

What is a cell?

Cell is the Structural and Functional unit of all organisms.

CELL THEORY

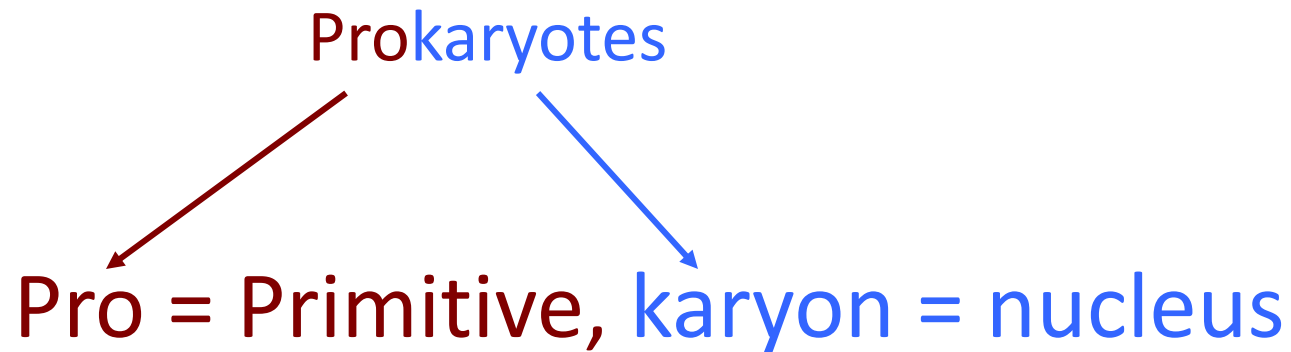
All living things are composed of cells and their products.

All cells arise from preexisting cells.

All cells are basically alike in composition and metabolic activities.

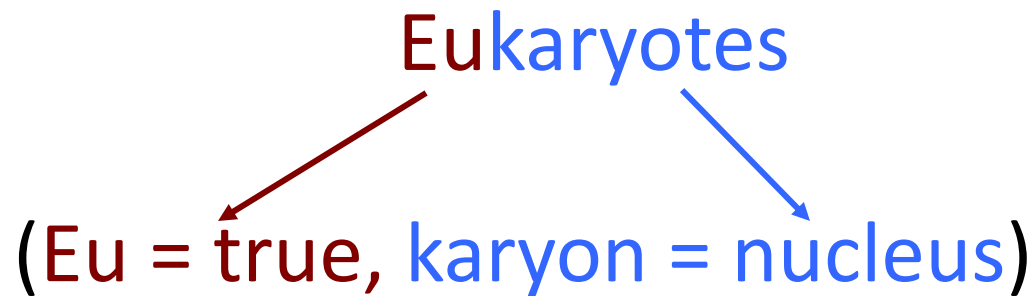
The function of an organism as a whole is the outcome of the activities and interactions of the constituent cells.

Basic Cell Plan



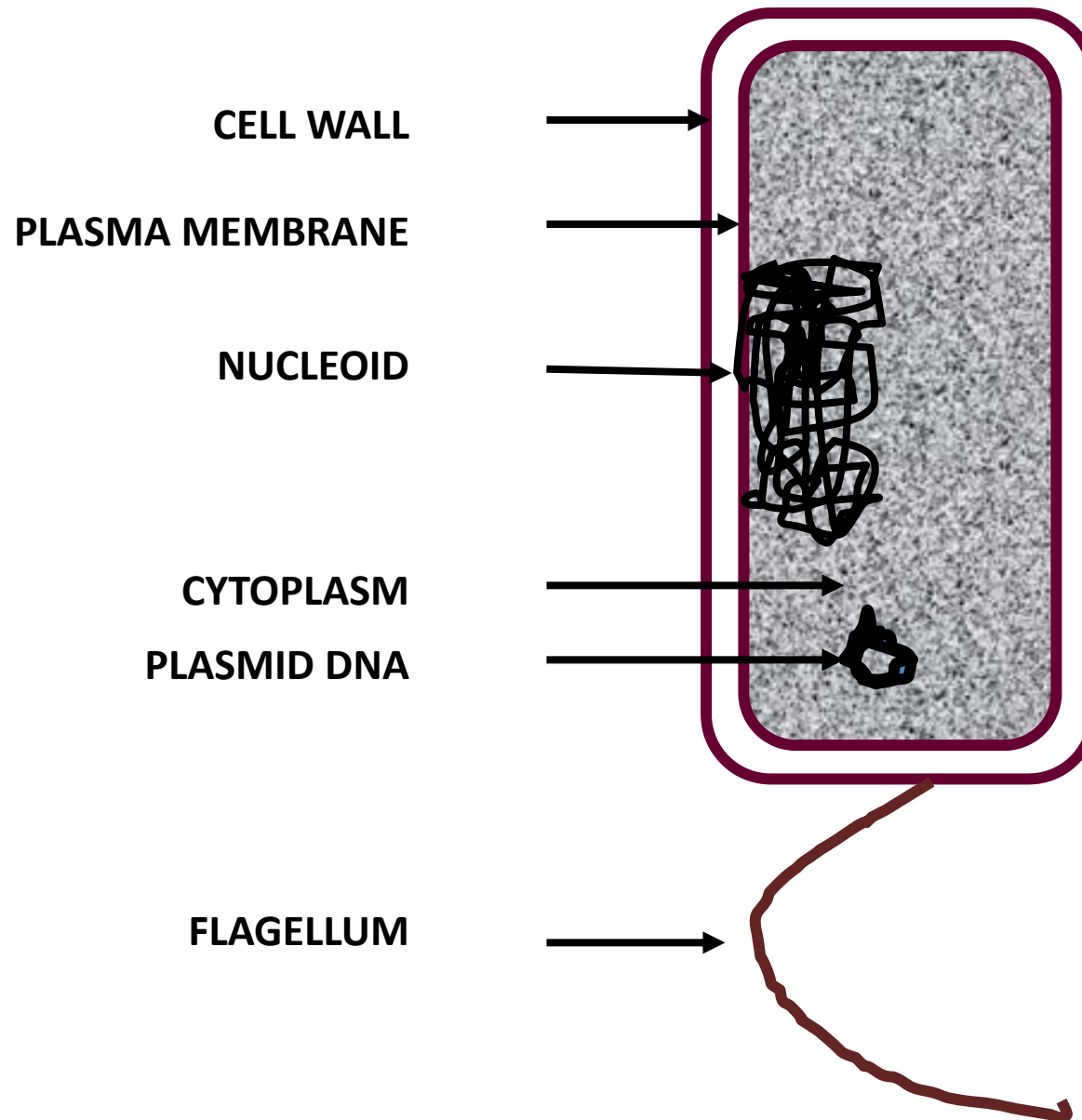
- Contain neither nucleus or membrane-bound organelles
- Archaeobacteria and Monera

Basic Cell Plan



- Contain double membrane nucleus and membrane-bound organelles
- Protista, Fungi, Plants and Animals

PROKARYOTIC BACTERIAL CELL



Cytoplasm Contents

The cytoplasm consists of water, nutrients and important biomolecules necessary for metabolism, growth and reproduction. These include:

& Carbohydrates

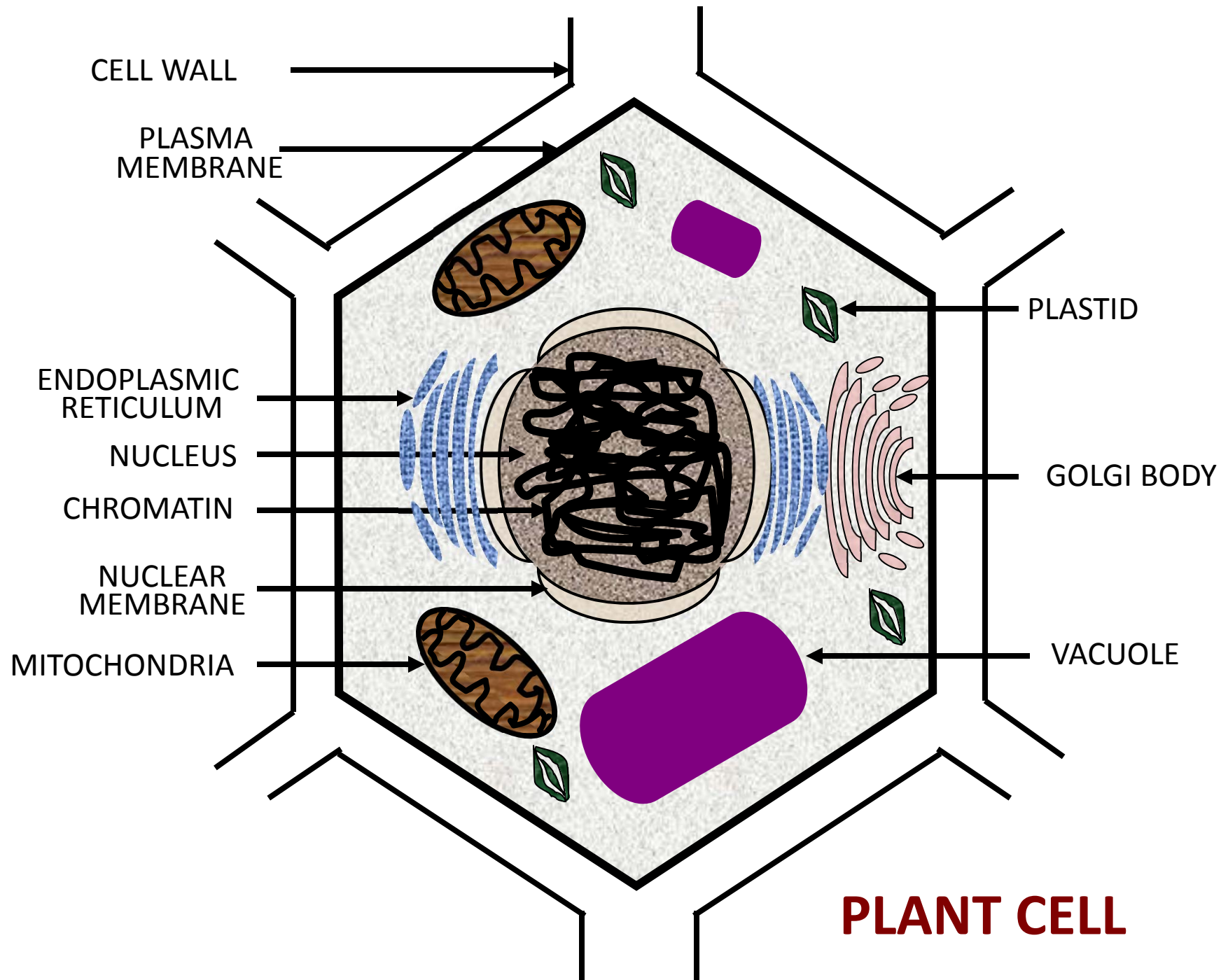
& Fatty acids

& Proteins – Primary, Secondary and Tertiary Structures

Enzymes – proteins that can catalyze biochemical reactions

& RNA – ribonucleic acid – messenger RNA (mRNA); transfer RNA (tRNA); ribosomal RNA (rRNA)

& Plasmids – nonchromosomal genetic material (DNA)



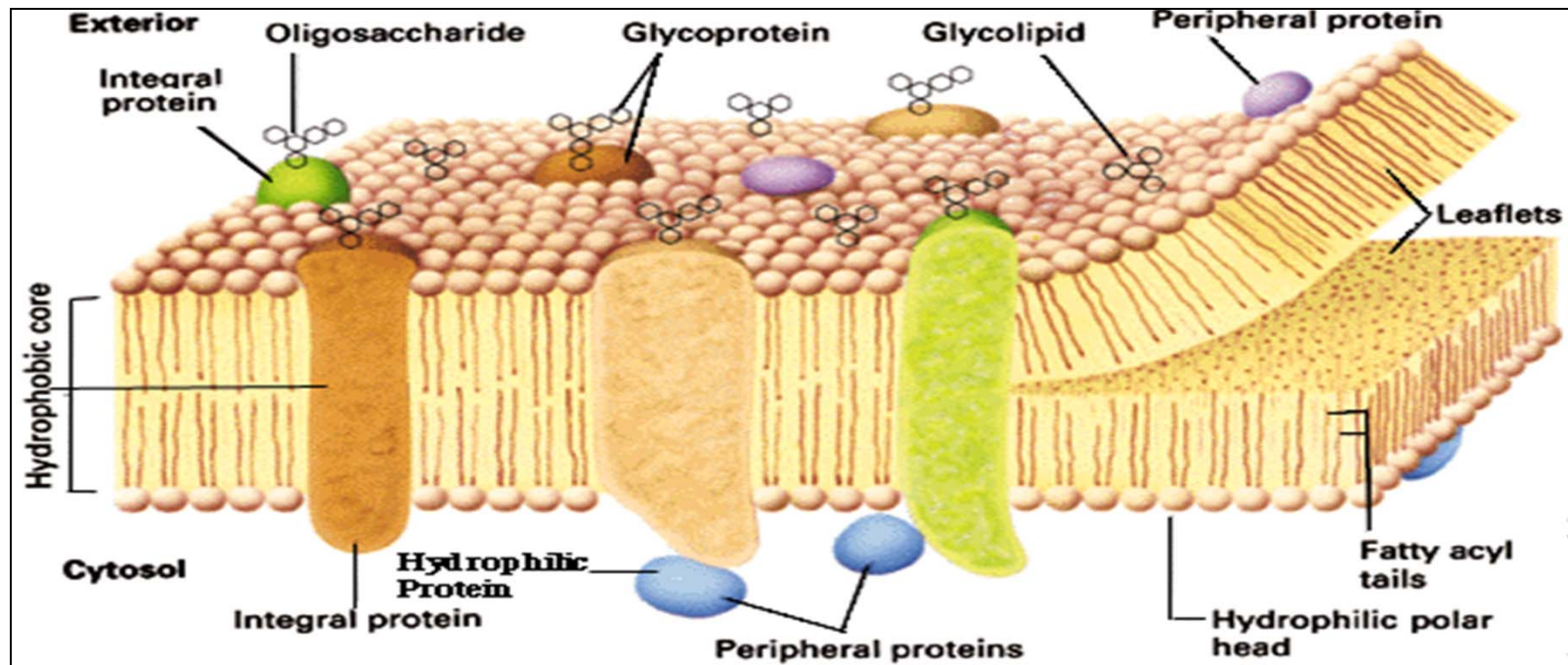
Differences b/w Plant & Animal Cells

	Animal Cell	Plant Cell
Cell wall:	Absent	Present
Shape:	Round (irregular shape)	Rectangular (fixed shape)
Vacuole:	One or more small vacuoles (much smaller than plant cells).	One, large central vacuole taking up 90% of cell volume.
Centrioles:	Present in all animal cells	Only present in lower plant forms.
Chloroplast:	Animal cells don't have chloroplasts	Plant cells have chloroplasts because they make their own food
Plastids:	Absent	Present
Plasma Membrane:	only cell membrane	cell wall and a cell membrane
Lysosomes:	Lysosomes occur in cytoplasm.	Lysosomes usually not evident.
Cilia:	Present	It is very rare

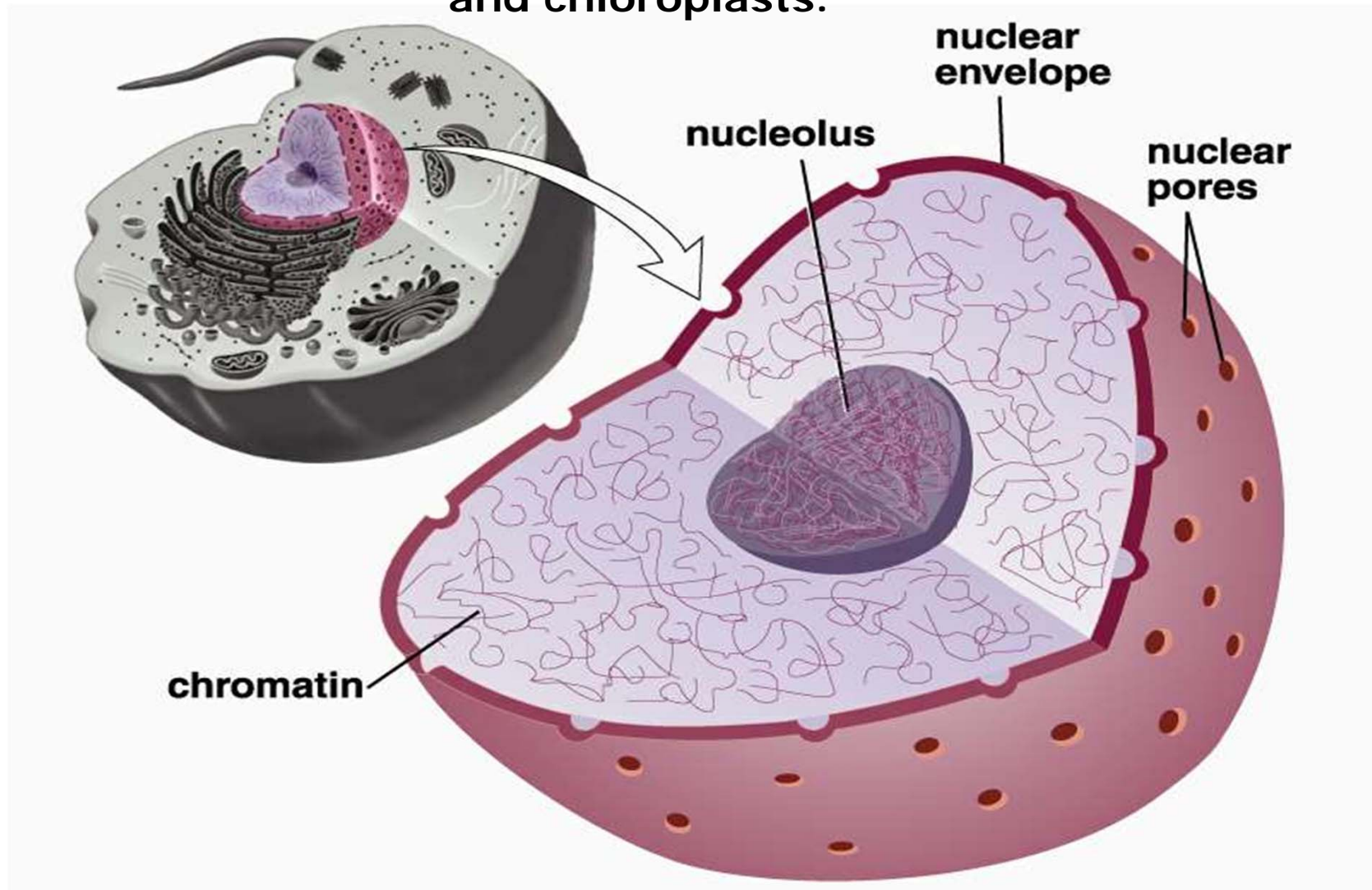
All cells possess a plasma membrane

Plasma membrane has phospholipid bilayer and embedded glycoproteins

- a. Isolates cytoplasm from environment
- b. Regulates molecular movement into and out of cell
- c. Interacts with other cells/environment



The nucleus is eukaryotic cell's genetic library which contains most of the genes. Some genes are located in mitochondria and chloroplasts.



The nucleus is separated from the cytoplasm by a double membrane. Space between membranes is called the nuclear envelope (NE).

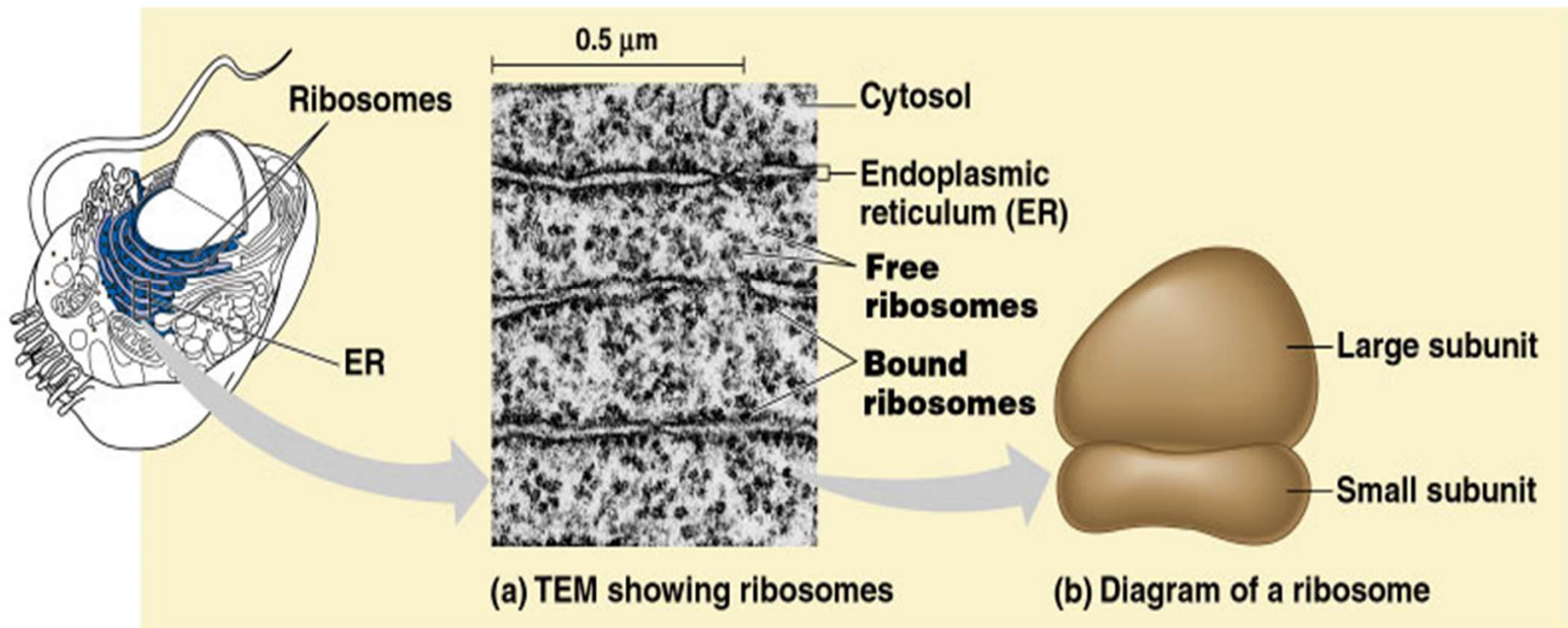
- **chromatin**

- DNA and associated proteins within the nucleus organized into fibrous material.
- In a normal cell chromatin appears as diffuse mass.

- **chromosomes**

- When the cell prepares to divide, the chromatin fibers coil up to be seen as separate structures.
- A typical human cell has 46 chromosomes, but sex cells (eggs and sperm, or gametes) have only 23 chromosomes.

- The nucleus **directs protein synthesis** by synthesizing messenger RNA (mRNA).
 - The mRNA travels to the cytoplasm and combines with ribosomes to translate its genetic message into the primary structure of a specific polypeptide.



Endoplasmic reticulum (ER)

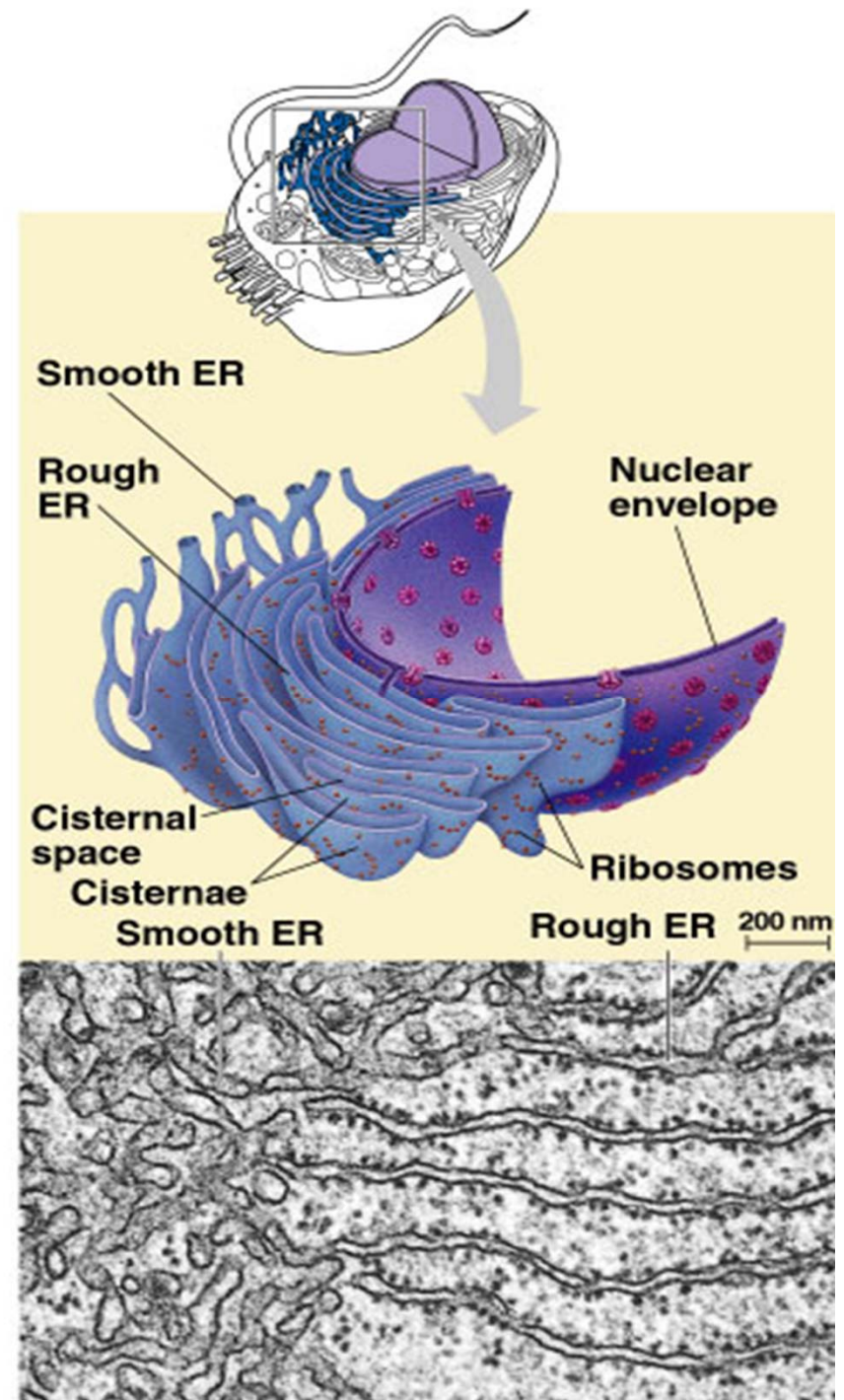
- Manufactures membranes.
- Performs a diversity of biosynthetic functions.
- **Smooth ER** looks smooth because it lacks ribosomes.
- **Rough ER** looks rough because bound ribosomes are attached to the outside, including the outside of the nuclear envelope.

Rough ER is also a membrane factory.

- Membrane bound proteins are synthesized directly into the membrane.
- Enzymes in the rough ER also synthesize phospholipids from precursors in the cytosol.

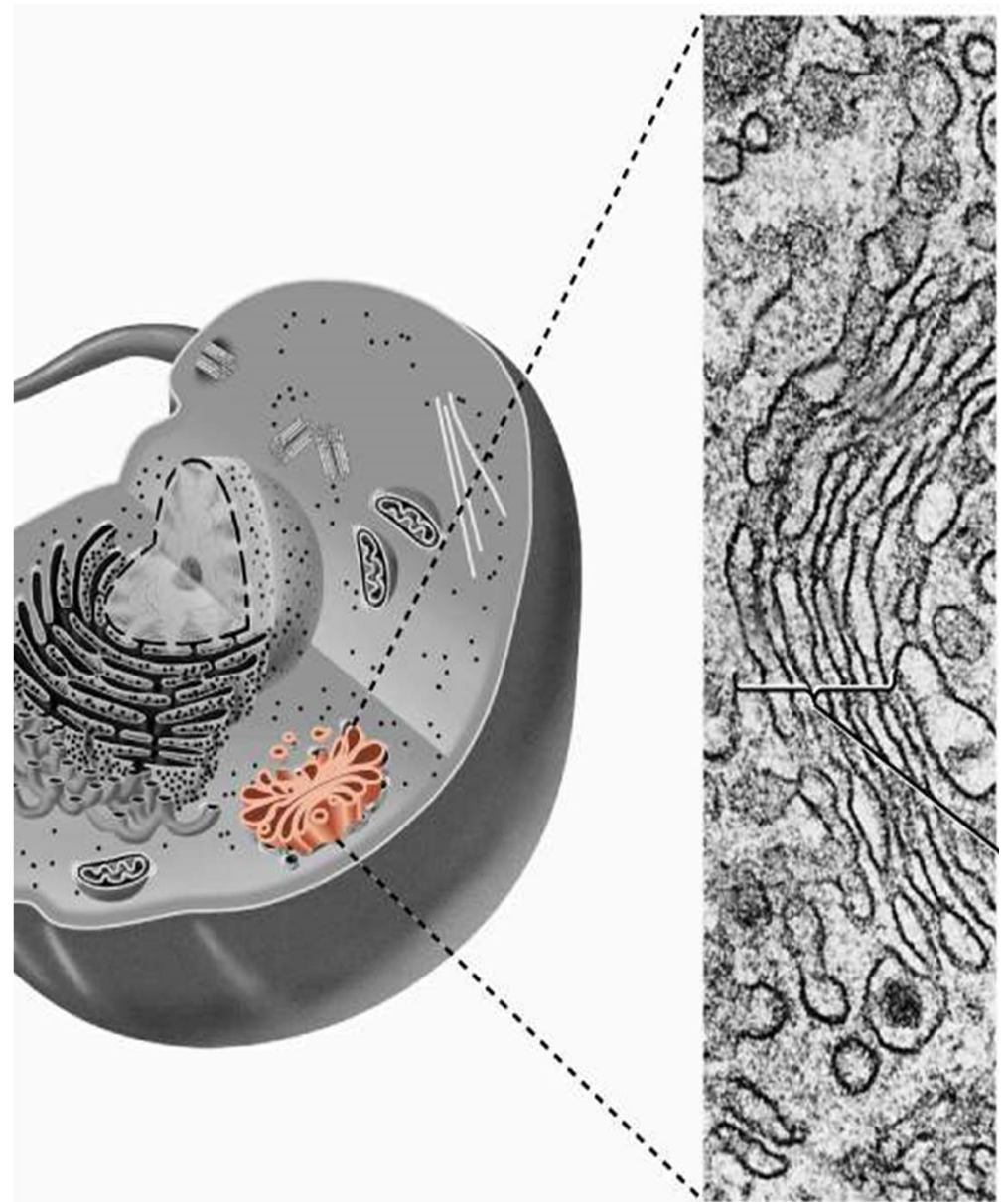
Enzymes of smooth ER synthesize lipids, including oils, phospholipids, and steroids.

- These includes the sex hormones of vertebrates and adrenal steroids.
- Enzymes in the smooth ER of the liver help detoxify drugs and poisons.



Golgi Complex

- A center of manufacturing, warehousing, sorting, and shipping.
- packages proteins inside the cell before they are sent to their destination;
- it is particularly important in the processing of proteins for secretion



MITOCHONDRIA & CHLOROPLASTS

- ORGANELLES THAT CONVERT ENERGY TO FORMS THAT CAN BE USED BY THE CELL
- NOT PART OF THE ENDOMEMBRANE SYSTEM
- CONTAIN THEIR OWN DNA
- CONTAIN THEIR OWN RIBOSOMES
- SEMIAUTONOMOUS ORGANELLES
(GROW AND “REPRODUCE” WITHIN THE CYTOPLASM)

ORIGIN

***ENDOSYMBIOSIS: PRIMITIVE EUKARYOTIC CELL “ATE” A BACTERIA
THAT PROVIDED THE FUNCTION***

MITOCHONDRIA : THE POWERHOUSE OF THE CELL

SITES OF CELLULAR RESPIRATION

Oxidizing the products of cytoplasmic metabolism and convert the energy so liberated into adenosine triphosphate (**ATP**), the energy currency of the cell.

the only place in the cell where energy generation from sugars, fats and other fuels with help of oxygen occurs.

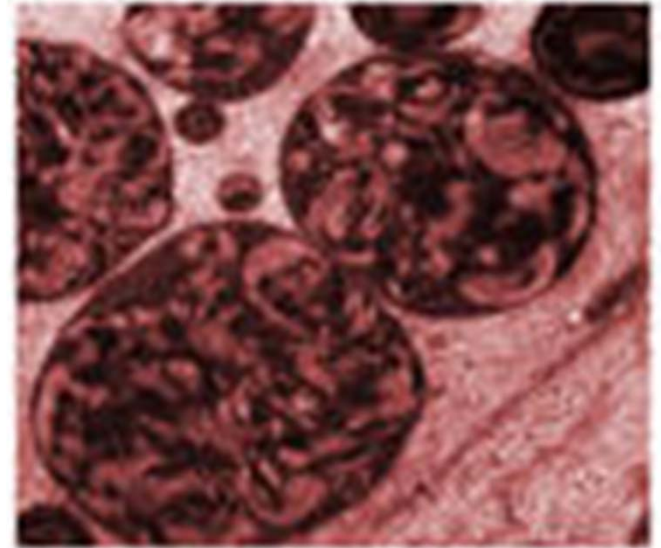
CHLOROPLAST : THE PHOTOSYNTHETIC FACTORIES

- Chloroplasts are the photosynthetic organelles in plant.
- They trap light energy and convert it partly into ATP but mainly into certain chemically reduced molecules that, together with ATP, are used in the first steps of carbohydrate production.

- **lysosome**

a membrane-bound sac of hydrolytic enzymes that digests macromolecules.

- Lysosomal enzymes can hydrolyze proteins, fats, polysaccharides, and nucleic acids.
- These enzymes work best at pH 5.



- Proteins in the lysosomal membrane pump hydrogen ions from the cytosol to the lumen of the lysosomes.
- The lysosomes creates a space where the cell can digest macromolecules safely.

BASIC CELL FUNCTIONS

& DNA Replication

& Reproduction

& Protein Synthesis

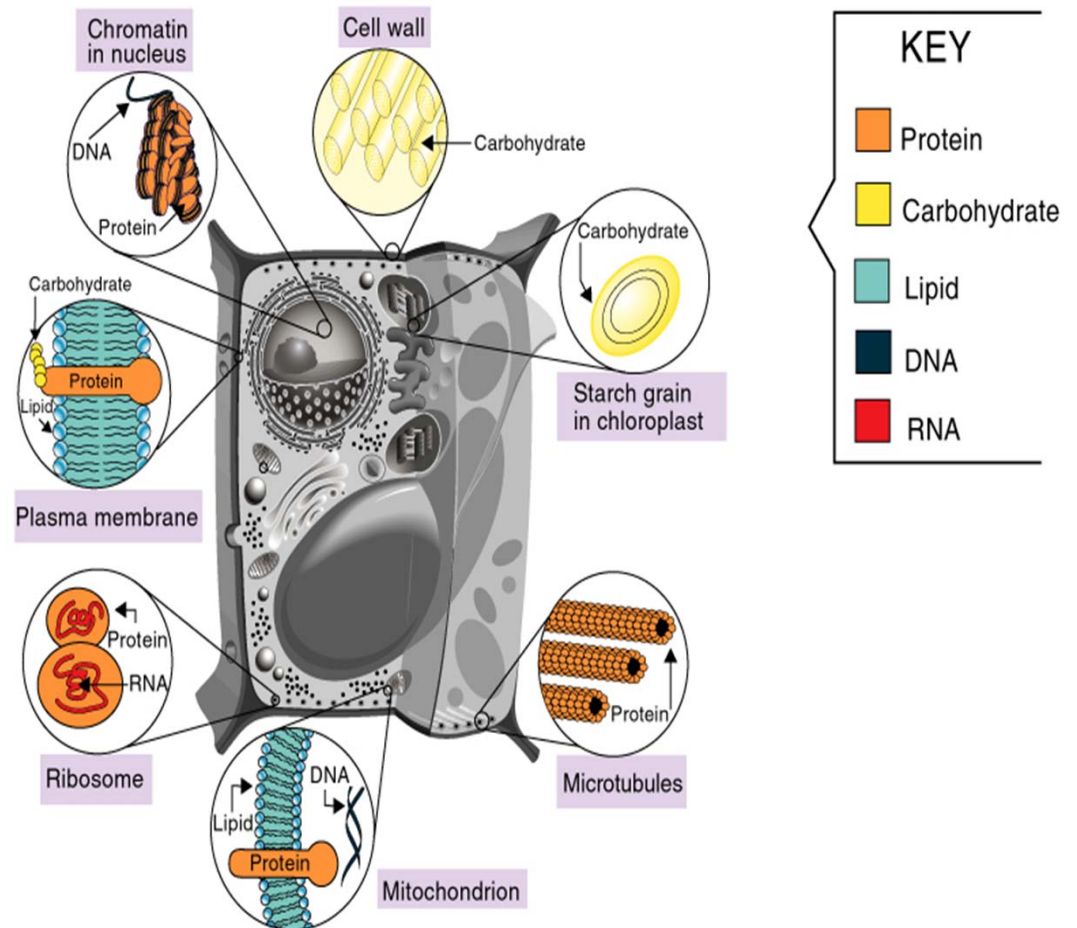
& Cellular Metabolism

& Molecule Transport

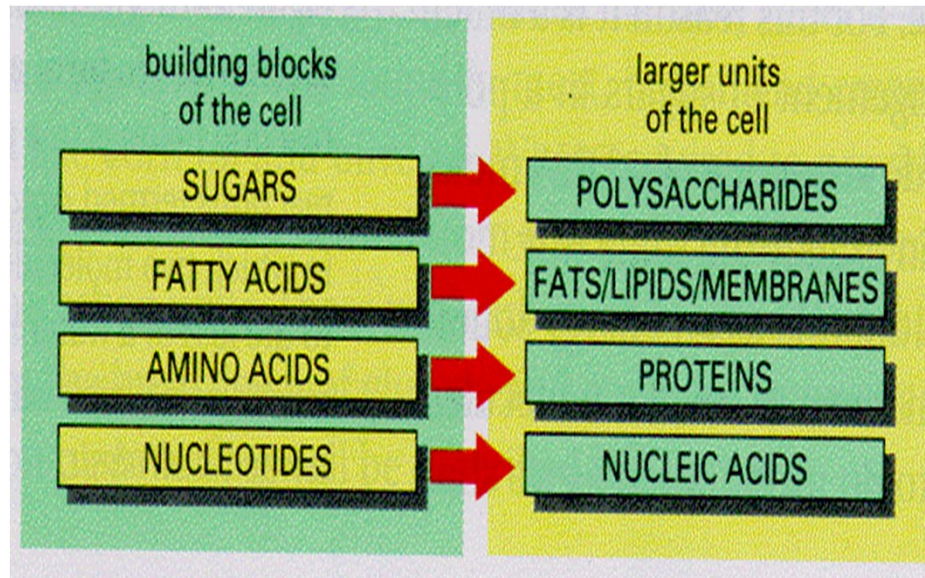
& Cellular Signaling

Classes of macromolecules common to all cells:

- Carbohydrates
- Fats
- Nucleic acids(DNA,RNA)
- Proteins



Macromolecules , their monomers & functions



Functions

Energy source & structural components

Energy storage & structural components

Work horses of the cell, Enzymes, structural proteins, transporters etc

Storage & transmission of genetic information

Gene

Unit of inheritance

A piece of the genetic material that determines the inheritance of a particular characteristic, or group of characteristics.

Genes are carried by chromosomes in the cell nucleus and are arranged in a line along each chromosome.

Every gene occupies a place, or locus, on the chromosome. Consequently, the word *locus* has become loosely associated with the word *gene*.

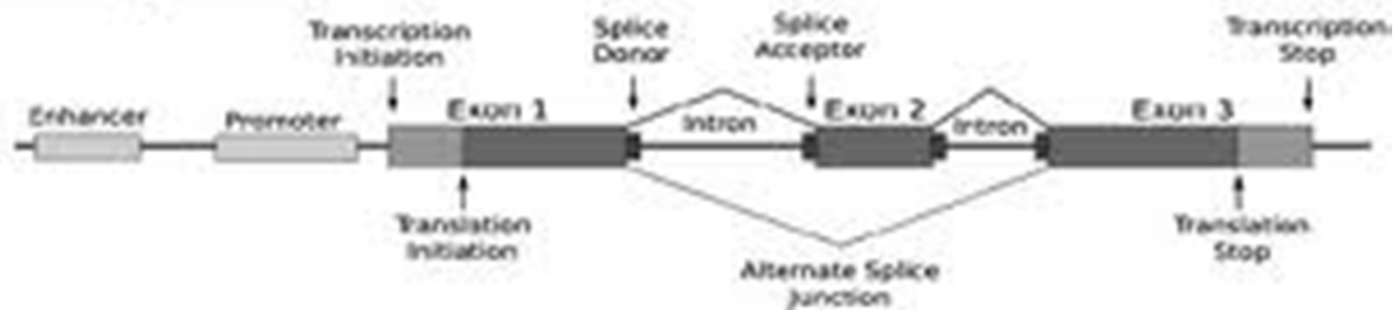
Prokaryotic Genes

A



Eukaryotic Gene

B



GOD AND DNA



Here comes the concept of hereditary material !!!!!

Functions performed by DNA

- Stores genetic information
- Replicates precisely during cell division
- Expressed as phenotype= physical representation (e.g., hair color, type of protein)

Importance of DNA structure

“Structure determines the function”

- How it replicates?
- How its information is utilized?
- How alteration in the primary structure of the DNA (mutation) is kept to a minimum?