

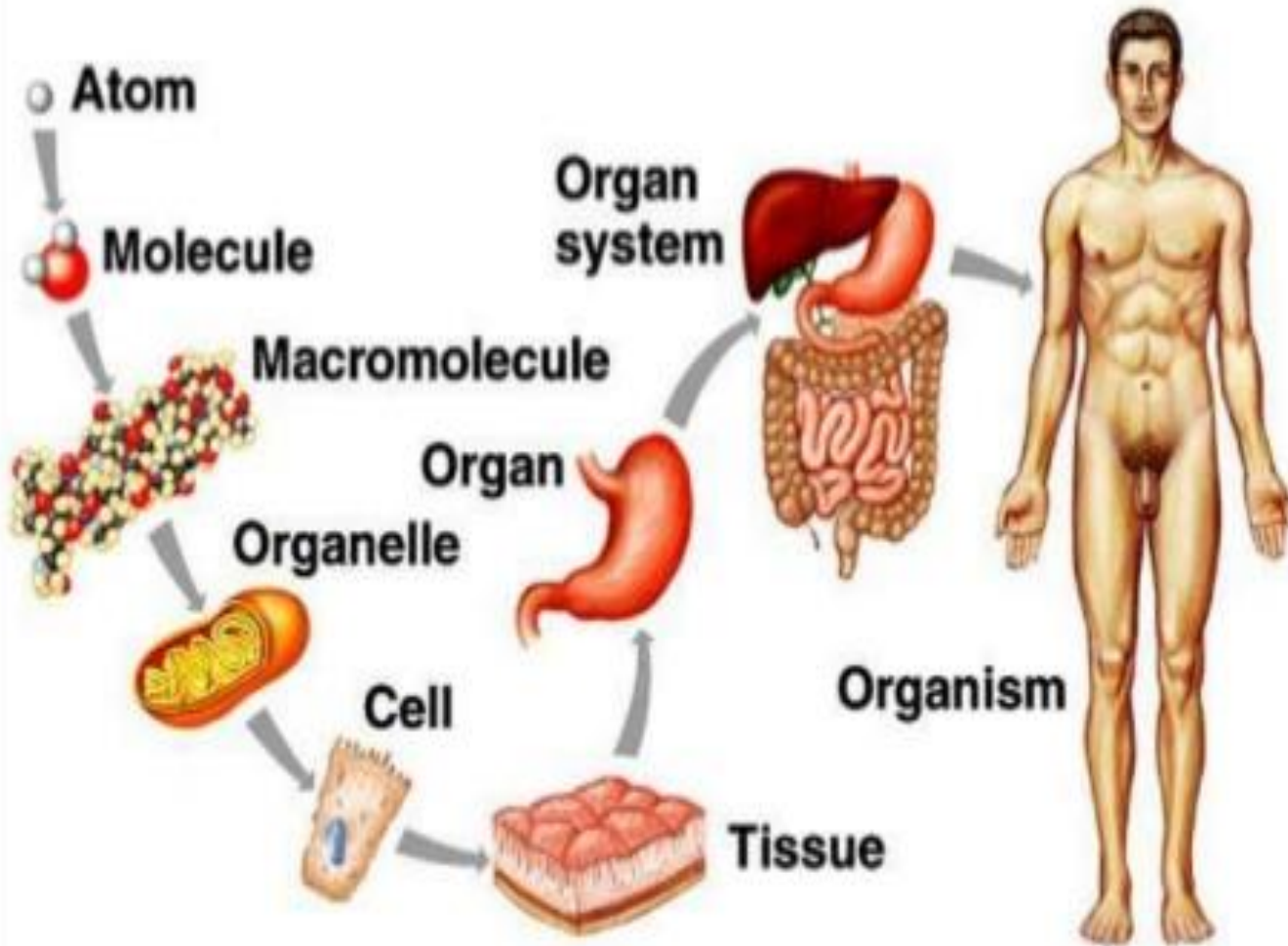


Biochemistry of cell

Dr Bela Goyal

Levels of Structural Organization

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Structural hierarchy in the molecular organization of cells

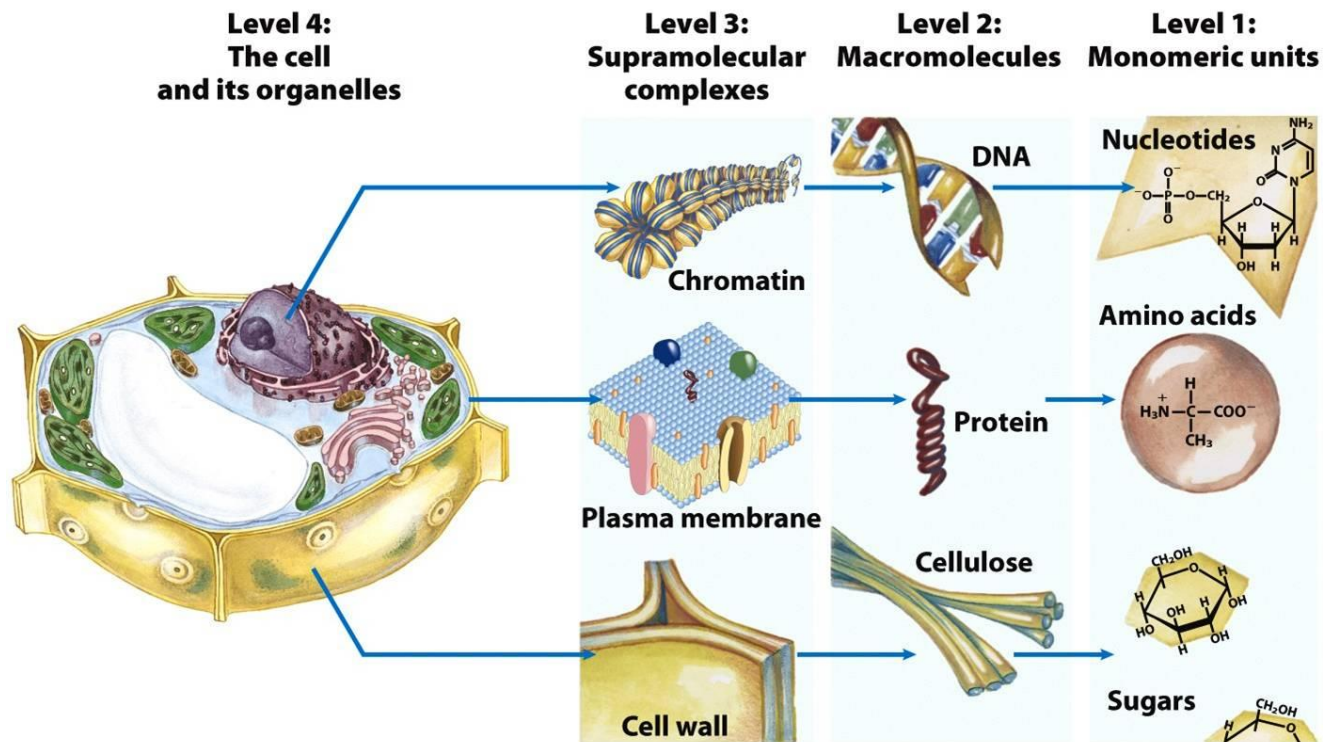


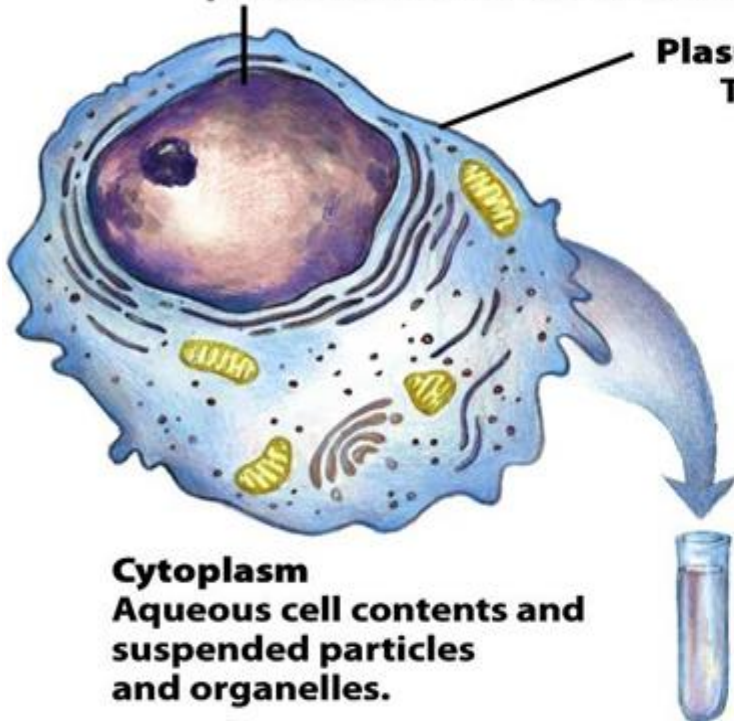
Figure 1-11
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Cells are the structural and functional units of all living organisms

**Nucleus (eukaryotes)
or nucleoid (bacteria, archaea)**
Contains genetic material—DNA and associated proteins. Nucleus is membrane-enclosed.

Plasma membrane
Tough, flexible lipid bilayer. Selectively permeable to polar substances. Includes membrane proteins that function in transport, in signal reception, and as enzymes.

Cytoplasm
Aqueous cell contents and suspended particles and organelles.



Phylogeny of the three domains of life

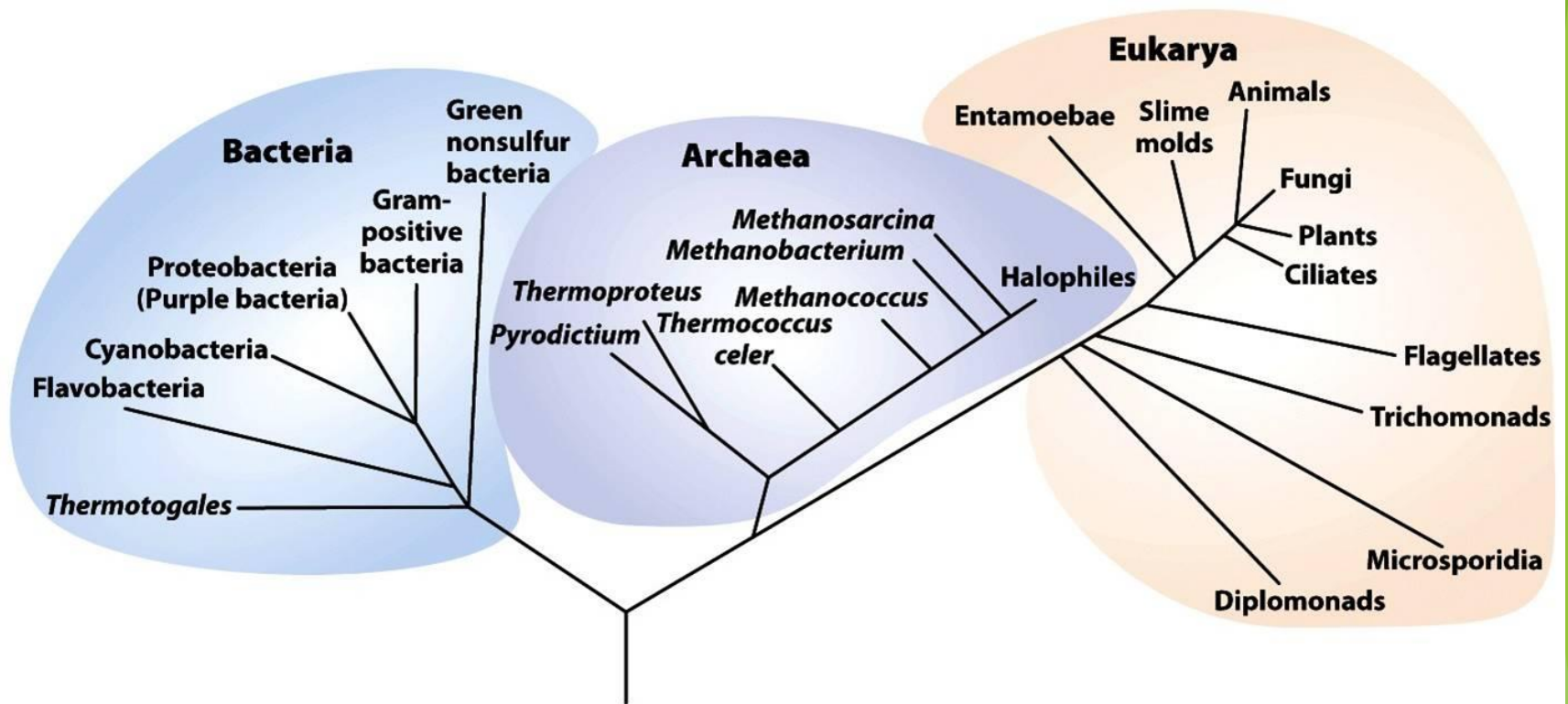
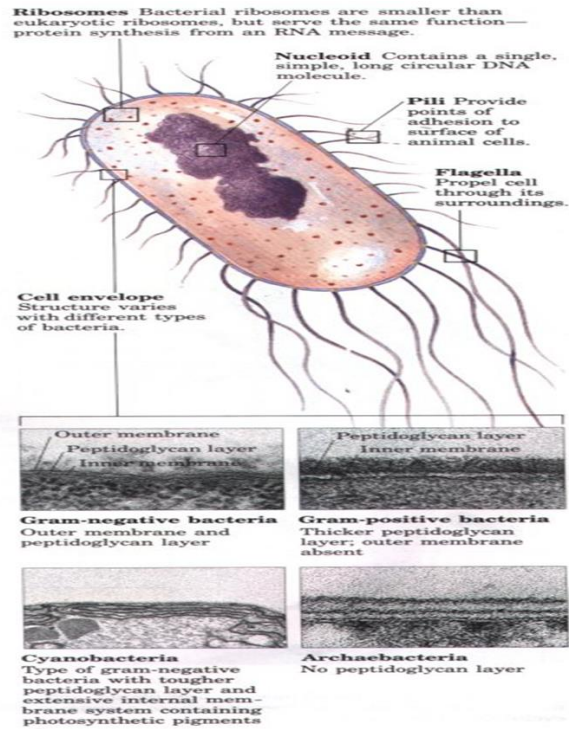


Figure 1-4

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Common structural features of bacterial cells.



Eukaryotic cell structure

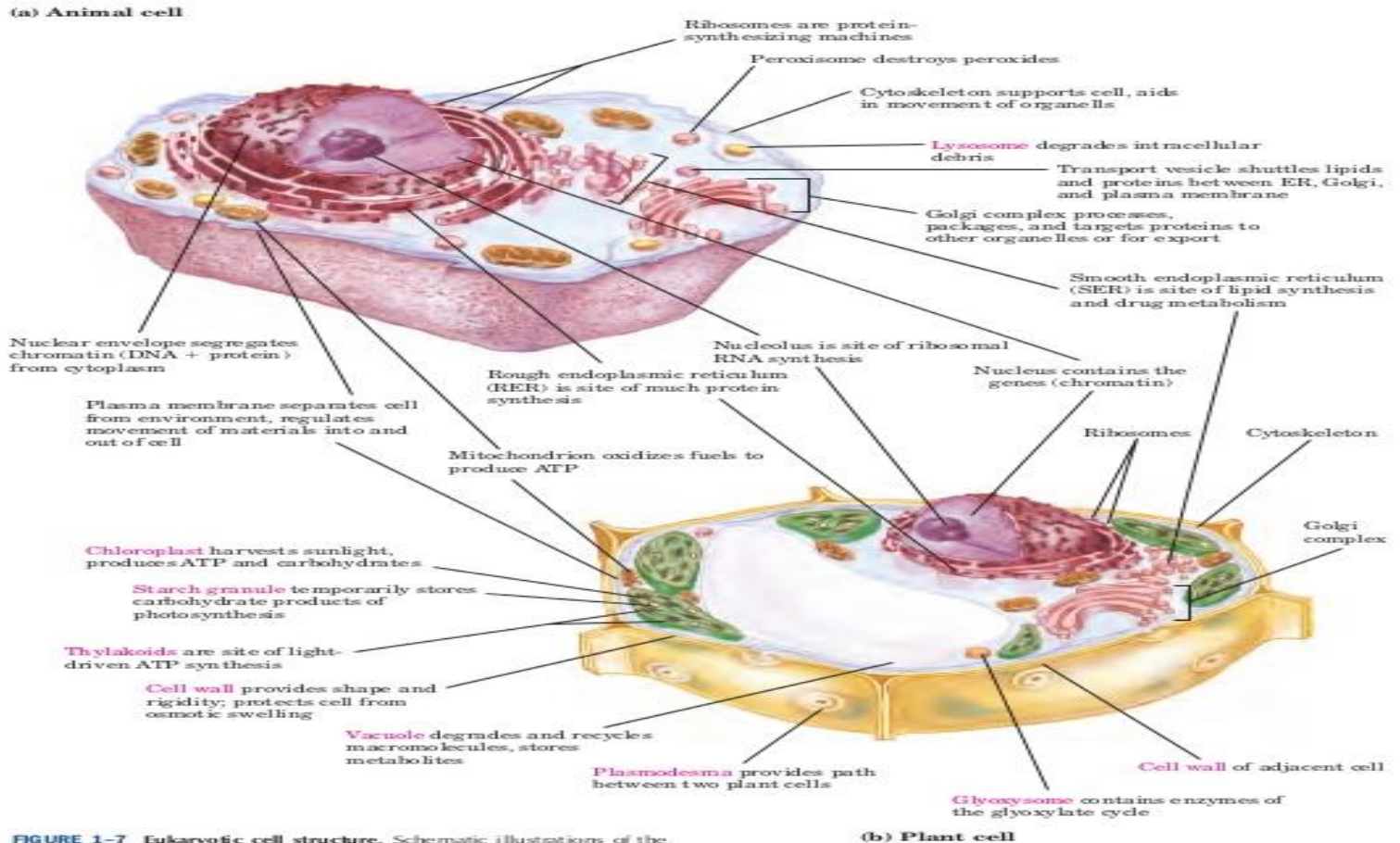
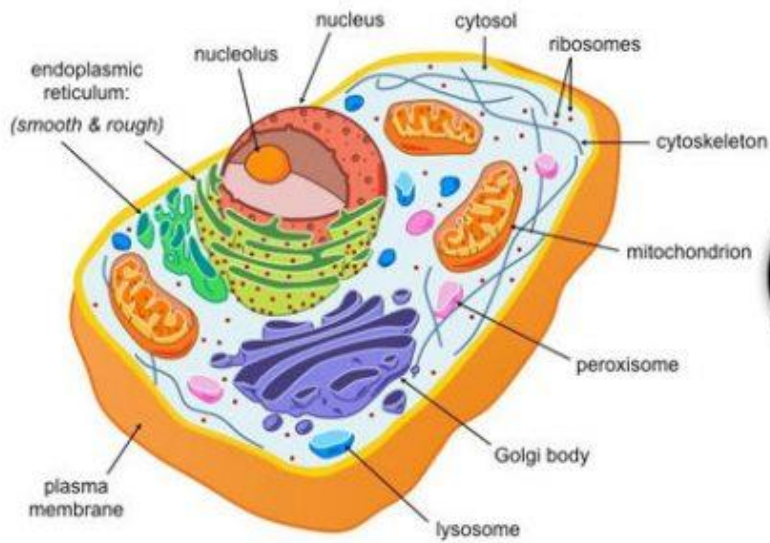
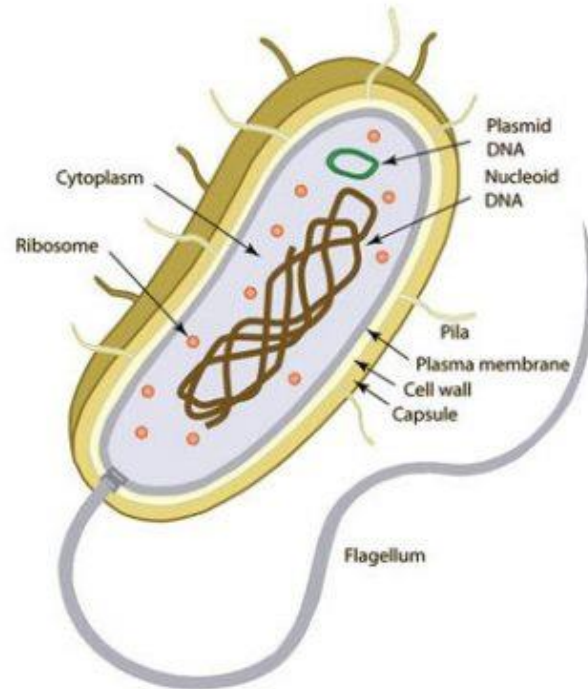


FIGURE 1-7 Eukaryotic cell structure. Schematic illustrations of the two major types of eukaryotic cell: (a) a representative animal cell and (b) a representative plant cell. Plant cells are usually 10 to 100 μm in diameter—larger than animal cells, which typically range from 5 to 30 μm . Structures labeled in red are unique to either animal or plant cells.



VS



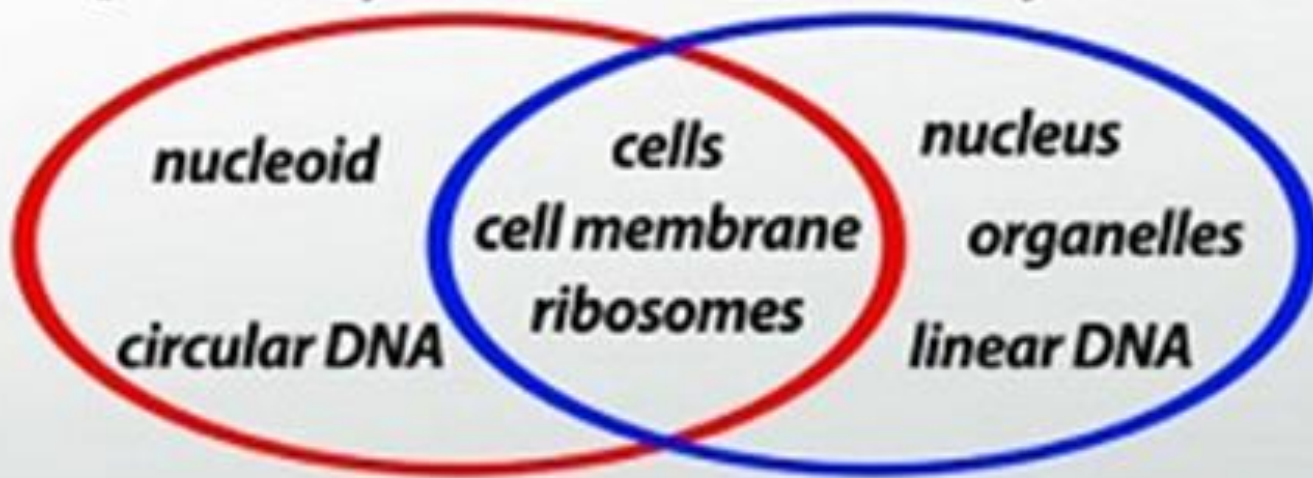
Eukaryotic Cell vs. Prokaryotic Cell



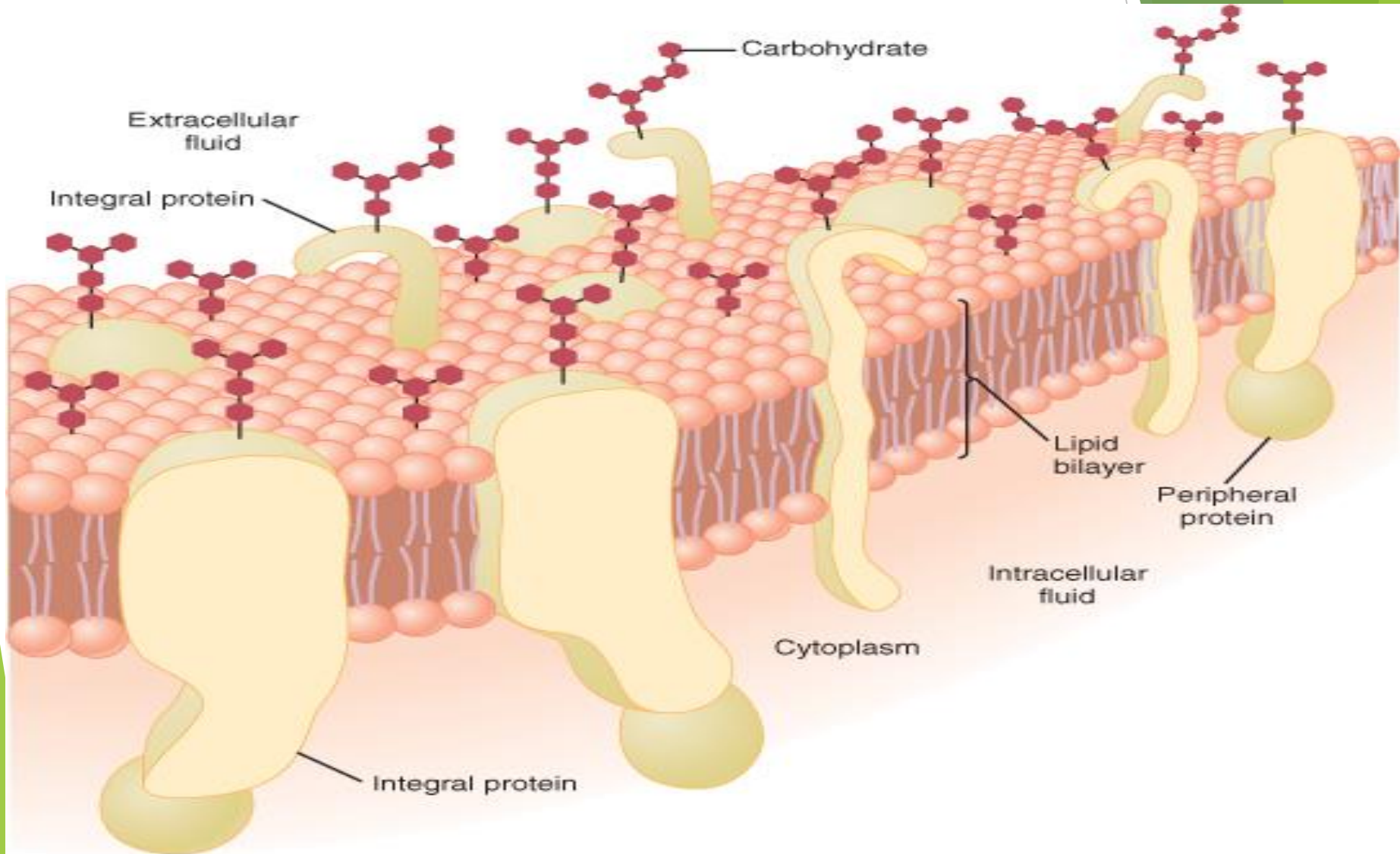
LESSON SUMMARY

prokaryotes

eukaryotes



Cell Membrane



Cytoplasm and Its Organelles

- ▶ The cytoplasm is filled with both minute and large dispersed particles and organelles.
- ▶ **Cytosol:** clear fluid portion ; contains mainly dissolved proteins, electrolytes, and glucose.
- ▶ Dispersed in the cytoplasm are neutral fat globules, glycogen granules, ribosomes, secretory vesicles.
- ▶ and five especially important organelles: the endoplasmic reticulum, the Golgi apparatus, mitochondria, lysosomes, and peroxisomes.

Endoplasmic reticulum

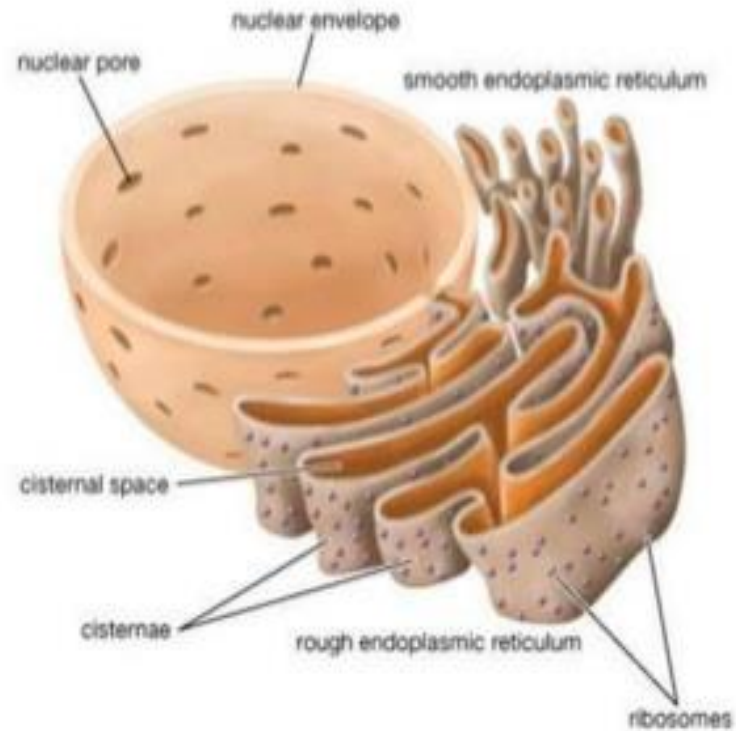
Endoplasmic Reticulum Structure

Rough endoplasmic reticulum (RER)

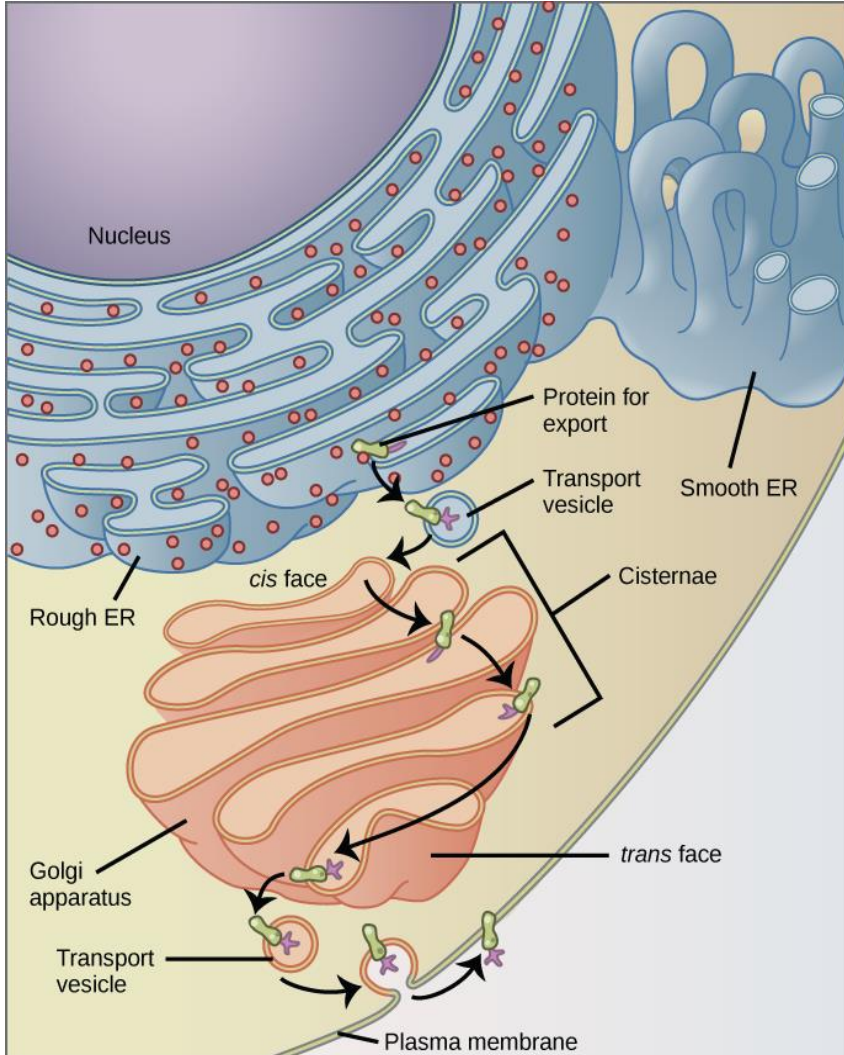
1. bound ribosomes are attached to RER
2. synthesize proteins

Smooth endoplasmic reticulum (SER)

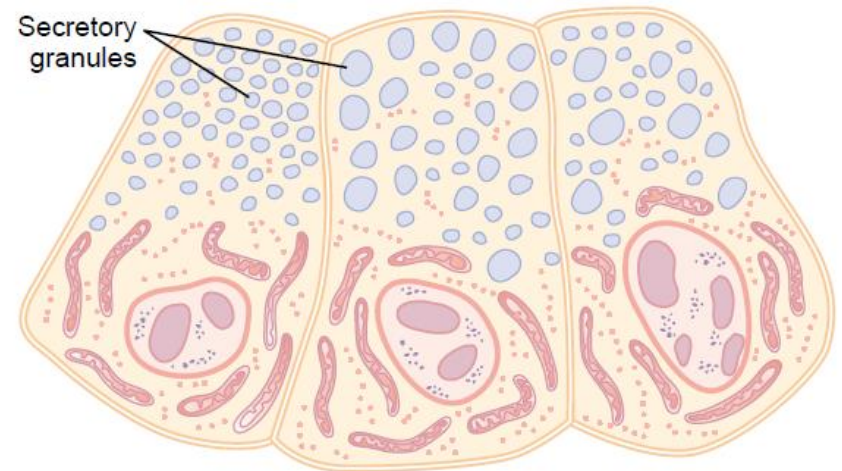
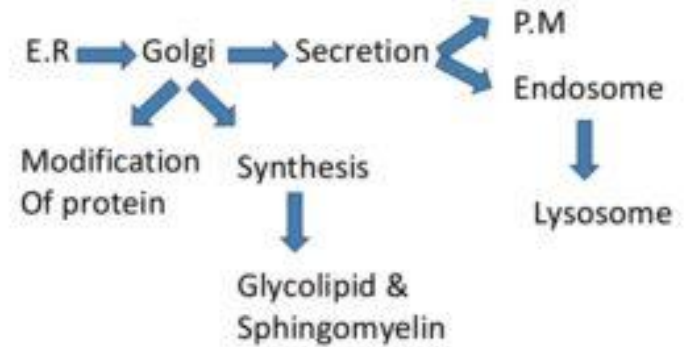
1. synthesize lipids and steroids
2. metabolize carbohydrates and steroids
3. regulate calcium concentration, drug detoxification, and attachment of receptors on cell membrane proteins



Golgi Apparatus

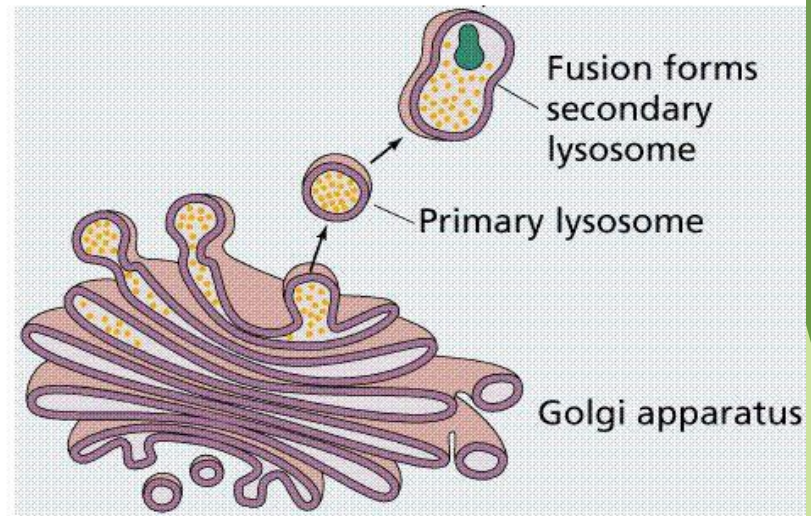


Functions of the Golgi:

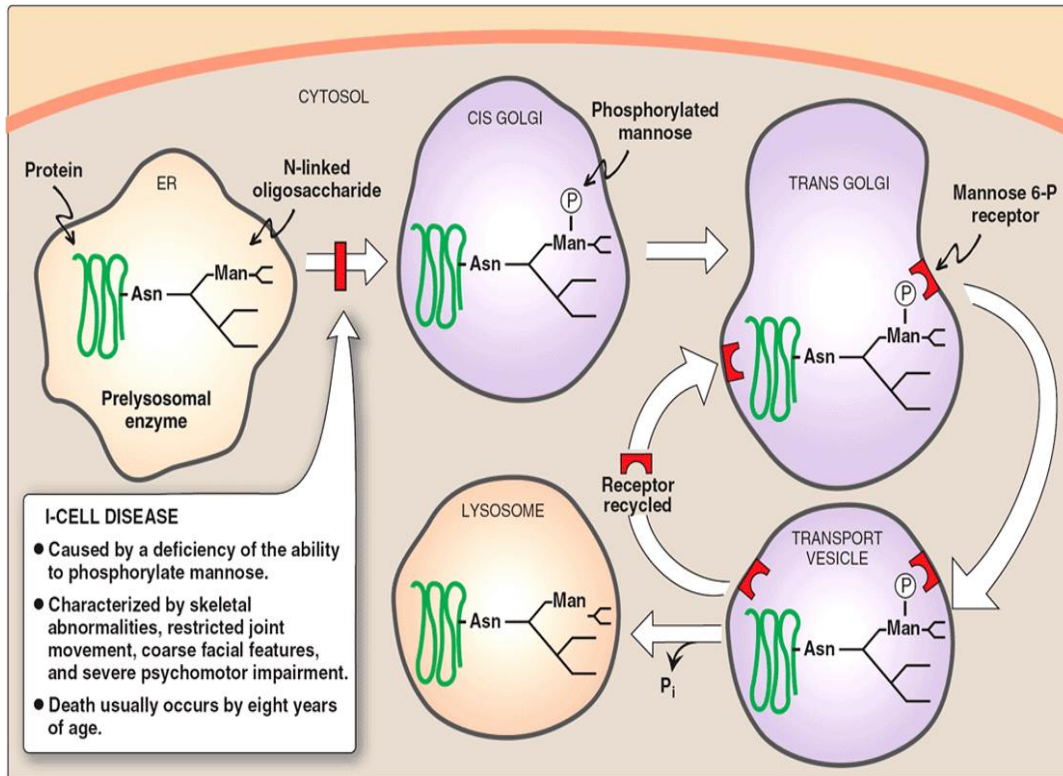


LYSOSOMES

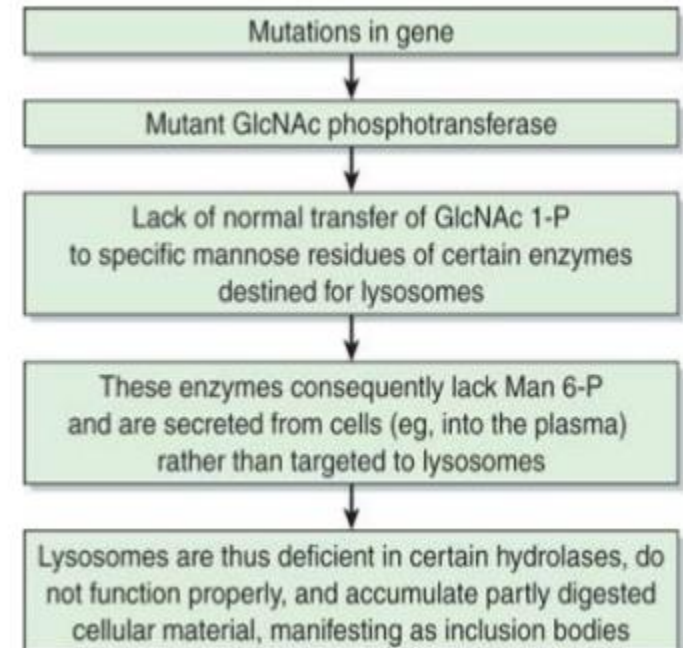
- Structure
 - ▣ Spherical organelles
 - ▣ Contain enzymes
- Function
 - ▣ Digestion
 - Organic molecules
 - Old organelles
 - Foreign substances
- Cell Type
 - ▣ Eukaryotic Cells
 - ▣ Plant and Animal Cells

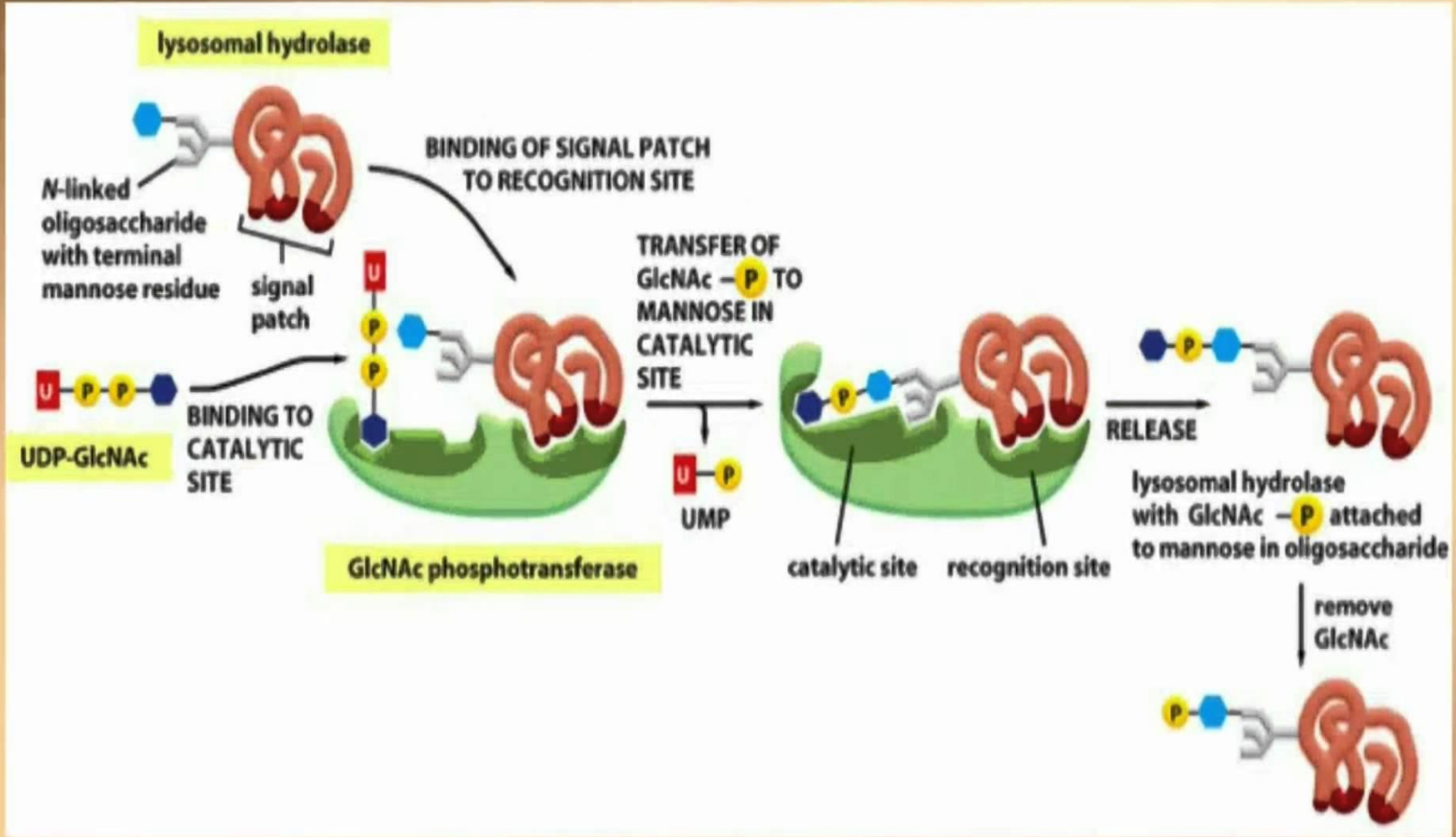


I Cell Disease



I-Cell Disease:





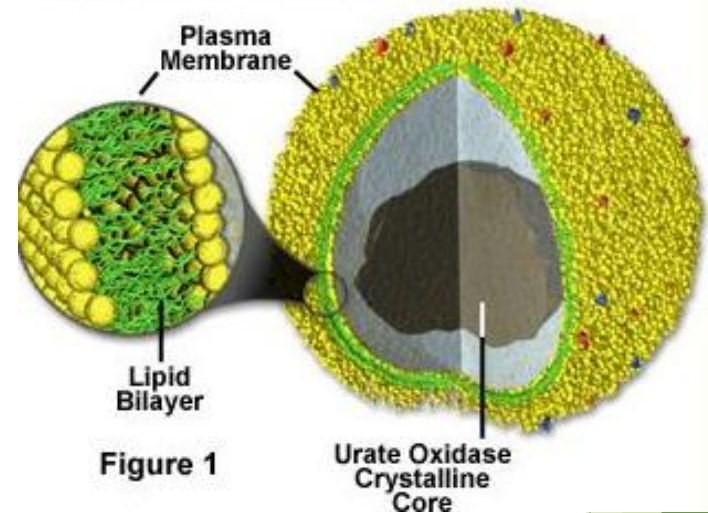
Peroxisomes

- ▶ Self replicative

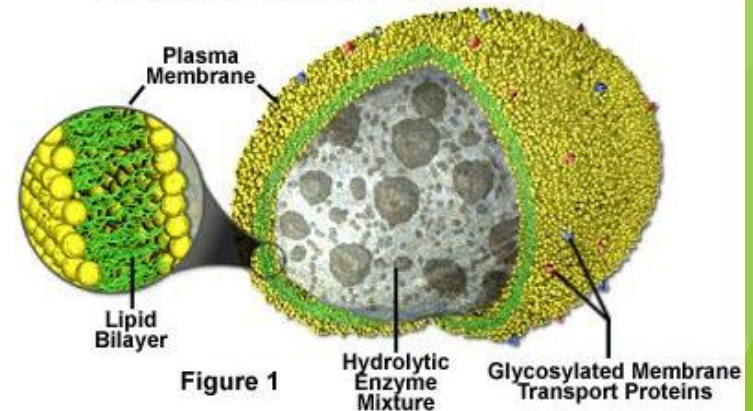
Peroxisomes –are single membrane cellular organelle,also called microbodies

Catalase and peroxidase: the enzymes of peroxisomes destroy unwanted peroxides & other free radicals

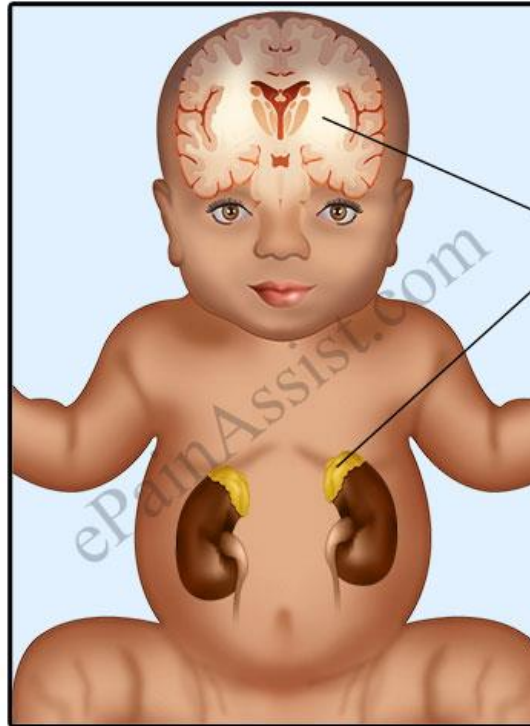
Anatomy of the Peroxisome



Anatomy of the Lysosome



PBD



Zellweger Spectrum Disorders

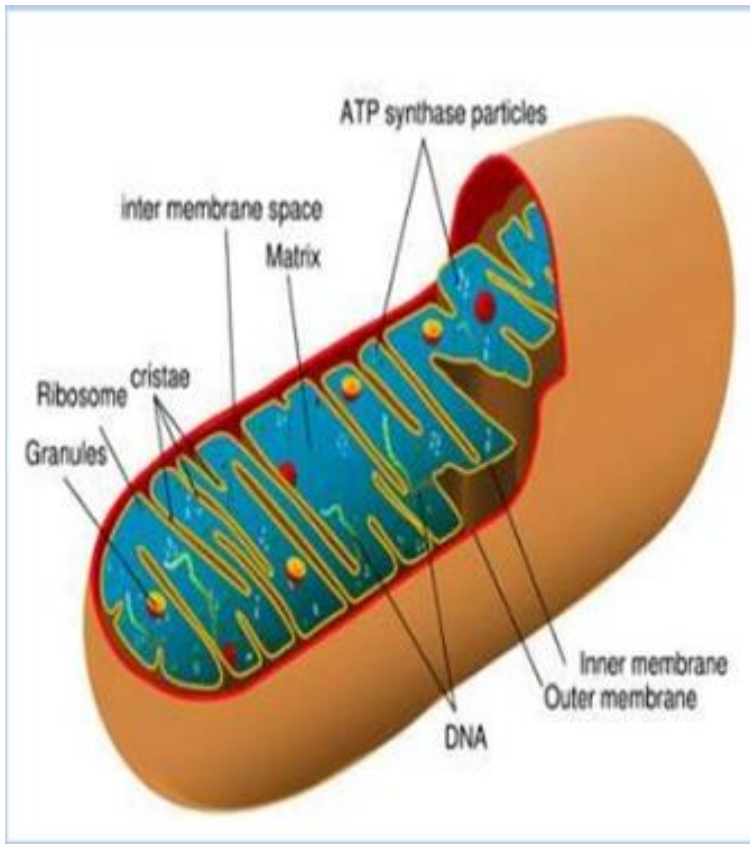
- Adrenoleukodystrophy damage the white matter of the brain and impairs the adrenal glands

“Children may show delayed development but not have vision and hearing problems until adulthood”

For More Information,
Visit: www.epainassist.com

Zellweger syndrome is a rare, autosomal recessive disease characterized by abnormalities of the liver, kidney, brain, and skeletal system.

Mitochondria



- Energy conservation
- Cellular respiration
- Oxidation of carbohydrates and lipids
- Urea and heme synthesis

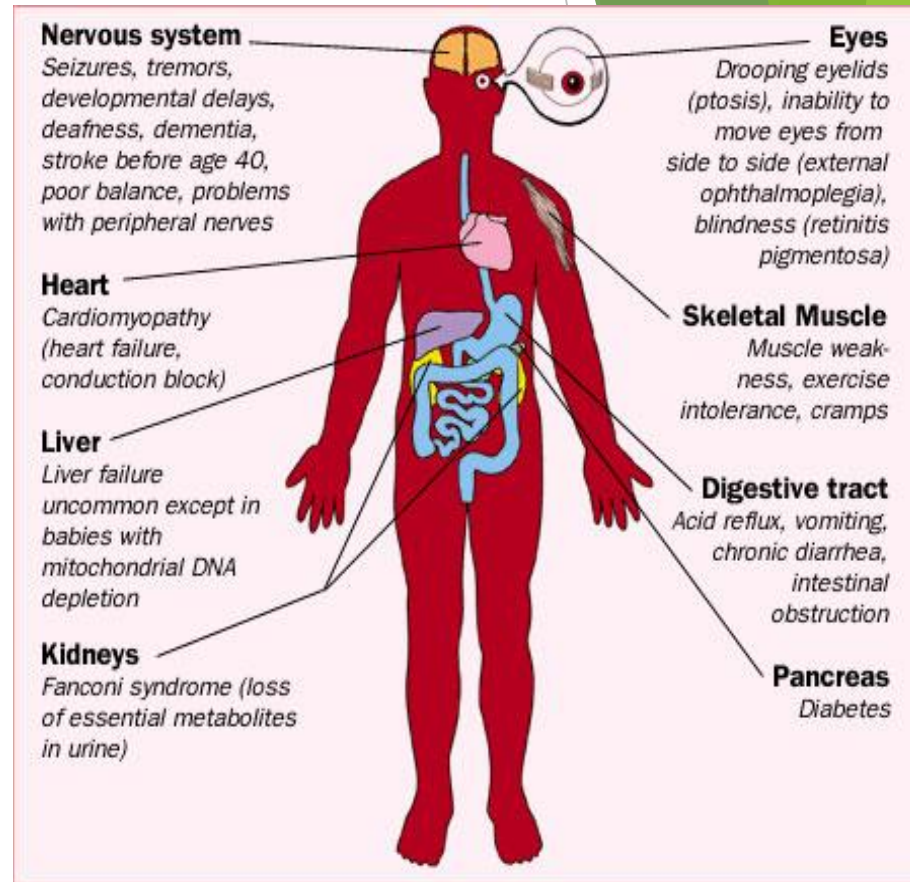
Mitochondrial Diseases: Luft's Disease

- ▶ A disease specifically involving mitochondrial energy transduction was first reported in 1962.
- ▶ A 30-year-old patient was described with general weakness, excessive perspiration, a high caloric intake without increase in body weight, and an excessively elevated basal metabolic rate. It was demonstrated that the patient had a defect in the mechanism that controls mitochondrial oxygen utilization. The condition is referred to as Luft's disease.
- ▶ Mutations of mtDNA as well as nuclear DNA lead to genetic diseases or due to free radical (superoxides) formation which can damage mtDNA.

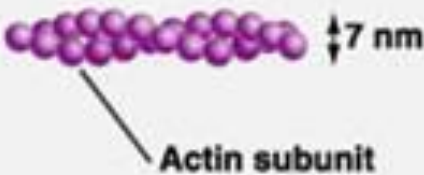


Mitochondrial Disorders

Table. Recognizable syndromes of mitochondrial dysfunction.

Syndrome and features	Genetics
Leigh syndrome Neonatal subacute encephalopathy with bilateral symmetric midbrain and basal ganglia necrosis on MRI	Autosomal recessive, mitochondrial DNA, X-linked
Pearson syndrome Sideroblastic anemia, pancytopenia, exocrine pancreatic insufficiency, and renal tubulopathy	Mitochondrial DNA
MERRF Myoclonic epilepsy with ragged-red fibres on muscle biopsy	Mitochondrial DNA
NARP Neurogenic weakness, ataxia, and retinitis pigmentosa	Mitochondrial DNA
MELAS Mitochondrial encephalopathy with lactic acidosis and stroke-like episodes	Mitochondrial DNA
Alpers syndrome Encephalopathy, seizures, and hepatic dysfunction	Autosomal recessive, autosomal dominant
MNGIE Mitochondrial neurogastronintestinal encephalopathy	Autosomal recessive
Kearns-Sayre syndrome External ophthalmoplegia, pigmentary retinopathy, elevated CSF protein, cerebellar ataxia, and cardiac conduction defects	Mitochondrial DNA; often sporadic
MIDD Maternally inherited diabetes and deafness	Mitochondrial DNA
SANDO Sensory ataxia, neuropathy, dysarthria, and ophthalmoplegia	Autosomal dominant



Filament and tubular structure of cell

	Microfilaments	Intermediate filaments	Microtubules
Protein subunits	Actin	Keratin, vimentin, lamin, others	α -tubulin and β -tubulin dimers
Structure	Two intertwined strands	Fibers wound into thicker cables	Hollow tube
	 <p>7 nm</p> <p>Actin subunit</p>	 <p>10 nm</p> <p>Keratin subunits</p>	 <p>25 nm</p> <p>Tubulin dimer</p>
Functions	<ul style="list-style-type: none"> • maintain cell shape by resisting tension (pull) • motility via pseudopodia • muscle contraction • cell division in animals 	<ul style="list-style-type: none"> • maintain cell shape by resisting tension (pull) • anchor nucleus and some other organelles 	<ul style="list-style-type: none"> • maintain cell shape by resisting compression (push) • motility via flagella or cilia • move chromosomes during cell division • move organelles

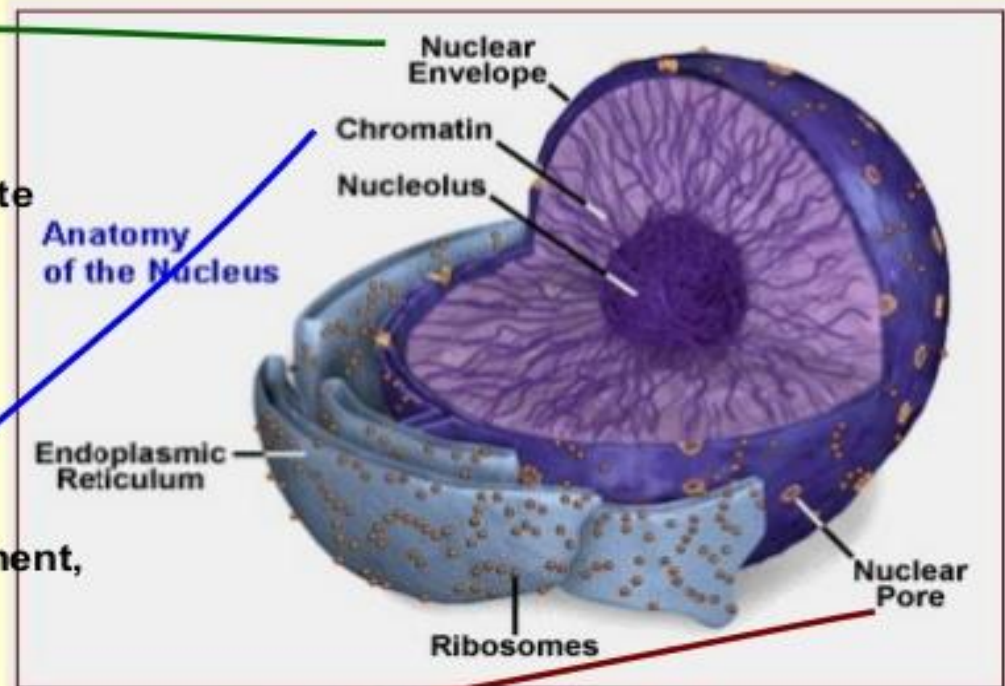
Nucleus

STRUCTURE OF NUCLEUS

Nuclear envelop: double membrane structure, separate cytoplasm from nucleus

Nuclear pores: Present in membrane and function for transport of macromolecules across nuclear envelop

Chromatin: Impotent component, scatered DNA, during cell division it gets organised to chromosomes



Organelle	Function
Cytoplasm	
Cell membrane	<p>Delimits the cell and regulates all substances entering and leaving the cell. Passive diffusion is a continuous exchange of across osmotic or electrochemical gradients. Facilitated diffusion requires a carrier molecule such as insulin to move glucose into the cell. Active transport is a form of moving molecules into and out of a cell using energy (ATP). Bulk transport involves an engulfment of particles or molecules by formation of vacuoles, a process collectively called endocytosis.</p>
Endoplasmic Reticulum: (smooth ER and rough ER)	<p>sER-Lipid biosynthesis, detoxification, intracellular transport. rER-Contains ribosomes for protein synthesis, and extra cellular transport.</p>
Golgi Apparatus	<p>Packages the cell's secretory products into vacuoles for transport out of the cell. The golgi is like the post office of the cell, it receives cellular products, packages and "mails" them to appropriate extra cellular locations</p>
Lysosomes	<p>Contain hydrolytic enzymes that degrade substances form engulfment by endocytosis. These materials may be recycled or utilized for the maintenance of the cell.</p>
Mitochondrion	<p>Often called the powerhouse of the cell. It is the organell that is responsible for providing the energy needs of the cell by catabolism of glucose to regenerate ATP. To perform its many functions the mitochondria need oxygen taken from the air we breathe.</p>
Nucleus	
Nuclear membrane	<p>A double layered envelope that surrounds the nucleus enclosing the cell's DNA. The nucleus contains pores through which copies of the DNA called mRNA communicates with the cytoplasm of the cell.</p>
Nucleoli	<p>Sites within the nucleus where ribosomal rRNA is synthesized and ribosomal subunits are assembled for transport to the cytoplasm.</p>