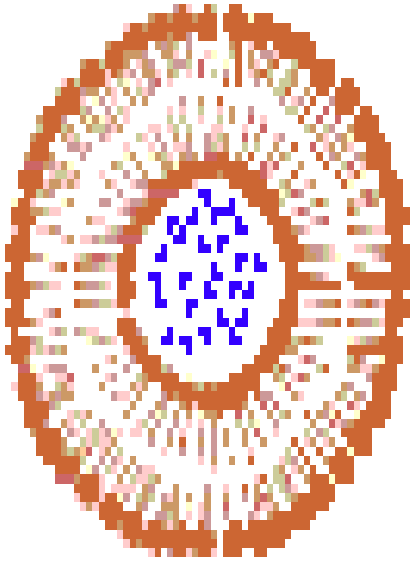
Medical Biology



VESICLE

PLASMA MEMBRANE

Cytoplasm

Cytoplasm is a watery environment inside the cell. Cytoplasm includes salts, an assortment of organic molecules, including many enzymes that catalyze reactions, as well as water.

One of the most interesting features of cytoplasm is its ability to change from a liquid (or sol) state to semisolid (or gel) state.

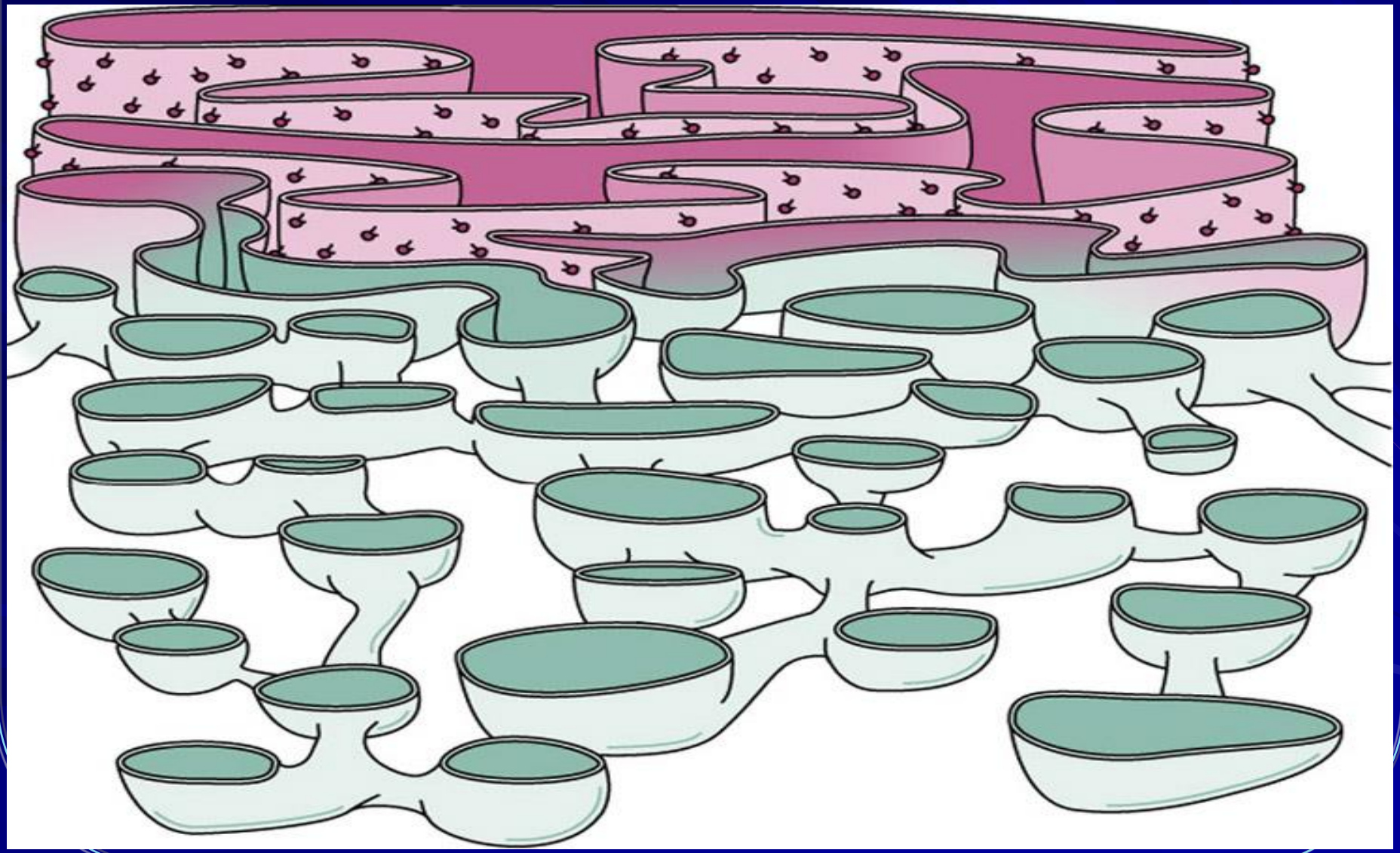
Cytoplasmic matrix fills the space between the plasma membrane and the internally located nucleus and is composed of highly organized complex meshwork of elongated protein molecules responsible for many of the cell functions.

Cytoplasmic organelles:

1. Membranous organelles with plasma membranes that separate the internal environment of the organelle from the cytoplasm .
2. Non membranous organelles without plasma membranes .

Membrane bounded organelles

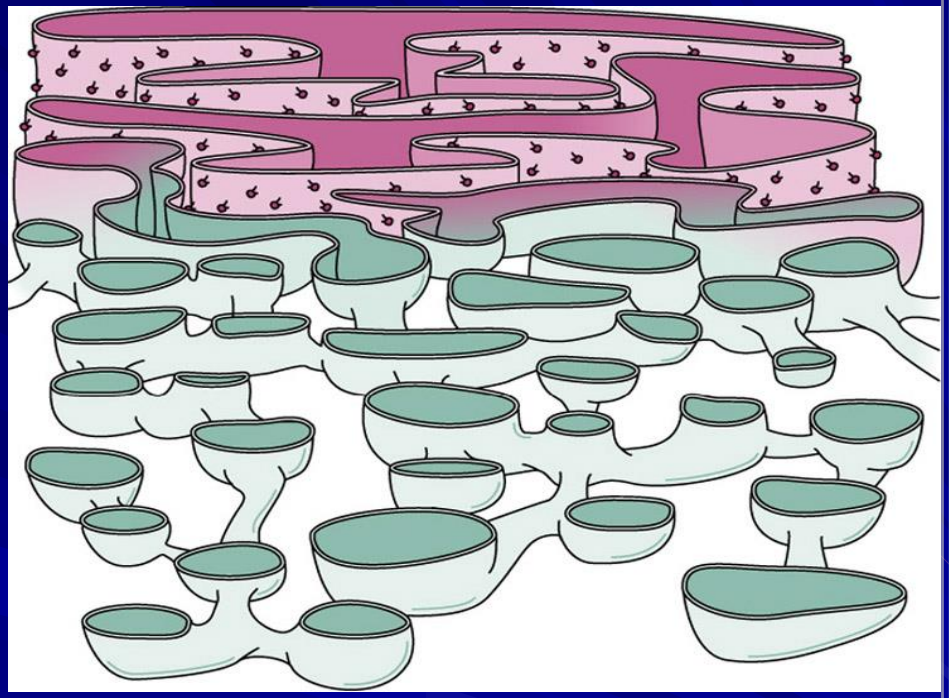
Endoplasmic reticulum (ER)



The entire ER is enclosed by a continuous membrane and is the largest organelle of most **eukaryotic cells**. Its membrane may account for about half of all cell membrane and is enclosed a space (**the cisternal space**) (**or lumen**) from the cytosol.

There are **2** types of ER that perform different functions within the cell:

1. **the rough ER**:
2. **the smooth ER**:

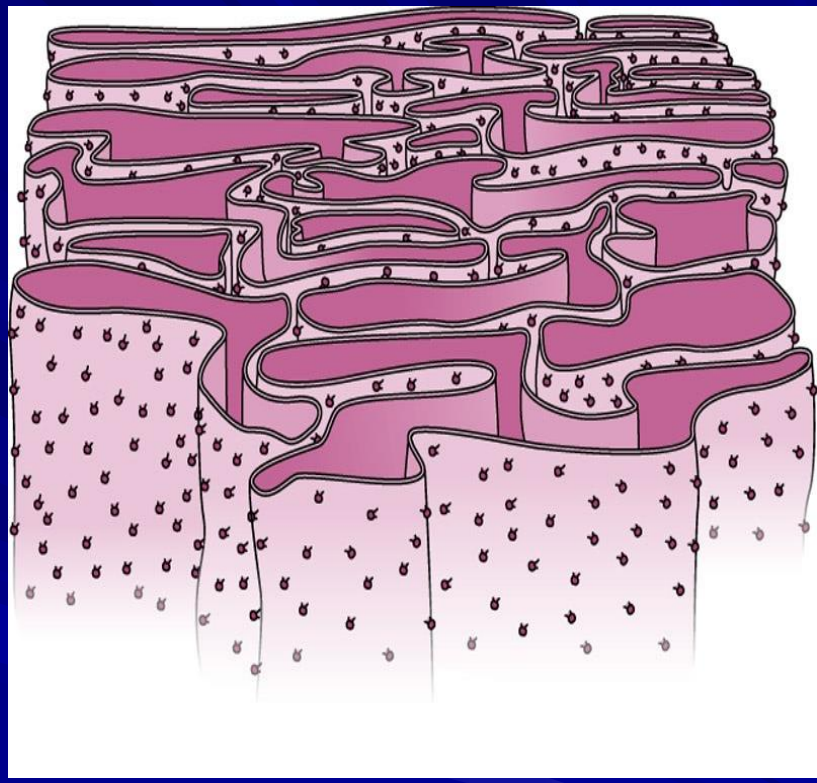


The ER is part of the **endomembrane system**.

Rough endoplasmic reticulum (RER):

Function of RER:

1. has role in the synthesis of protein to be exported outside the cell.
2. modification of newly formed polypeptides.
3. assembly & folding of multichain protein.
4. initial glycosylation of the glycoprotein which means addition of glucose to the protein.



Clinical notes:

- Dysfunction of the rough endoplasmic reticulum (ER) can contribute to various medical conditions, particularly those involving protein folding lead to protein misfolding disorders like Alzheimer's disease and Parkinson's disease.

Smooth endoplasmic reticulum (SER):

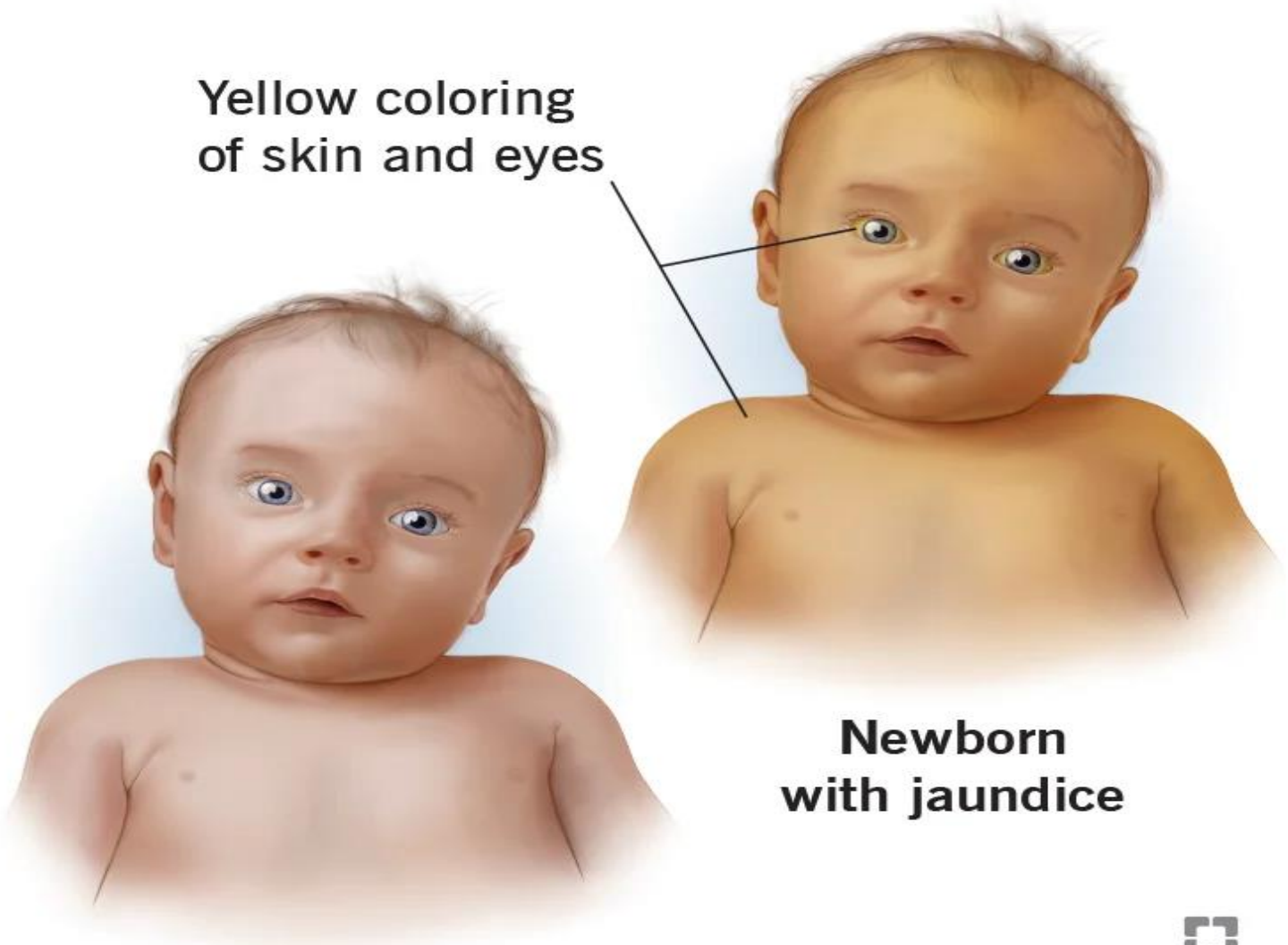
Function of SER:

1. it is abundant in the liver and intestinal epithelium and seems to be involved in detoxification of certain substances like alcohol and toxins.
2. glycogen break down in the liver cells.
3. lipid and cholesterol metabolism.
4. biosynthesis of steroid hormones (adrenal gland).
5. participates in the contraction process in muscle cells, here SER is called **sarcoplasmic reticulum**.

Clinical notes:

- Jaundice denotes a yellowish discoloration of the skin and is caused by accumulation of bilirubin and other pigmented compounds in extracellular fluid, which are normally metabolized by SER enzymes in cells of the liver and excreted as bile. A frequent cause of jaundice in newborn infants (physiological jaundice) is an under developed state of SER in liver cells, with failure of bilirubin to be converted to a form that can be readily excreted.

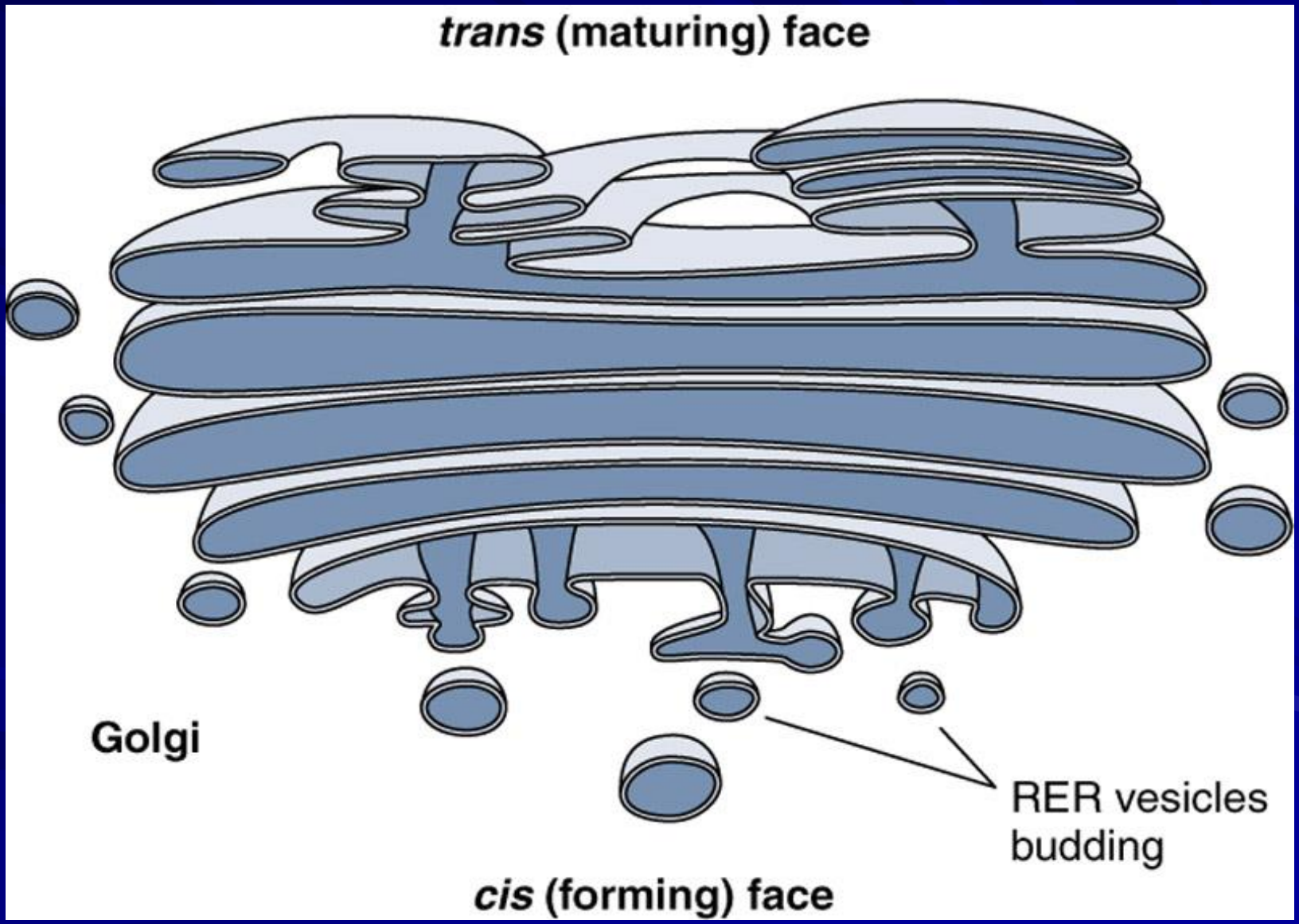
Jaundice in Newborns



Golgi apparatus

Golgi apparatus (Golgi complex) is an organelle found in typical **eukaryotic cells**. It forms a part of the **endomembrane system** present in eukaryotic cells. Its primary **function** is to **process and package macromolecules** synthesized by the cell, primarly proteins and lipids.

Structure:

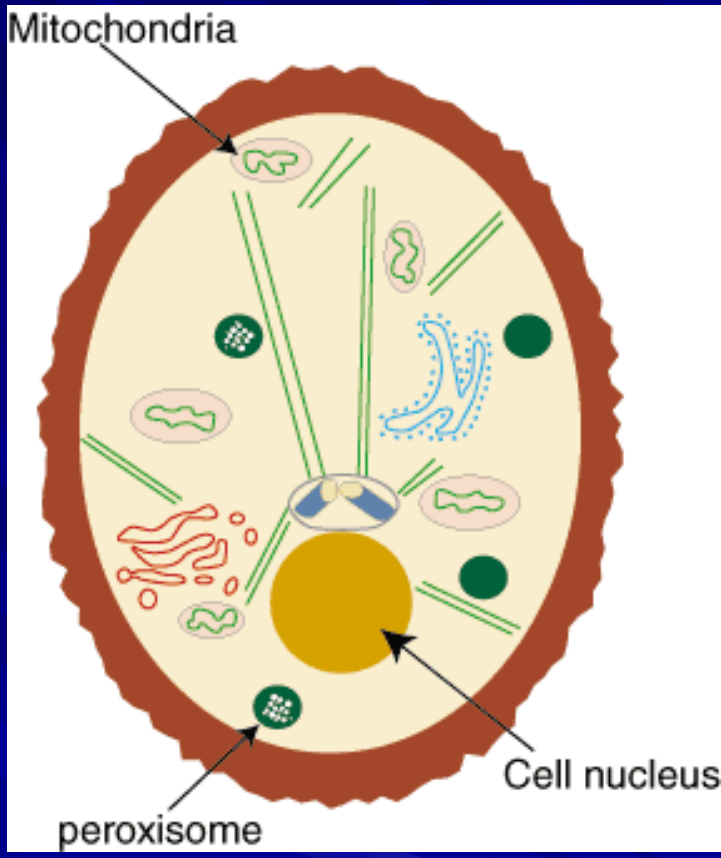

trans (maturing) face
Golgi
RER vesicles budding
cis (forming) face

Functions of Golgi apparatus:

1. participate in protein synthesis.
2. initial proteolysis (cutting of protein).
3. terminating glycolysis and glycosylation.
4. phosphorylation (addition of phosphate group).
5. sulfation (addition of sulfa group).
6. processing and sorting glycoprotein.
7. lipid metabolism.

Peroxisomes

Are organelles in eukaryotes that function to rid the cell of toxic substances. Peroxisomes are small membrane- enclosed organelles that contain enzymes involved in a variety of metabolic reactions.



Functions of peroxisomes:

$$RH_2 + O_2 \longrightarrow R + H_2O_2$$

$$H_2O_2 + RH_2 \longrightarrow R + 2H_2O$$

$$2H_2O_2 \longrightarrow 2H_2O + O_2$$

lipid biosynthesis.

production of bile acids.

Clinical notes:

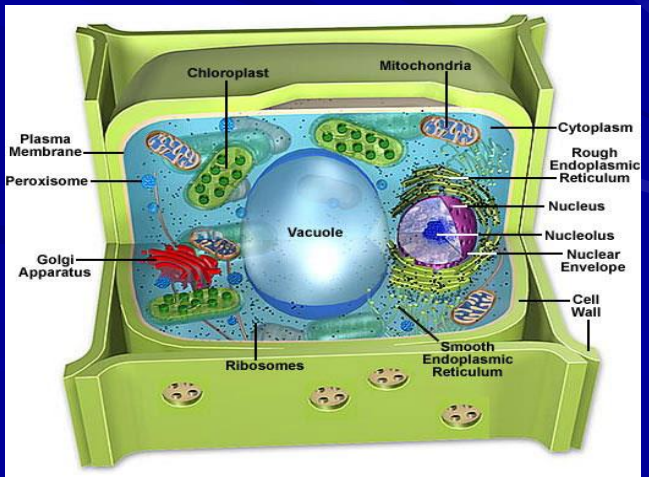
- 1. A large number of disorders arise from defective peroxisomal proteins, because this organelle is involved in several metabolic pathways.
- 2. Deficiency in peroxisomal enzymes causes the fatal Zellweger syndrome, with severe muscular impairment, liver and kidney lesions, and disorganization of the central and peripheral nervous systems. Electron microscopy reveals empty peroxisomes in liver and kidney cells of these patients.

Vacuoles

Vacuoles are membrane- bound compartments within some eukaryotic cells.

Functions of vacuoles:

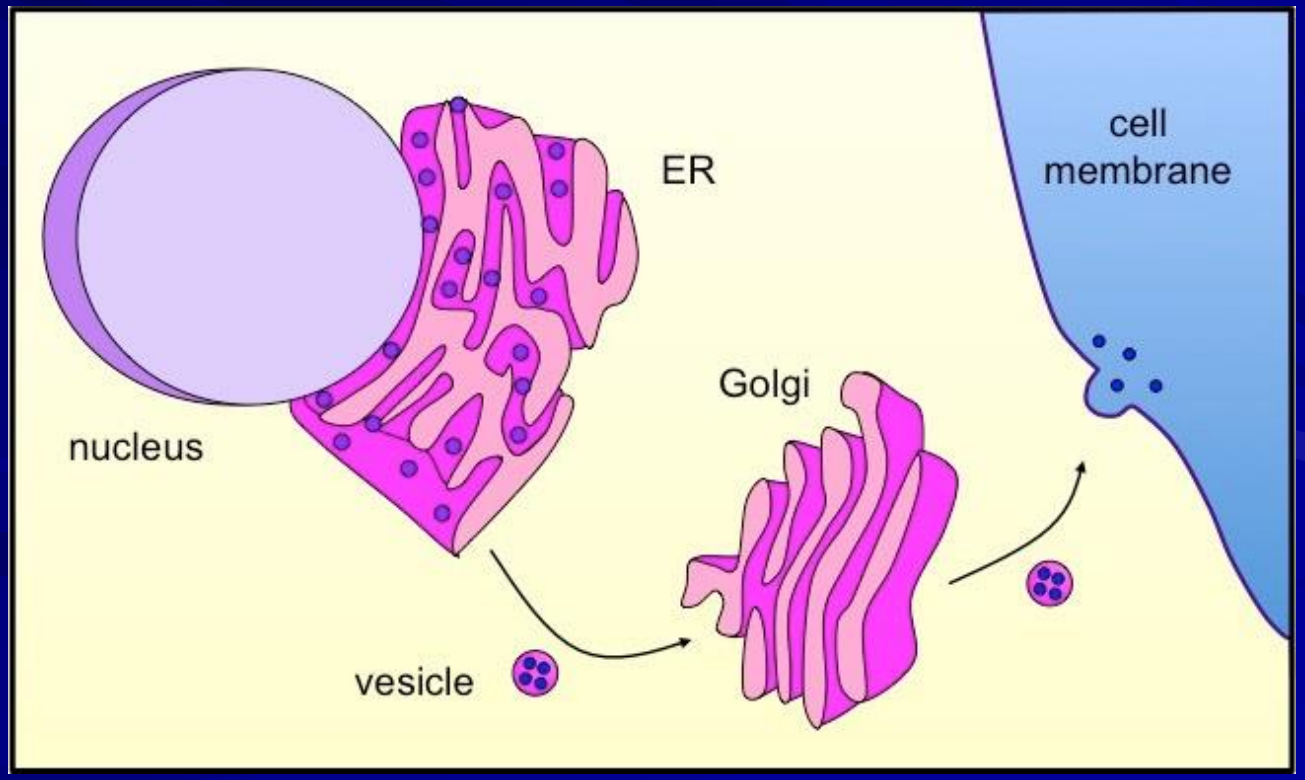
- isolating materials that might be harmful to the cell.
- marinating internal hydrostatic pressure within the cell.
- maintaining an acidic internal pH.
- enabling the cell to change shape.

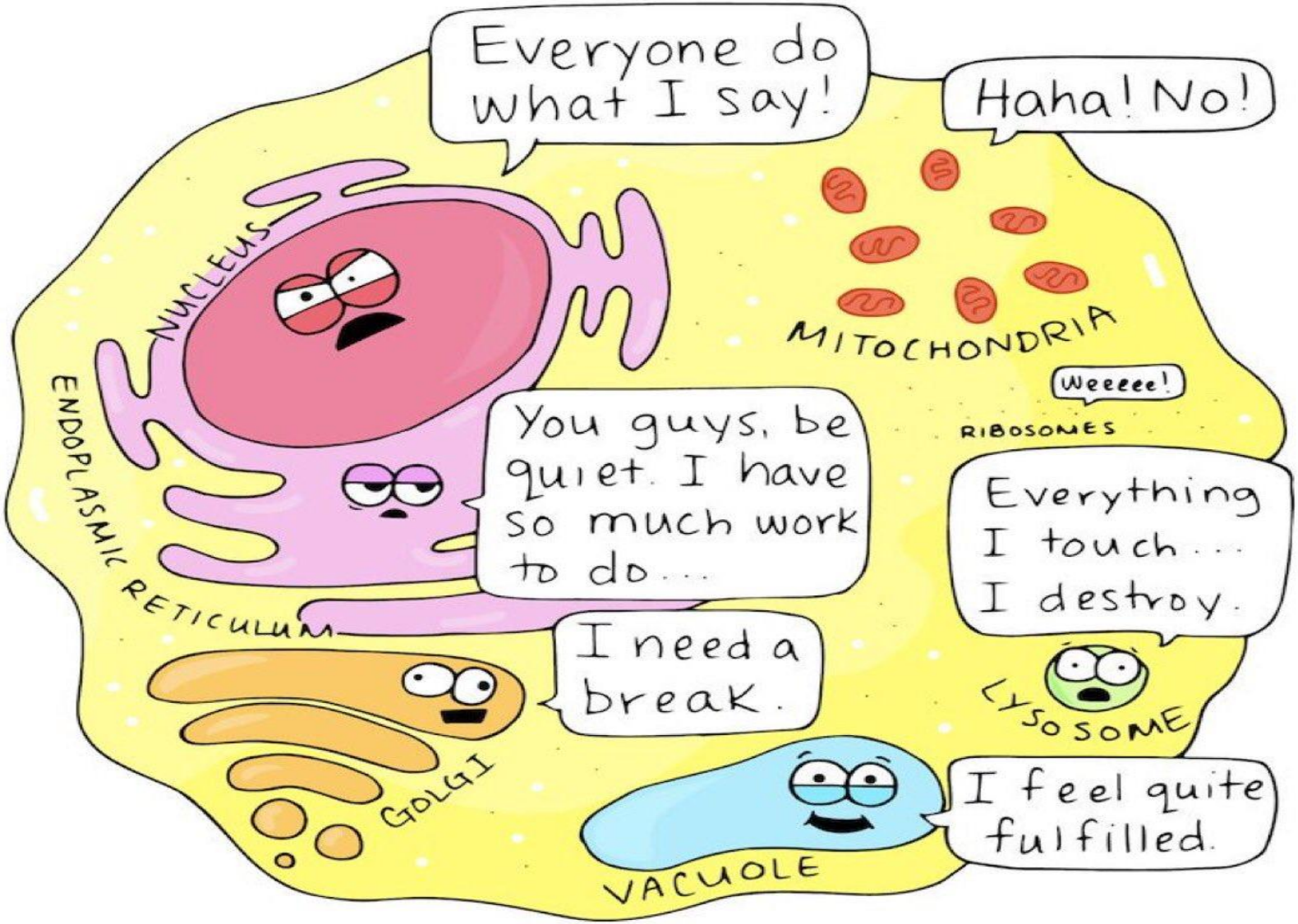


Vesicles

A vesicle is a relatively small and enclosed compartment. Vesicles store, transport or digest cellular products and waste products.

Many vesicles are made in the Golgi apparatus, but also in the endoplasmic reticulum, or are made from parts of the plasma membrane.





If organelles could talk.

Beatrice the Biologist

Thank you