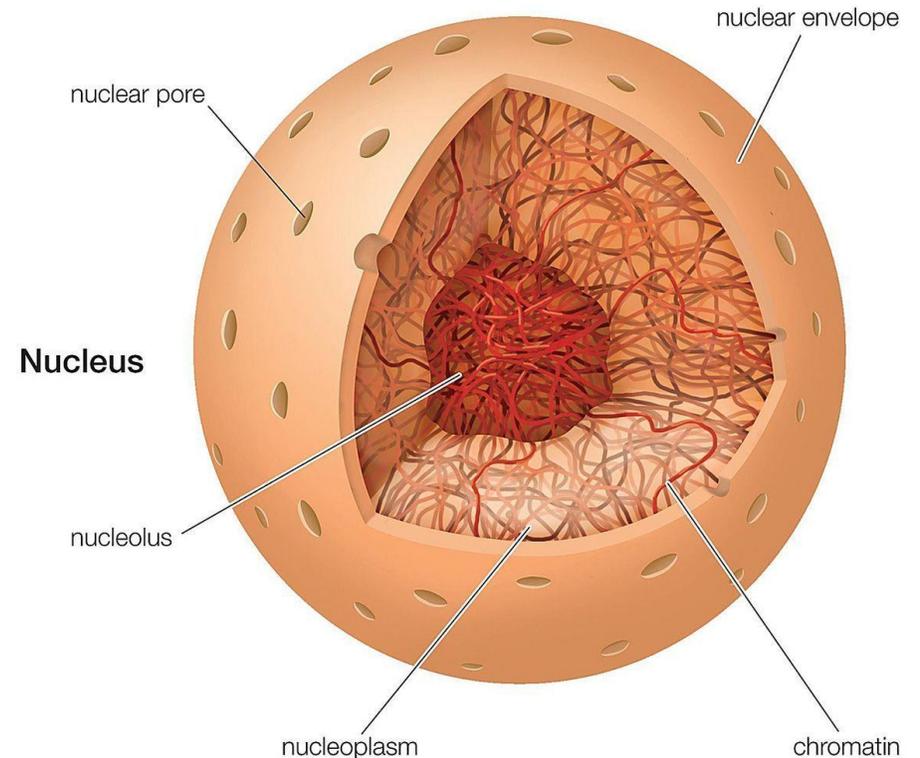


Inside a cell

- Cells are replicating, membrane-bound factories
- **Organelles** = subcellular structures with specific functions
 - May be membrane-bound themselves

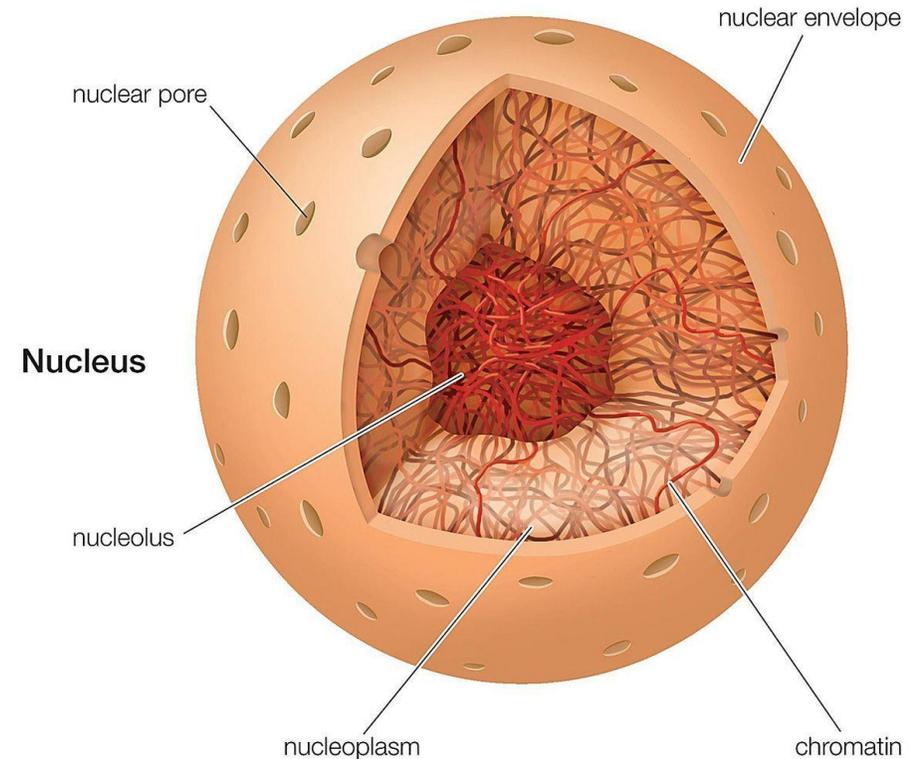
Cellular organelles (eukaryotes)

- **Nucleus** = repository for genetic information, cell control center
- **Nucleolus** = r-RNA synthesis, **ribosome** construction
- **Nuclear envelope** = an inner and an outer membrane which run parallel to each other
- **Nuclear pores** = gaps in nuclear envelope
 - ~ 100 nm in real diameter (however due to the presence of central regulatory proteins, the true size of the gap is around 9 nm)
 - control the passage of molecules in&out of the nucleus
 - larger molecules (e.g., big proteins and nucleic acid) are unable to pass through these pores → nuclear envelope works to selectively separate the contents of the nucleus from that of the cytoplasm



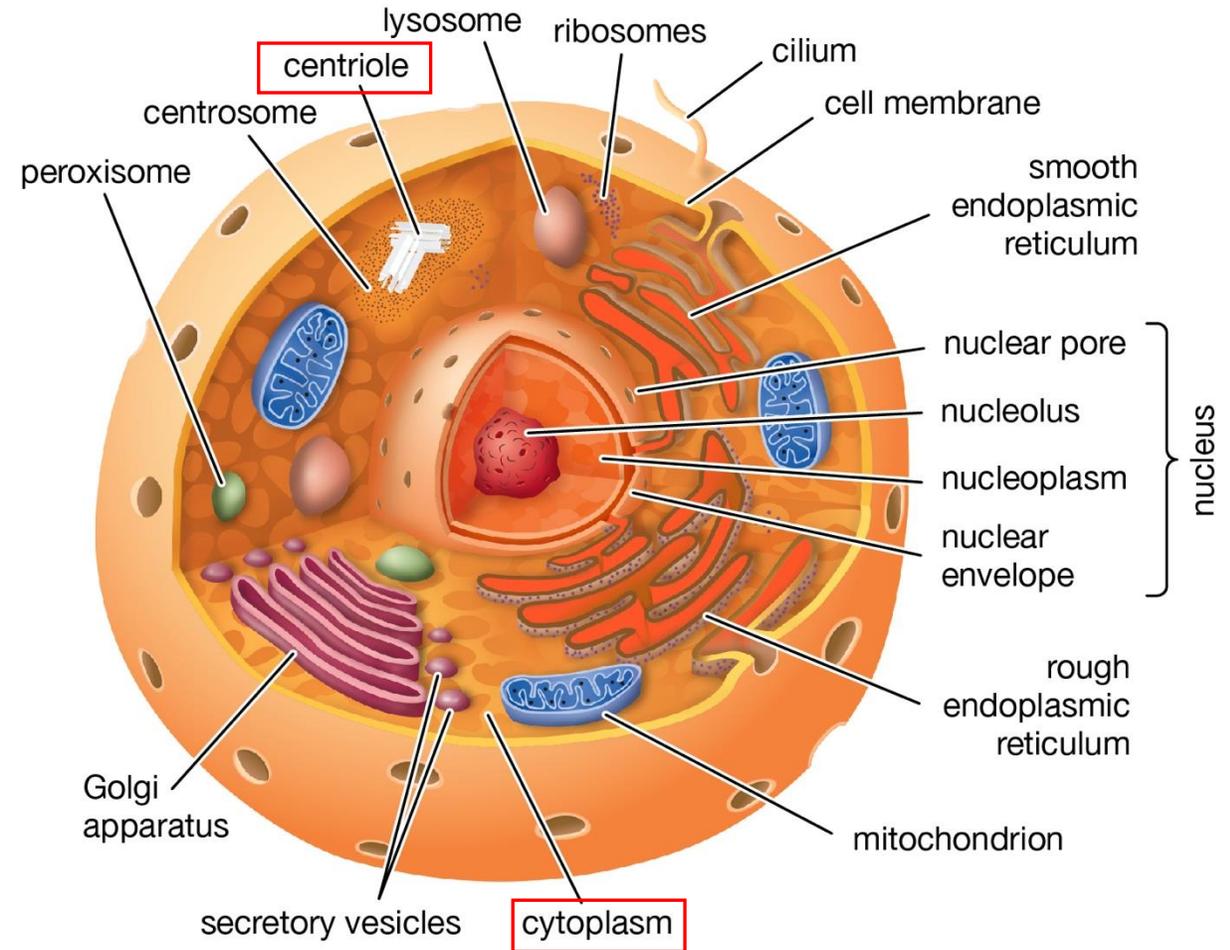
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- **Chromatin** = DNA complexed with proteins (histones)
 - Histones combined with DNA form **nucleosomes**
 - a nucleosome describes a segment of DNA associated with **8** histone proteins
 - by associating with histones, DNA is more compact and able to fit into the nucleus



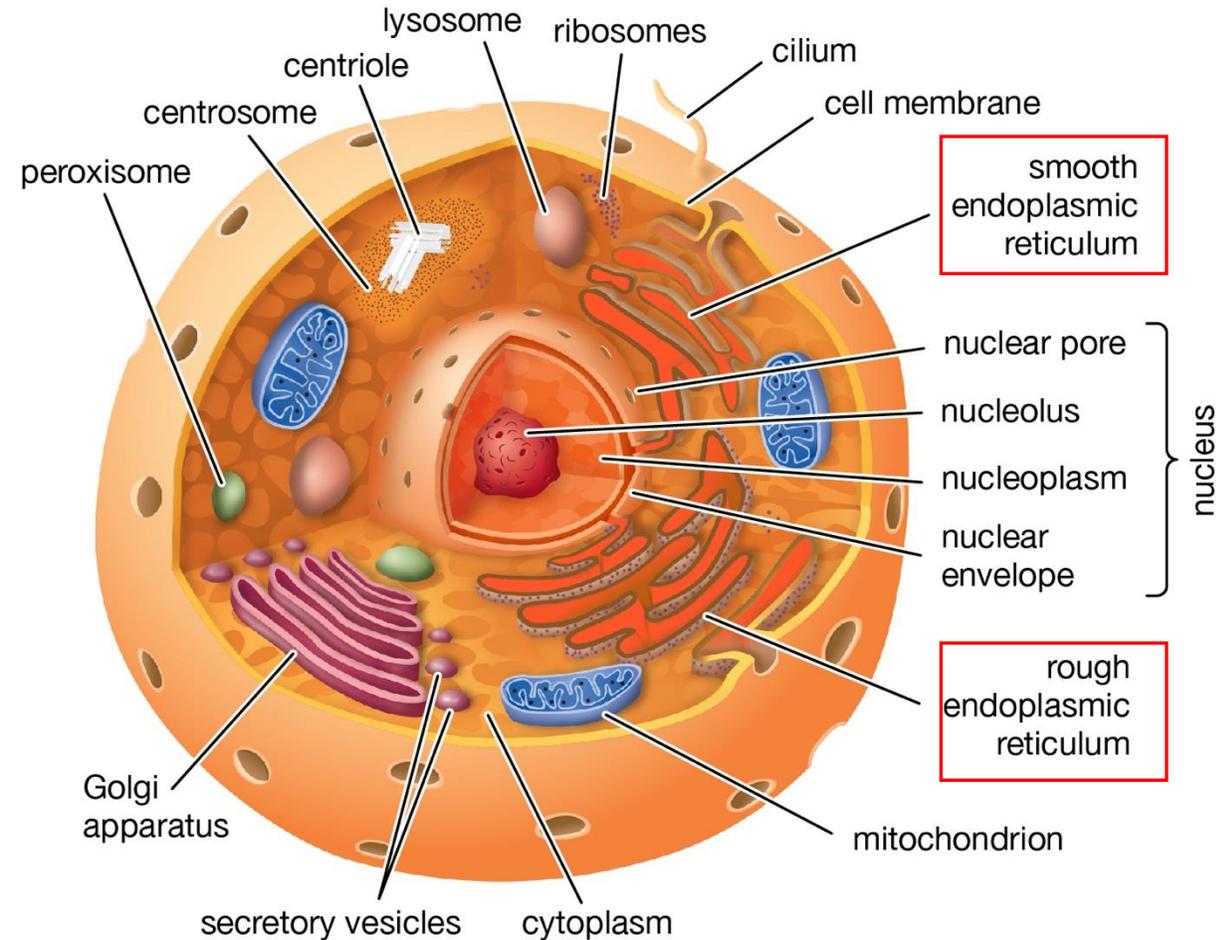
Cellular organelles (eukaryotes) – fly-by view

- Everything non-nuclear = **cytoplasm**
- **Centrioles** = organize structural components of the cell involved in moving the cell's components during cell division



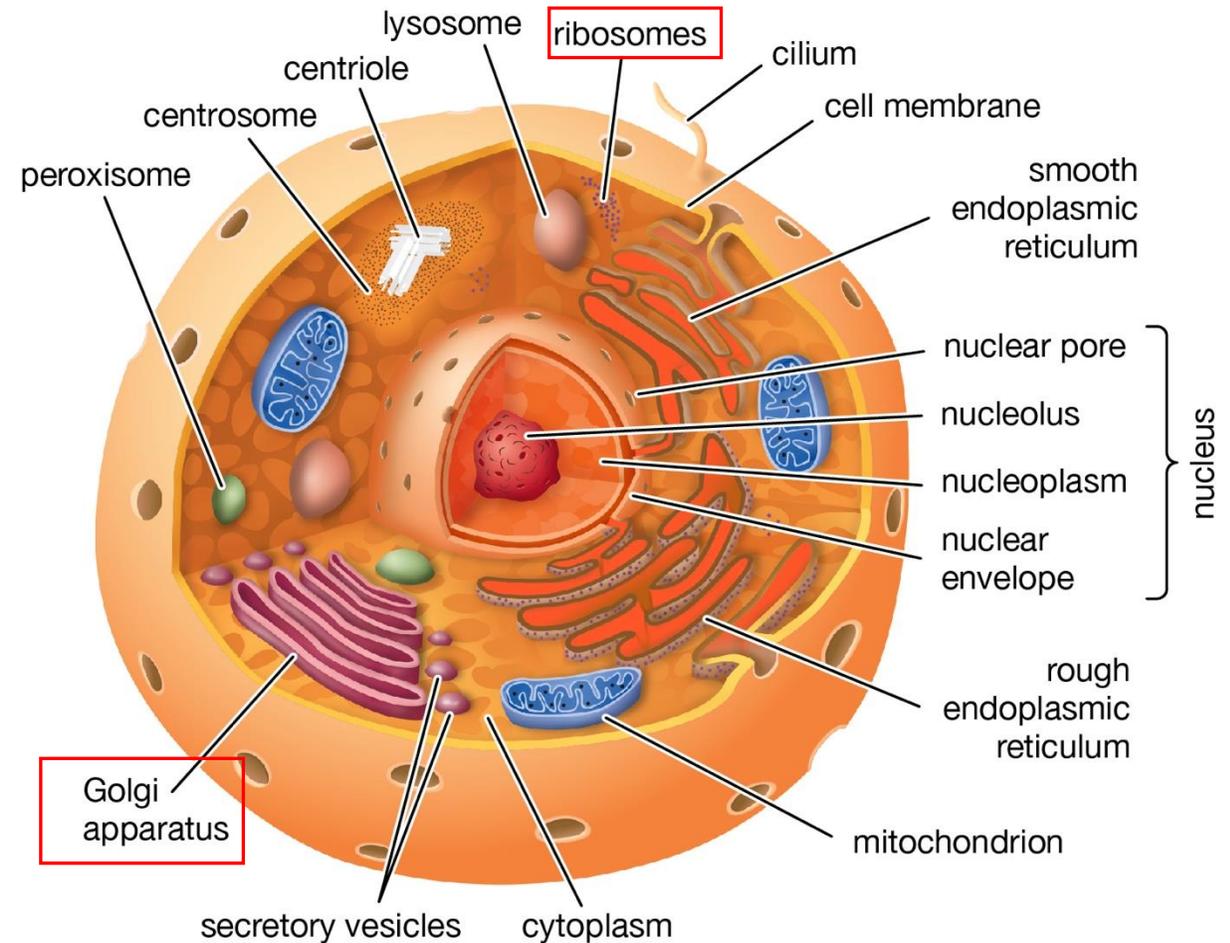
Cellular organelles (eukaryotes) – fly-by view

- **Endoplasmic reticulum (ER)**
- **Rough ER (RER)**
 - Contains the **ribosomes** (the protein synthesis machinery)
 - The cell's factory assembly line
- **Smooth ER (SER)**
 - Shuttles the cell's reaction products to the **Golgi apparatus**
 - The cell's factory shipping department



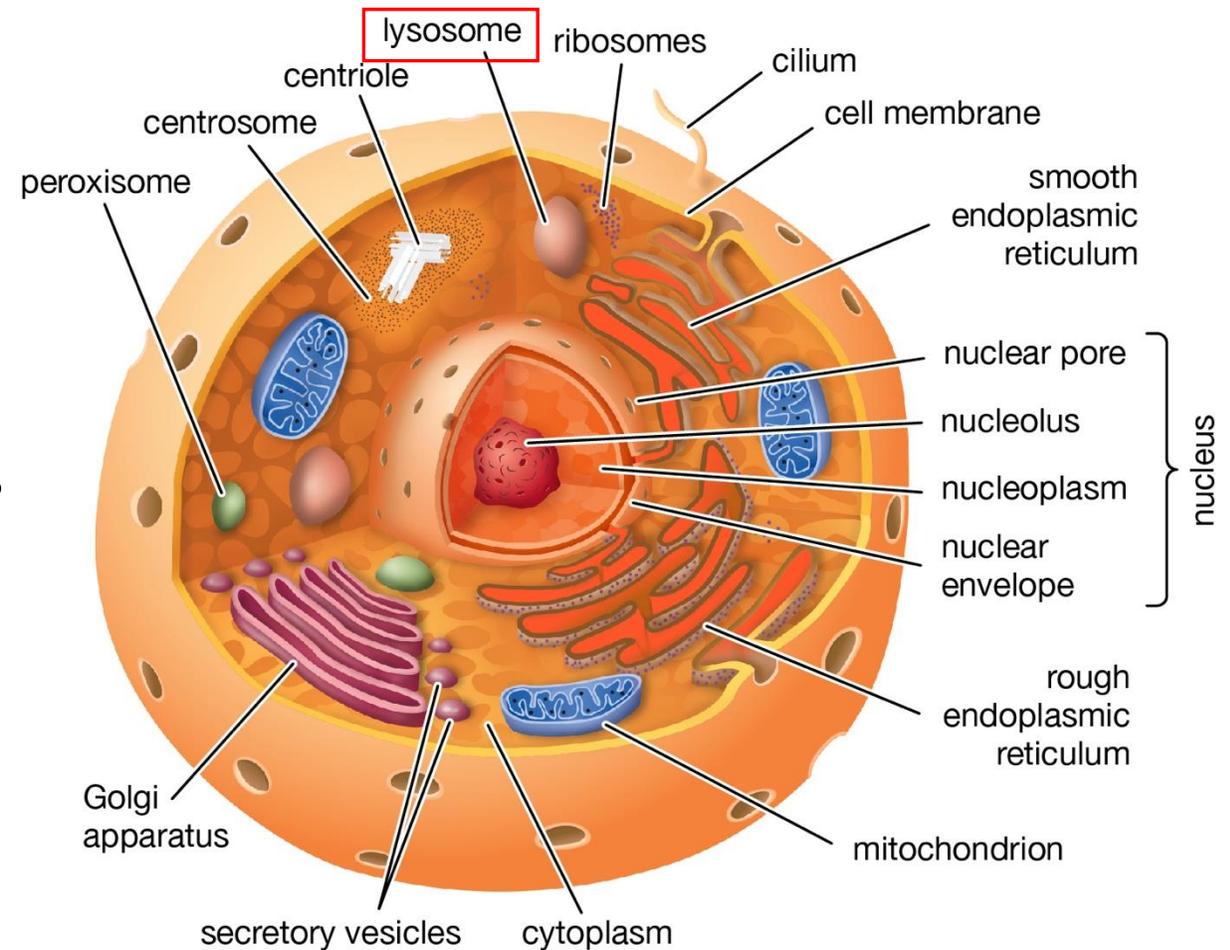
Cellular organelles (eukaryotes) – fly-by view

- **Ribosomes** = cell's organelles in which amino acids are assembled into proteins
 - Contain proteins and nucleic acid subunits
 - Cell factory's strategic department
- **Golgi apparatus** = Materials produced by the cell are packed into vesicles and sent to other organelles (for metabolism) or to cell membrane (for excretion)
 - Cell factory's postal system



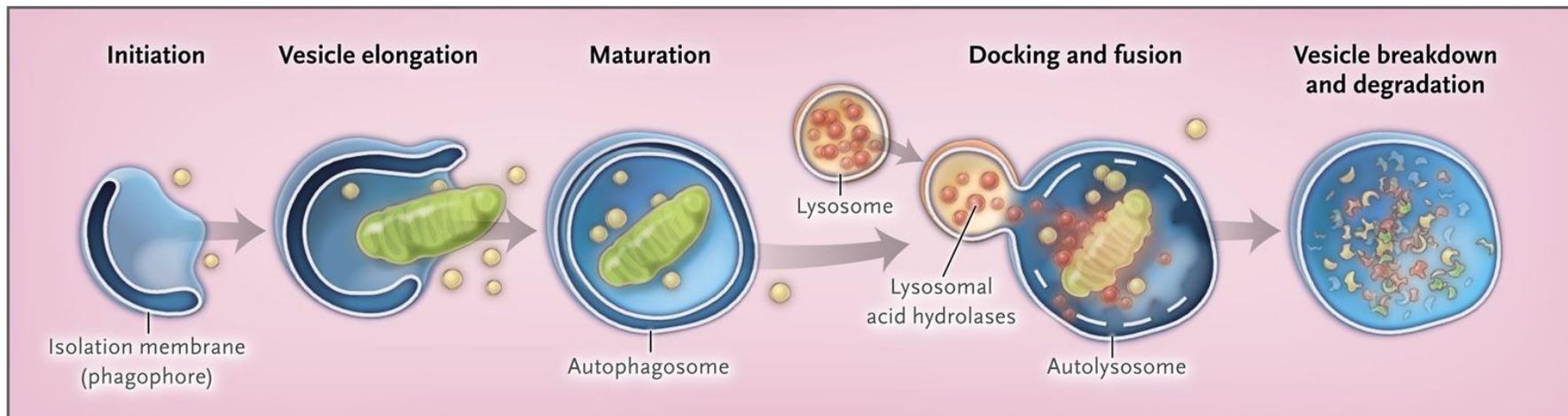
Cellular organelles (eukaryotes) – fly-by view

- **Lysosomes** = breaking down cellular components no longer needed/unwanted substances
 - They also digest dead organelles (autophagy or autodigestion)
 - Can be thought of as the cell factory's landfill



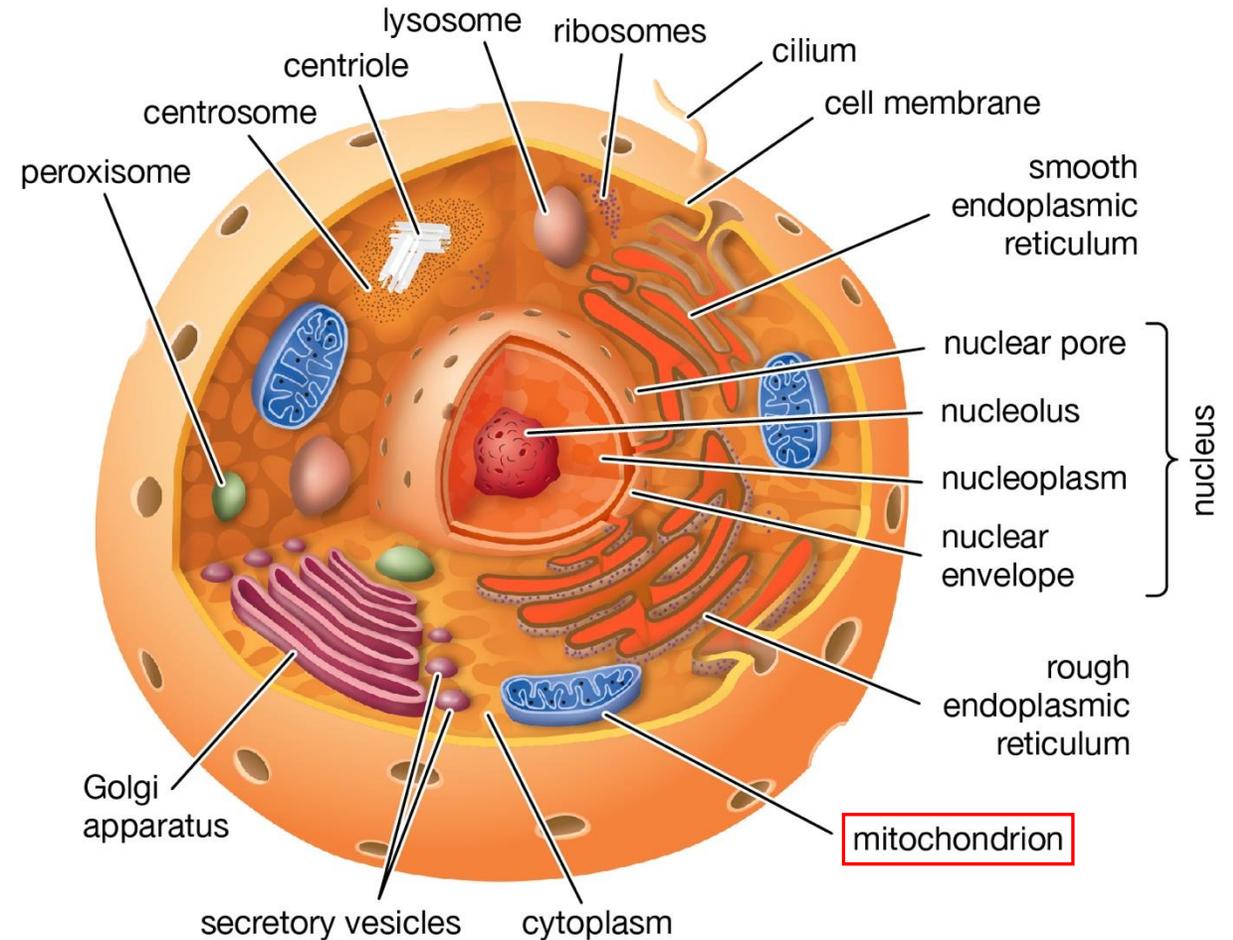
Autophagy

- A cellular self-degradative process fundamental in:
 - balancing sources of energy at critical times in development and in response to nutrient stress
 - housekeeping in removing
 - misfolded or aggregated proteins
 - clearing damaged organelles (mitochondria, ER...)
 - eliminating intracellular pathogens
- **Autophagy is generally thought of as a cellular survival mechanism**



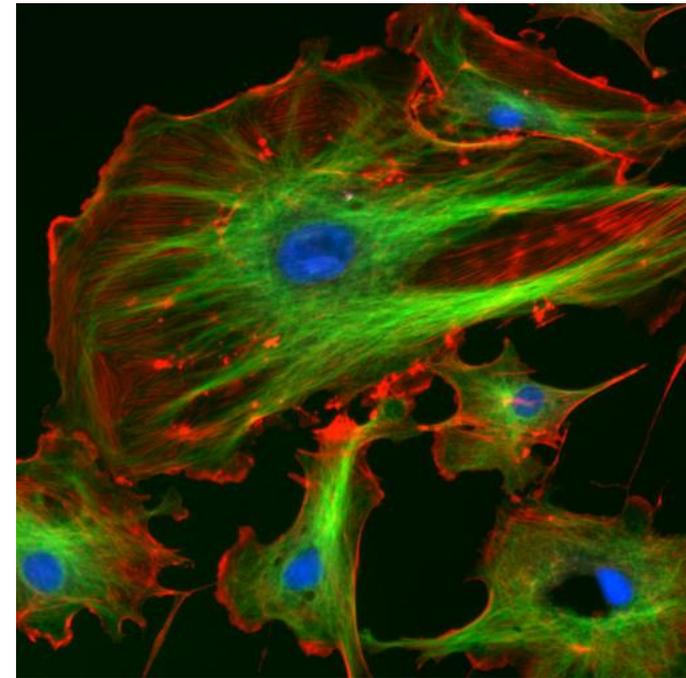
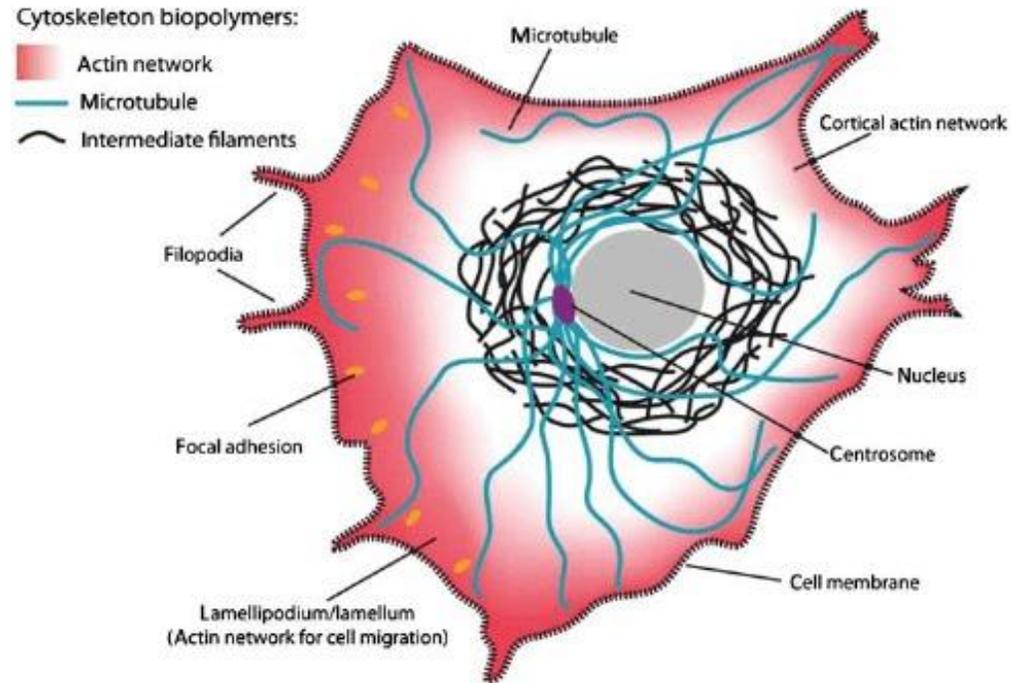
Cellular organelles (eukaryotes) – fly-by view

- **Mitochondria** = the cellular power plants where energy is produced
 - They use food components (mainly carbohydrates) to produce highly energetic molecules (ATP)
 - ATP hydrolysis = energy



Cellular organelles (eukaryotes) – fly-by view

- **Cytoskeleton** = mechanical support, shape, and strength



Cellular organelles (eukaryotes) – fly-by view

- **Cilia, flagella** = cellular movement, sensory organelles

