Cell Structure

Organelle	Structure	Function
Nucleus	**Spherical** organelle in the eukaryotic cell. Surrounded by a **nuclear envelope**, which is a **double membrane** that is continuous with the rough endoplasmic reticulum. The nuclear envelope is **perforated with pores** to allow substances like **enzymes**, **ribosomal subunits**, **nucleotides** and **mRNA** to pass through. It contains the **nucleolus** and **chromatin**.	Contains the **hereditary material** in the form of DNA. **Controls cell activities** by synthesizing mRNA which will be translated into proteins which are needed in the cell.
Nucleolus	**Non-membranous** sphere(s) within the nucleus. Contains a large concentration of **DNA**, **rRNA** and **proteins**.	Site of **synthesis** of **rRNA**, a component of ribosomes. Site of the **assembly** of **rRNA** and **ribosomal proteins**, exported from the cytoplasm, into large and small **ribosomal subunits**.
Chromatin	Thin elongated threads of DNA coiled around histone proteins. **Euchromatin** is **lightly stained**, **transcriptionally active** and exists in a diffused, extended state while **heterochromatin** is **darkly stained** and **transcriptionally inactive**. Condense to form **thicker** and **shorter chromosomes** before cell division.	**Hereditary material** of the cell.

Rough Endoplasmic Reticulum	A network of **flattened** membrane-bound **sacs** called **cisternae** with **ribosomes attached** to the outer surface. **Continuous** with the outer membrane of the nuclear envelope.	**Transports proteins** which are synthesized by the ribosomes on its surface to the **Golgi apparatus** via **transport vesicles**. Allows **proteins** to **fold into their native conformation** in the **cisternal space** and **glycosylate** them to form glycoproteins.
Organelle	**Structure**	**Function**
Smooth Endoplasmic Reticulum	Network of **tubular** membrane-bound **sacs** called **cisternae** without bound ribosomes.	**Synthesize lipids** and **carbohydrates**. **Detoxify** drugs and poisons.
Golgi Apparatus	**Stack** of membrane-bound **flattened sacs** called **cisternae** and associated **Golgi vesicles**. **New cisternae** are formed by fusion of **transport vesicles** from the endoplasmic reticulum at the **cis** face and **Golgi vesicles bud off** from the **trans** face.	**Glycosylates proteins** and **lipids** to form glycoproteins and glycolipids respectively. **Modifies** existing glycoproteins and glycolipids by **cleaving** the existing sugar chains. **Sorts** and **packages** proteins into different vesicles and **target** the proteins to **different parts of the cell** or for **secretion**. Forms **lysosomes**. **Synthesizes polysaacharides** which are transported in vesicles to the cell membrane.

Lysosome	Membranous sac containing hydrolytic enzymes in an optimum **acidic** environment.	**Fuses** with **phagocytic vesicle** and **digests** its contents with **hydrolytic enzymes**. Soluble products of digestion are absorbed into the cytoplasm. **Releases enzymes** from the cell by **exocytosis** for breakdown of **extracellular content**. **Digests** unwanted or worn-out **organelles** through **autophagy**. Products are returned to the cytoplasm for reuse. To self**-destruct** a cell during **autolysis** when the contents of **many** lysosomes are released in the cell, creating an **acidic environment** for function of **hydrolytic enzymes**.

Organelle	Structure	Function
Ribosome	Consists of a **small** and **large** subunit that only comes together during translation. Complex of **protein** and **rRNA**. Can be found **freely floating** in the cytosol or bound to the **rough endoplasmic reticulum**.	Site for **protein synthesis**. **Free ribosomes** produce proteins that function in the **cytosol** while **bound ribosomes** synthesize proteins meant for **insertion** into membranes, **packaging** within organelles or **secretion** out of the cell.
Centriole	**Pair** of **rod-like hollow cylinders** positioned at **right angles** to each other. They are made up of **nine triplets of microtubules** each. Microtubules are made up of **tubulin**. Found in a region called the **centrosome** which is the microtubule organizing center. Absent in higher plant cells.	Acts as the microtubule organizing center during spindle formation in **cell division**, replicating and moving to opposite ends of the cell.

Cell Wall	Found only in **plants**.	Provides **mechanical support** and **protection** for the cell, preventing **bursting**. Determine the **shape** of cells. Allows **turgor pressure** to occur which is important for **support** in **herbaceous plants**.

Describe how proteins are secreted out of the cell.
DNA is **transcribed** in the **nucleus** to **mRNA** which leaves the nucleus via nuclear pores. The mRNA is **translated** into **polypeptides** on the **ribosomes** bound to the **rough endoplasmic reticulum**. The polypeptide then enters the **lumen** of the **cisterna** where it undergoes **modification**. **Transport vesicles** containing the protein then **bud off** from the rough endoplasmic reticulum and transport the protein to the **Golgi apparatus**. The transport vesicles **fuse** with the **cis** face of the Golgi apparatus where it undergoes further **modification**, **sorting** and **packing**. Upon processing, **secretory vesicles bud off** from the **trans** face of the Golgi apparatus and are directed to the **cell surface membrane** by **microtubules** where the vesicle membrane **fuses** with the cell surface membrane and releases the protein content via **exocytosis**.

Compare the structure and function of mitochondria and chloroplasts.		
Point of Comparison	**Mitochondria**	**Chloroplasts**
Membrane	Both are bound by a **double membrane** with a **smooth outer membrane**.	
Fluid Filled Cavity	Inner membrane encloses a **fluid filled cavity**, the **matrix** in mitochondria and the **stroma** in chloroplasts.	
Contents	Contains **70S ribosomes**, **circular DNA** and **enzymes** in the matrix and stroma respectively.	
Shape	**Spherical** or **rod** shaped.	**Lens** shaped.
Size	**Larger**.	**Smaller**.
Inner Membrane	**Extensively folded** inner membrane with folds called **cristae**.	**Not** folded.
Internal Membrane	**No** internal membrane system.	Internal membrane system consisting of **stacks** of **flattened sacs** of **thylakoids** called **grana** and **intergranal lamella**.
Granules Present	**Phosphate granules** present.	**Starch grains** present.
Pigments	**No** colored pigments.	**Photosynthetic pigments** such as **chlorophyll** are located on the **thylakoid membrane**.
ATP Synthase	Located on the **inner membrane** projecting into the **matrix**.	Located on the **thylakoid membrane** projecting into the **stroma**.