

Cell Biology

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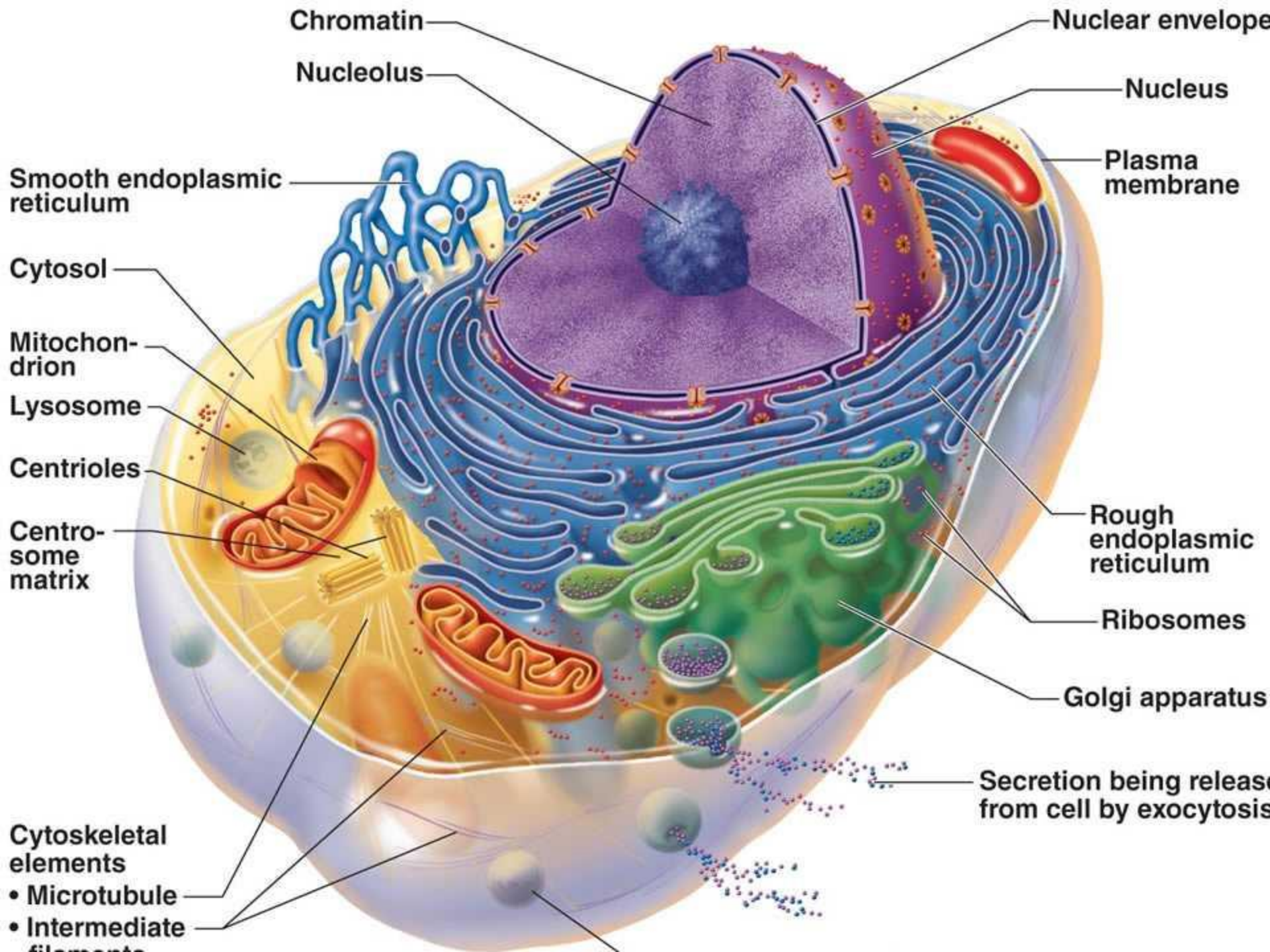
PhD, Neurophysiology

Cell-Introduction

- Smallest functional units of the body
- Grouped together to form tissues, each having a specialized function, e.g. blood, muscle, bone.
- Different tissues are grouped together to form organs, e.g. heart, stomach, brain.
- Organs are grouped together to form systems, that perform particular function that maintains homeostasis and contributes to the health of the individual. E.g. digestive system, cardiovascular system.

The cell

- A cell consists of a cell (plasma) membrane inside which a **nucleus** and **cytoplasm** surrounding the nucleus is present
- Organelles are small organs of the cell embedded in the cytoplasm.
- Have individual and highly specialized functions
- Organelles are enclosed in their own membrane within the cytoplasm.
- Individual cells are too small to be seen through the naked eye.

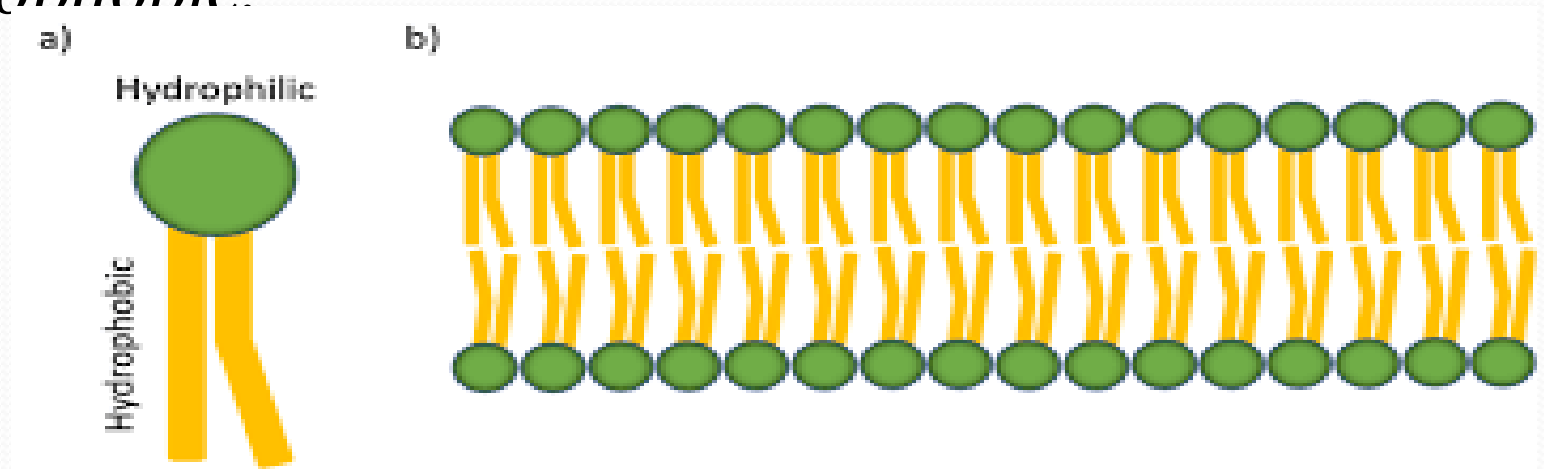



Cell Membrane

- The cell membrane (also called the plasma membrane), which envelops the cell.
- It is a thin, pliable, semipermeable elastic structure only 7.5 to 10 nanometers thick.
- Composed almost entirely of proteins and lipids.
- The approximate composition is:
 - Proteins 55 %.
 - Phospholipids 25 %
 - Cholesterol 13 %
 - Other lipids 4%
 - Carbohydrates 3 %

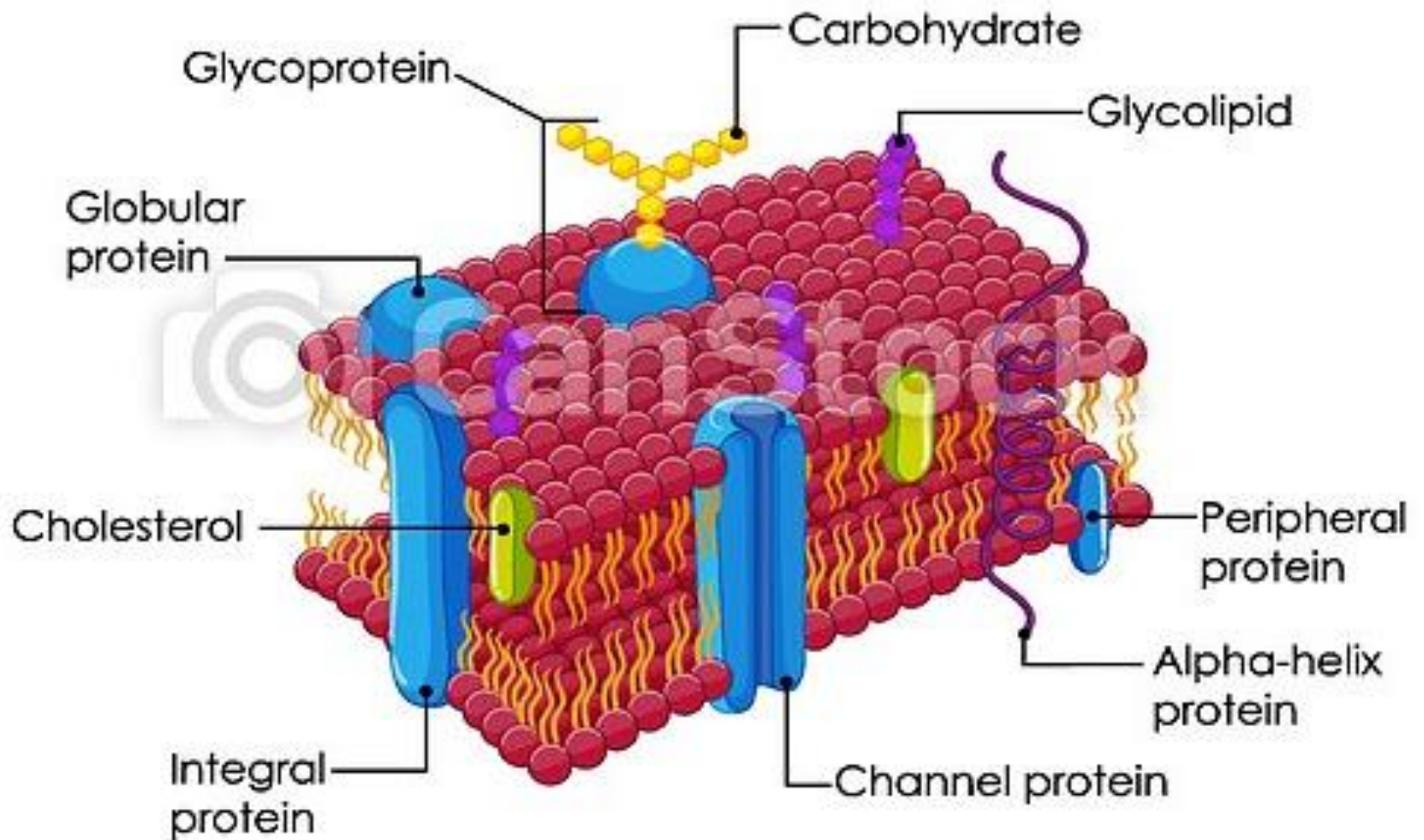
❖ Its basic structure is a *lipid bilayer*, which is a thin, double-layered film of phospholipid molecules embedded in this lipid film large globular protein molecules.

- The phosphate end of each phospholipid molecule is soluble in water; that is, *hydrophilic*.
- The fatty acid end is soluble only in fats; that is, *hydrophobic*.



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- The lipid layer in the middle of the membrane is impermeable to the usual **water-soluble substances**, such as ions, glucose, and urea that enter the cell through protein molecule that extended all the way through the membrane provide a channel .
 - Conversely, **fat-soluble substances**, such as oxygen, carbon dioxide, and alcohol, can penetrate this portion of the membrane with ease.

CELL MEMBRANE



The Functions of Plasma Membrane

1. Protect the cytoplasm and the organelles present in the cytoplasm.
2. Semipermeable that means allow only some substances to pass through it and act as barrier for other substances.
3. Mitochondrial and other waste products from the cell are excreted out the cell membrane.
4. Nutrient are absorbed through the cell membrane.
5. O_2 enter the cell from the blood and the CO_2 leave the cell and enter the blood through the cell membrane.
6. Cell membrane is responsible for the maintenance of shape and size of the cell.

Cytoplasm and Its Organelles

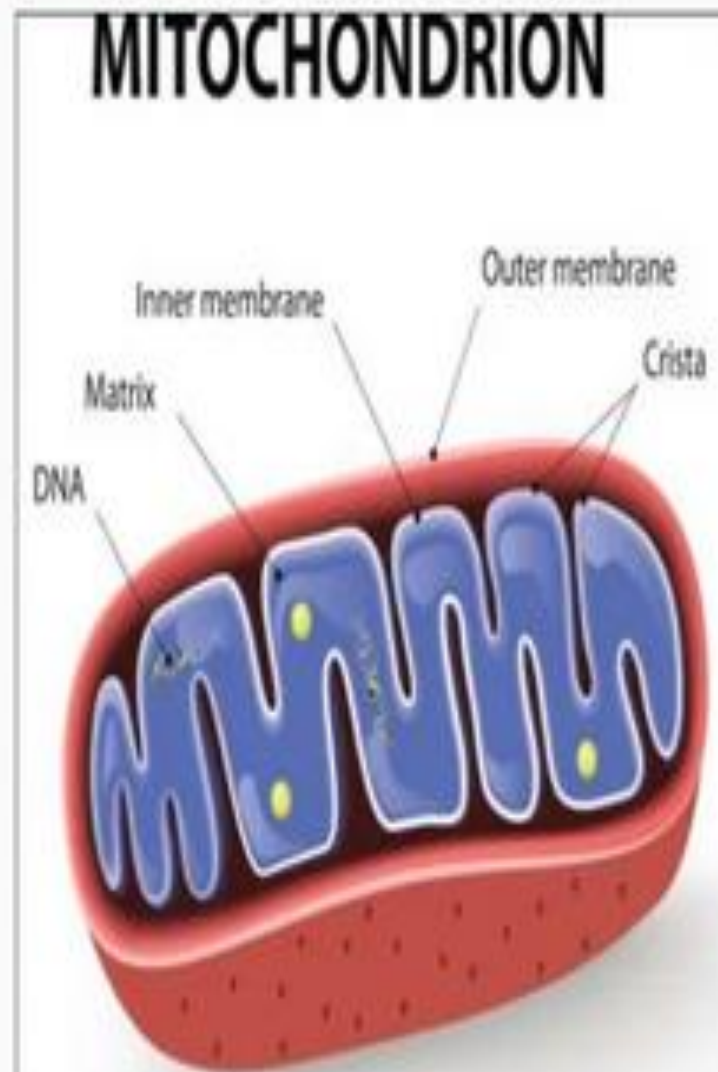
- The cytoplasm is filled with both minute and large dispersed particles and organelles.
- The clear fluid portion of the cytoplasm in which the particles are dispersed is called *cytosol*; this contains mainly dissolved proteins, electrolytes, glucose.
- Six especially important organelles are dispersed in the cytoplasm :
 - The nucleus.
 - Mitochondria
 - The endoplasmic reticulum.
 - The Golgi apparatus..
 - Lysosoms.
 - Peroxisomes.

• Nucleus

- Every cell has a nucleus (except matured erythrocyte).
- Nucleus is the largest organelle inside a nuclear envelope (10-20 micron)
- Nucleus contains body's genetic material (gene)
- The cells with nucleus are called
- **eukaryotes** - cell with nucleus
- **Prokaryote** - cell without nucleus
- **Nucleolus** is present within the nucleus which involves in the manufacture or synthesis and assembly of the components of ribosomes.

Mitochondria

- Mitochondria are membranous, sausage-shaped structures in the cytoplasm
- It is called as power house of the cell
- Involves in aerobic respiration (energy is made available in cell) by synthesizing ATP
- Most active cell types have the greater number of mitochondria e.g. liver, muscle



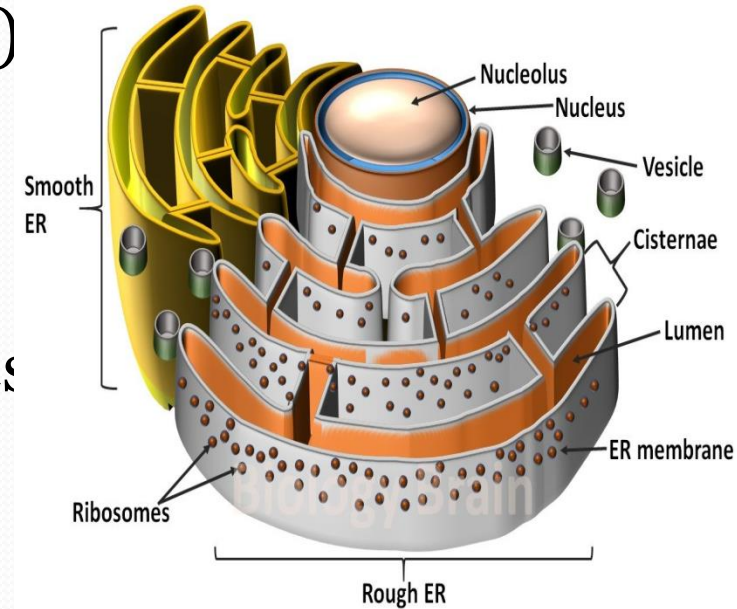
Endoplasmic reticulum(ER)

- Interconnecting membranous canal in the cytoplasm(intracellular highway where the molecules move from one part of the cell to another)

- **ER is consist of two types:**

1. **Rough ER:** covered by ribosomes (The ribosome is the physical structure in the cytoplasm on which protein molecules are actually synthesized).

2. **Smooth ER:** (No ribosomes) synthesize lipid and steroid hormone and associated with detoxification of some drugs.



Golgi apparatus

- Consists of stacks of closely folded flattened membranous sacs
- Proteins move from ER to GA where they are packed into membrane-bound vesicles called **secretory granules**.
- These vesicles move to the plasma membranes and fuse with it, when in need
- The contents then leave the cell by exocytosis



lysosomes

- Type of secretory vesicle with membranous walls formed by GA.
- Contain a variety of enzymes involved in breaking down fragments of organelles and large molecules (RNA, DNA, carbohydrates, proteins) inside the cell into smaller particles
- Lysosomes in WBC contain enzymes that digest foreign material such as microbes

Peroxisomes

- Peroxisomes are similar physically to lysosomes, but they are different in contain oxidases enzymes rather than hydrolases enzymes.
- The oxidases enzymes , such as hydrogen peroxide, are highly oxidizing substances and are used in association with *catalase* (another oxidase enzyme present in large quantities in peroxisomes) to oxidize many substances that might otherwise be poisonous to the cell.



Thank You!

