CELLULAR ORGANELLES

- RIBOSOMES
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- CELL WALL
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- PEROXISOMES
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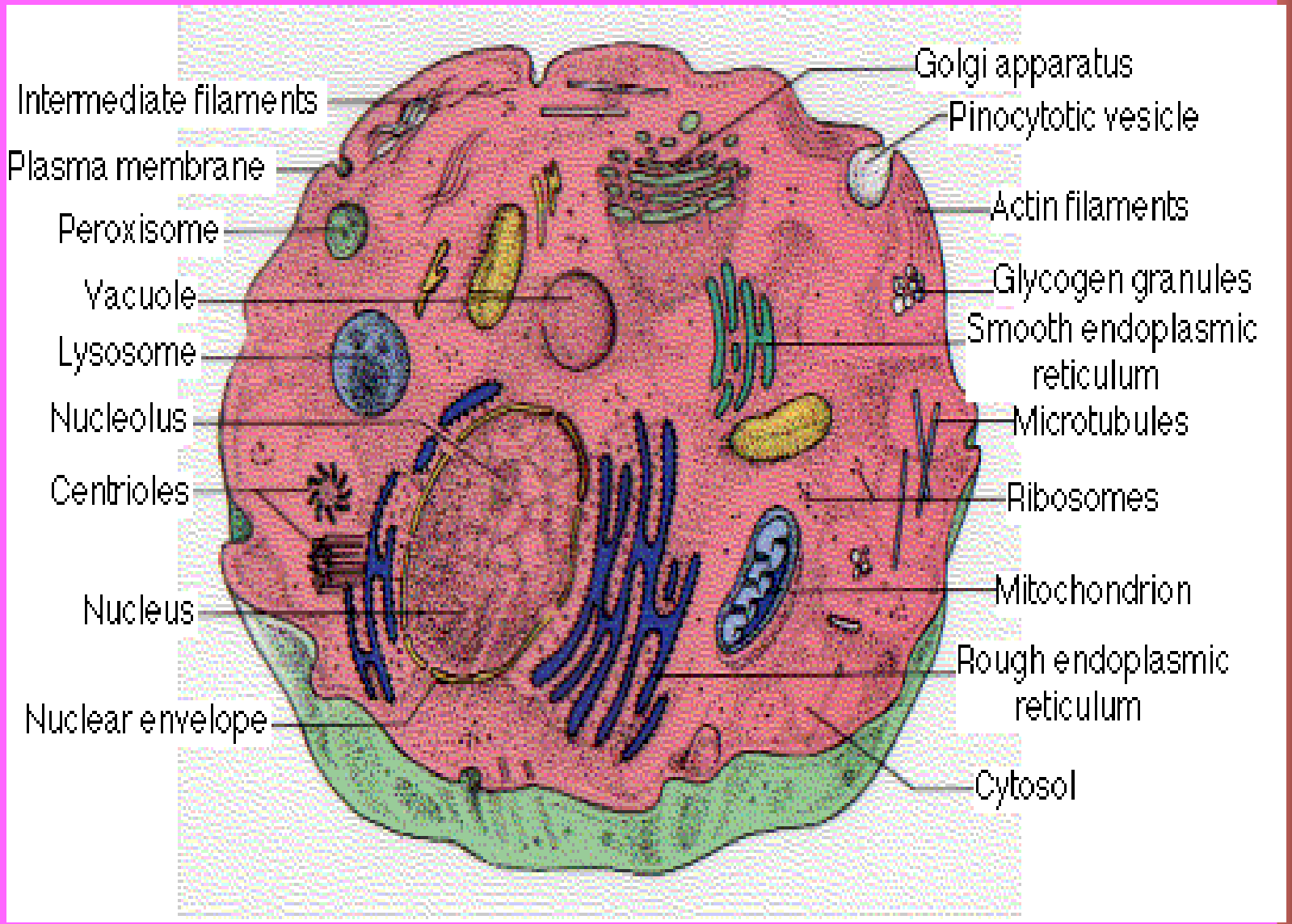
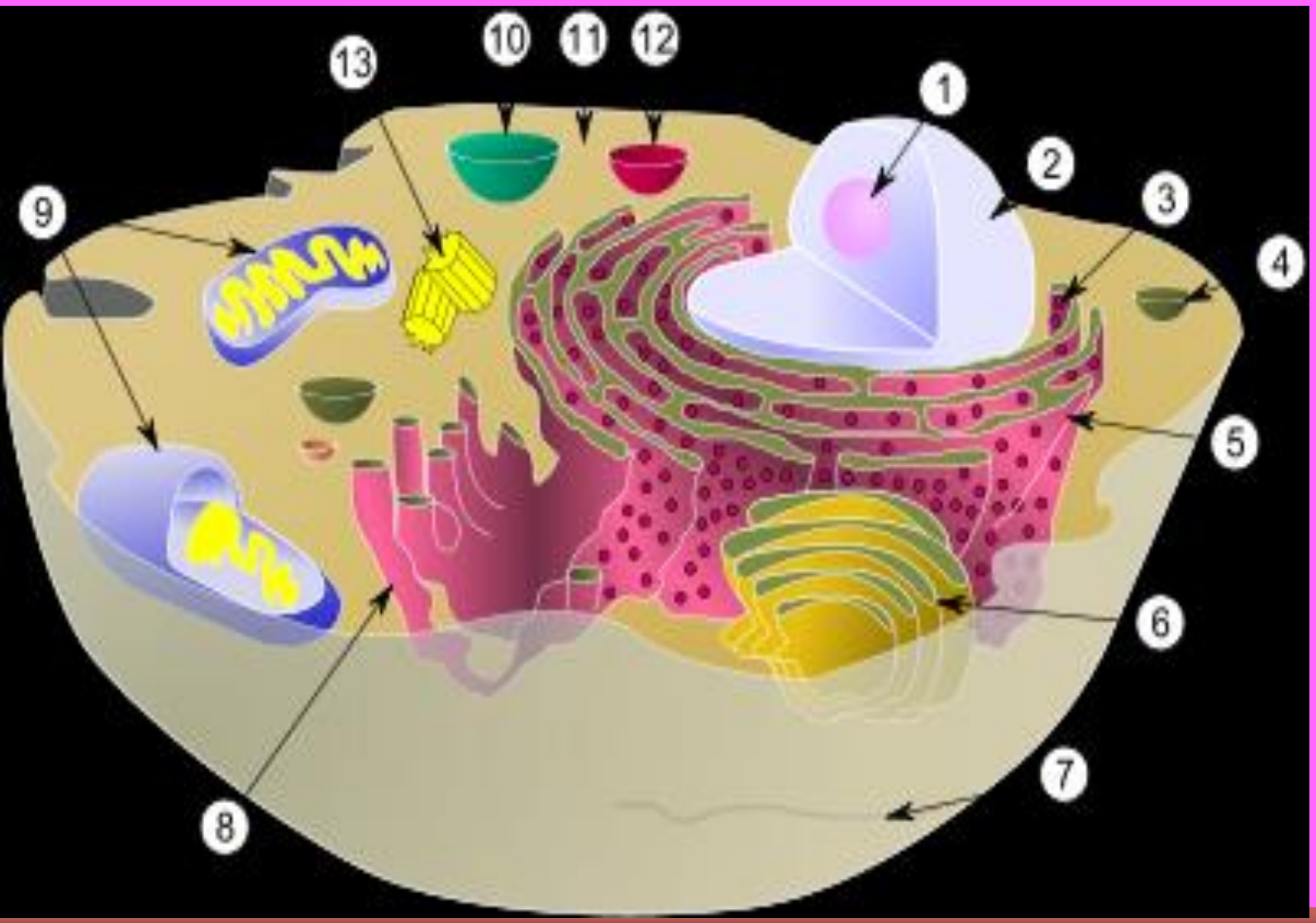
CELL STRUCTURE



EUKARYOTIC CELL



RIBOSOMES

- The ribosomes are very small organelles
- They are the sites of protein synthesis.
- They occur in the cytosol or are found attached to the endoplasmic reticulum.
- They can occur singly or in groups together with RNA to form poly ribosomes.
- They are found both in prokaryotes and eukaryotes

- They consist of a small and a large subunit.
- The small sub-unit contains 1 molecule of rRNA and 21 molecules of protein
- while the large sub-unit consists of 2 molecules of rRNA and 34 molecules of protein.
- Bacterial or prokaryotic ribosomes are smaller than eukaryotic ribosomes.

- A typical prokaryotic cell just has a few thousand ribosomes but a metabolically active eukaryotic cell such as a human liver cell has several million of ribosomes.
- Bacterial or prokaryotic ribosomes are smaller than eukaryotic ribosomes.
- In order to make proteins, the ribosomes attaches to the mRNA(from the nucleus(i.e. a transcribed copy of a portion of DNA) and uses the information to direct the synthesis of a protein.

- Proteins synthesized by ribosomes occurring freely in the cytoplasm are used within the **cytosol** whereas those synthesized by ribosomes attached to the endoplasmic reticulum end up in a **cellular membrane** stored in a **vesicle** or secreted out of the cell.

- The reason why some ribosomes bind to the endoplasmic reticulum is because if the protein being synthesized is produced by a ribosome that has an endoplasmic reticulum signal sequence (this enables a ribosome to bind to a receptor protein on the endoplasmic reticulum).

NUCLEUS

- It is derived from the latin word *nucleus* meaning kernel and it has a diameter of about 5µm.
- It is the largest and most important cell organelle.
- It was first described by the English botanist, Robert Brown in 1831.
- It is the control center of the cell and found in all eukaryotic cells except phloem sieve tubes and matured red blood cells (erythrocytes).

- The nucleus appears densely granular.
- The nucleus contains chromatin in a semi-fluid called the nucleoplasm. Chromatin looks grainy but actually it is a network of strands that undergoes coiling to form rod-like structures called chromosomes.
- Some dark regions of chromatin is called the nucleolus and this is where rRNA is produced and where rRNA joins with protein to form the subunits o f ribosomes.
- The nucleolus manufactures ribosomes.

- The nucleus is separated from the cytoplasm by a double lipid bilayer membrane known as the nuclear envelope.

- The nuclear envelope has nuclear pores of about 100nm to permit the passage of proteins into the nucleus and to allow the incorporation of the proteins into nuclear structures or to catalyze nuclear activities and to allow ribosomal subunits get out of the nucleus into the cytoplasm.

- It contains DNA which stores genetic information and determines the characteristics of a cell and its metabolic functioning.

- The nucleus also contains DNA which directs the synthesis of protein by the cell.

- Proteins colorfully called ‘importins’ and ‘exportins’ help regulate the passage of molecules between the nucleus and cytoplasm.

MITOCHONDRIA

- They are tubular or sausage- shaped organelles
- These are elongated structures with a diameter of 0.5- 1μ and range between 1-2μ in length.
- They are found only in eukaryotes.
- They are very numerous in the cell.

MITOCHONDRIA

- They are bounded by 2 membranes- smooth outer membrane and an inner one folded into numerous contiguous layers in order to increase the surface area is called Cristae.

- The inner and outer layers are semi-permeable and they surround the matrix. The space between the two layers is called the intermembrane space.

- The matrix is granular in nature and contains a few ribosome, a circular DNA and phosphate granules.

MITOCHONDRIA

- The Cristae partitions the mitochondria into 2 compartments which are the matrix(an inner space filled with semi-fluid medium that contains enzymes and these enzymes break down carbohydrate product and thus releasing energy that is used for ATP production) . The matrix also contains DNA and ribosomes.

- The outer membrane also called the inter-membrane space lies between the two mitochondrial membranes. On the surface and embedded within the inner membrane are proteins that carry out oxidative metabolism(the energy – requiring process by which energy in macromolecules is stored in form of ATP.

MITOCHONDRIA

- It carries on the process of cell respiration converting glucose to ATP energy that the cell can use and because of this function; the mitochondria are called the 'power house of the cell'.

- Also all the enzymes involved in fatty acid oxidation are found in the matrix of the mitochondria.

ENDOPLASMIC RETICULUM

- Their structure is normally tubular in vessicles or sacs. Some that possess the sac structure may become flattened and they extend throughout the cytoplasm and are called Cistema.

- The word is derived from the latin words *endoplasmic* and *reticulum* meaning within the cytoplasm and a little net respectively. Thus describing the endoplasmic reticulum to look like a little net that lies within the cytoplasm.

ENDOPLASMIC RETICULUM

- The endoplasmic reticulum is composed of a lipid bilayer embedded with proteins.
- There are 2 forms of the endoplasmic reticulum and they are the smooth and rough endoplasmic reticulum (SER & RER)
- The difference between the two is that the rough endoplasmic reticulum is studded with ribosomes.

ENDOPLASMIC RETICULUM

- It serves as a transport channel within the cell.
- It possesses a site for lipid and steroid metabolism
- It also helps in compartmentalizing the cell
- The rough endoplasmic reticulum is directly involved in protein synthesis while the smooth endoplasmic reticulum is involved in lipid, steroids and fatty acid synthesis, within the testes, they produce testosterone and in the liver they help to detoxify drugs.
- Also, the smooth ER forms vesicles in which molecules are transported to other parts of the

GOLGI BODY

- Camillo Golgi discovered the golgi body to be present in cells in 1898 and thus the organelle was named after him. It is also called Golgi apparatus.

- It looks like the endoplasmic reticulum but it is structurally different from it. They are flattened stacks of membranes.

- It is made up of a central core of slightly curved disc; each disc is enclosed in a continuous membrane. However, on the periphery (base) and concave side of the disc are many vesicles which arise through the process of budding.

GOLGI BODY

- The Golgi body receives newly synthesized protein from the endoplasmic reticulum through this small vesicle called transition elements. Some of the transition elements are budded off from the endoplasmic reticulum and then eventually fuse with the Golgi body.

- Within the golgi body, this elements fuse with carbohydrates. The elements are then collected at the ends of the membraneous folds of the golgi bodies, the folds are called Cisternae(collecting vessels).

GOLGI BODY

- Vesicles that fall off the cisternae carries the elements to the different compartments of the cell and to the inner surface of the plasma membrane, where molecules to be secreted are released to the outside.

- It stores and secretes glycoprotein

- It stores and secretes muco - polysaccharides.

GOLGI BODY

- The vesicles budded up from the Golgi body transports many cell materials.
- It is also involved in the formation of lysosomes.
- It also functions in the collection, packaging and distribution of molecules synthesized at one place in the cell and utilized at another location in the cell.

CELL MEMBRANE

- It selectively regulates the materials moving to and fro from cells.
- It varies in thickness from 40- 60A° unit.
- The structure was first proposed by Danielli and Davson.
- The cell membrane is made up of lipid by-layer which consists of modified fat molecules called phospholipids which is stabilized by a layer of protein both at the inner and outer surface of the membrane.
- Also present on the membranes are pores which are also coated with protein and are found at intervals in the membrane. The pores are extremely small and allow the passage of water but does not allow the passage of charged molecules.
- Owing to the presence of fat or the lipid bilayer in the cell membrane, water molecules that attempt to pass through it are repelled or not allowed to

CELL MEMBRANE

The function of the cell membrane includes:

a. The separation of the cell from its outside environment

b. It regulates the movement of materials in and out of the cell

c. Recognition of chemical signals.

d. It protects the internal organelles and the fluid contained within the cell from destruction.

e. The cell membrane creates and maintains a special micro environment for the intracellular organs thereby maintaining same pH and temperature needed for metabolism.

CELL WALL

- It surrounds and supports plant cells.
- It is a permanent rigid structure on the outer surface of the cell.
- The cell wall of two adjacent cells is held together by a middle lamella which is composed of pectic substances made up of calcium and magnesium pectate.
- The primary cell wall is a thin, rigid structure which consists mainly of polysaccharide and about 10% protein.

- The secondary cell wall is later formed between the plasma membrane and the primary cell wall.
- If the cell deposits material such as lignin in the cell wall then it becomes a woody cell.
- In between walls of adjacent cells is a sticky substance called the middle lamella which glues the cells together.
- The cell wall is freely permeable.

- The functions of the cell wall are:

A. provision of mechanical support and protection to the cell

B. prevention of osmotic bursting of the cell

VACUOLE

- It is a fluid filled sac bound by a single membrane known as a tonoplast.

General functions of vacuoles:

- Plant vacuoles increase the osmotic potential of the cell thereby attracting water into the cell and increasing cell turgidity

- In some plant cells, the vacuole performs the function of storing latex and this special vacuole are termed lacticifers.

- Stores waste products of metabolism and secondary plant products

- The following are the examples of the types of vacuoles and their functions:

- Contractile vacuole
  It pumps out excess water and waste from the cell

- Food vacuole
  It stores and digests food

- Phagocytic vacuole
  It fights external organisms by engulfing them

- It is mostly found in plants and some protists.

PLASTIDS

- There are 2 types of plastids;
- Coloured plastids –chromoplasts, carotenes, xantophylls and chloroplasts e. g chlorophyll

- Colourless plastids or leucoplasts- Examples are amyloplasts(stores starch), aleuroplasts(stores protein), glysosomes(stores lipids).

CHLOROPLAST

- It is found in plant cells and algae and it carries on the process of photosynthesis.
- Chloroplasts convert light energy (from the sun) to chemical energy via the process of **photosynthesis**.
- The main pigment (green color) located in chloroplasts and involved in photosynthesis is **chlorophyll**.
- **Chloroplasts are surrounded by an outer membrane and inner membrane separated by an inter-membrane space.**

- The fluid within the center of the chloroplast is called stroma.
- Within this fluid is an interconnected system of stacks of disks, kind of like more water-balloon-pancakes.
- Each sack is called a thylakoid and has chlorophyll and other useful pigments built into its membranes. A stack of thylakoids is called a granum.

LYSOSOME

- It is a simple spherical sac bound by a single membrane.
- They are membrane bounded digestive vesicles produced by the golgi body
- It contains digestive or hydrolytic enzymes e.g proteases, lipases, phosphates, nucleases e.t.c.

- The content of the lysosomes appear acidic and homogenous, they are found in eukaryotic cells and animal cells.

- They perform the function of eliminating other cells by the following processes: autolysis, autophagy, endocytosis, exocytosis and digestive processes.

- It is also involved in the secretion of digestive enzymes.