

CIE Biology A-level

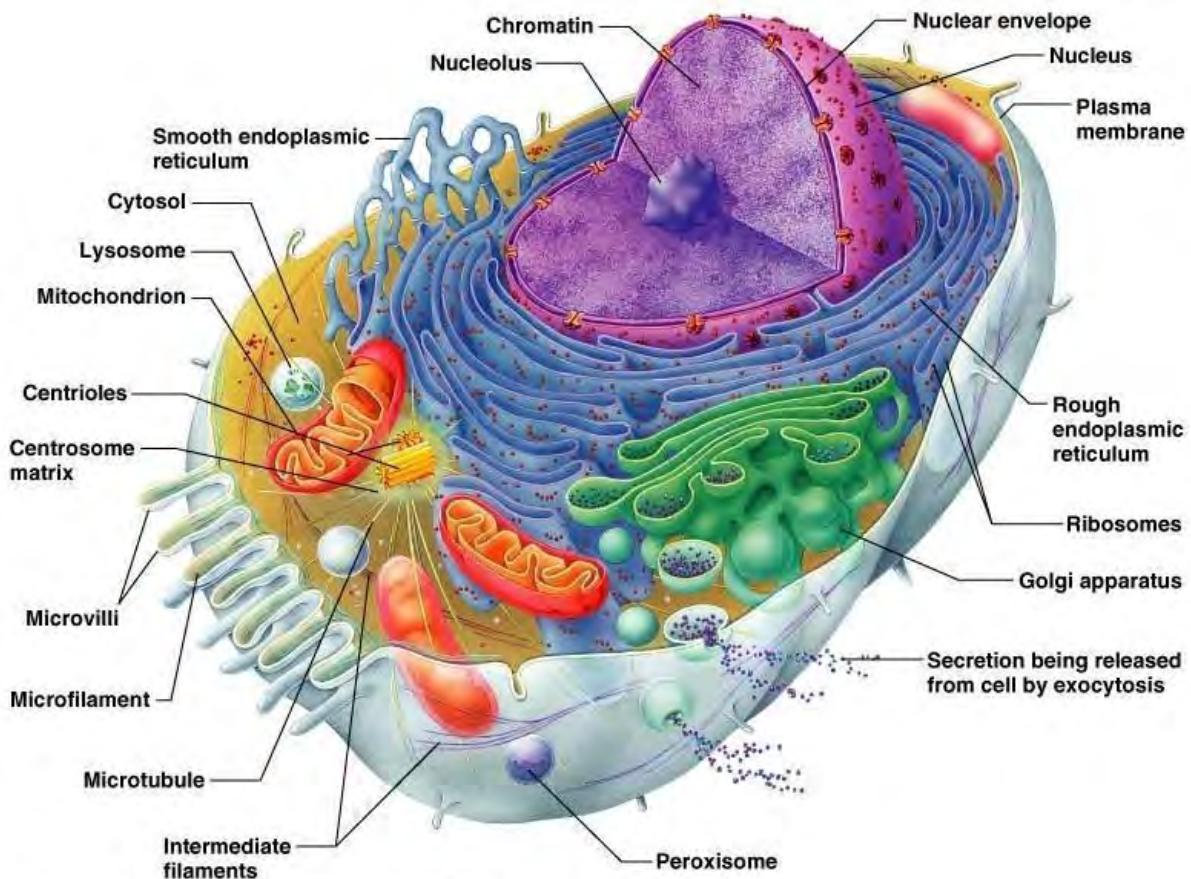
Topic 1: Cell Structure

Notes



All living organisms are made of cells, there are several different types of cells, some of them sharing some common features. Human are made up of **eukaryotic cells**. All eukaryotic cells contain a nucleus and membrane bound organelles. A more detailed structure of cells called the **ultrastructure** can be obtained by using a microscope.

Ultrastructure of eukaryotic cells:



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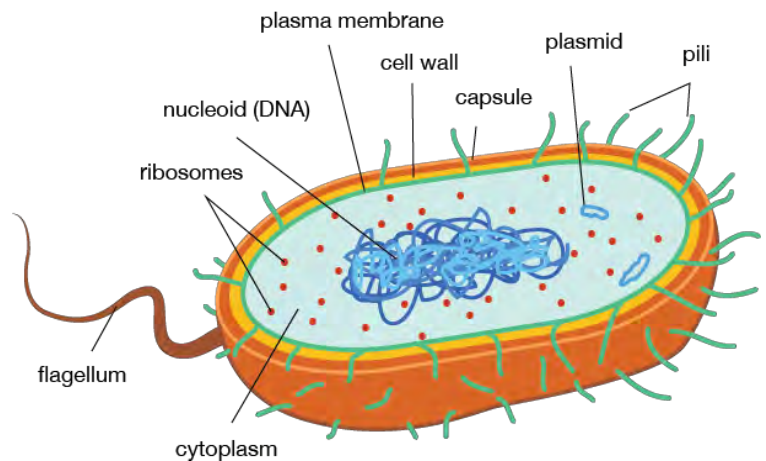
- **Nucleus** surrounded by a **double membrane called the envelope** containing **pores** which enable molecules to enter and leave the nucleus, the nucleus also contains **chromatin** and a **nucleolus** which is the site of ribosome production.
- **Rough endoplasmic reticulum** which is a **series of flattened sacs** enclosed by a membrane with ribosomes on the surface. RER **folds and processes proteins** made on the ribosomes.
- **Smooth endoplasmic reticulum** is a system of **membrane bound sacs**. SER **produces and processes lipids**.
- **Golgi apparatus** is a series of **fluid filled, flattened & curved sacs** with vesicles surrounding the edges. The Golgi apparatus **processes and packages proteins and lipids**. It also **produces lysosomes**.
- **Mitochondria** are usually **oval shaped, bound by a double membrane called the envelope**. The inner membrane is folded to form projections called **cristae** with **matrix** on the inside containing all the enzymes needed for **respiration**.



- **Centrioles** are **hollow cylinders** containing a ring of **microtubules** arranged at right angles to each other. Centrioles are involved in **cell division**.
- **Ribosomes** are **composed of two sub units** and are **the site of protein production**
- **Lysosome** is a vesicle containing **digestive enzymes** bound by a **single membrane**.
- **The cell surface membrane** surrounds the cell and **controls what enters and exits**.
- The **vacuole** is a fluid-filled sac present in plant cells, surrounded by a membrane called the **tonoplast**. It contains mineral salts, sugars, amino acids, waste substances and pigments. Its role is to colour the cell to **attract pollinating insects**, act as a **temporary food store** and **provide support through turgidity**.
- The **cell wall** (plant cells) is made of **cellulose microfibrils**. Its role is to **strengthen** the cell and **prevent bursting** due to osmosis.
- **Plasmodesmata** are small channels that pass through the cell wall of adjoining plant cells to **allow communication** between cells.

Prokaryotic cells such as bacteria contain:

- **Cell wall** – Rigid outer covering made of **peptidoglycan**
- **Capsule** – Protective slimy layer which helps the cell to **retain moisture** and **adhere** to surfaces
- **Plasmid** –Circular piece of DNA
- **Flagellum**- a tail like structure which **rotates to move the cell**
- **Pili**- Hair-like structures which attach to other bacterial cells
- **Ribosomes**- Site of **protein production**
- **Mesosomes**- Infoldings of the inner membrane which **contain enzymes required for respiration**



Prokaryotic cells are **unicellular** and are typically **1–5µm in diameter**, which is much smaller than eukaryotic cells. They **do not contain membrane bound organelles** or a nucleus, and their **ribosomes are smaller (70S)** than ribosomes in the cytoplasm of eukaryotic cells (80S).

Viruses:

Viruses are **non-living** structures which consist of **nucleic acid** (either DNA or RNA) enclosed in a protective protein coat called the **capsid**, sometimes covered with a lipid layer called **the envelope**.

Microscopy

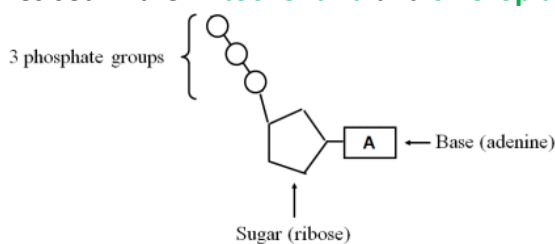
Microscopy is the most important technique used in biology as it enables us to see and examine organisms and structures which cannot be seen with the naked eye. **Magnification** is an indicator of how much bigger the microscope image is than the actual object whereas **resolution** is the smallest interval measurable by a microscope. **Magnification can be calculated by dividing the size of the image by the size of real object.**

There are two types of microscopes:

- **Light microscopes**- these are good for observing samples in a lab as they are **cheap** and **portable**. They have a **lower magnification and resolution** than electron microscopes, however.
- **Electron microscopes**- these are **good for examining organelles in high detail**. They have a **high magnification and resolution**, but samples must be placed in a **vacuum** and prepared first. This technique can be very **expensive**.

ATP

Adenosine triphosphate is a nucleotide derivative and consists of **ribose, adenine and three phosphate groups**. It is synthesised in the **mitochondria** and **chloroplasts** of cells.



- **Energy is released when ATP is hydrolysed** to form **ADP and a phosphate molecule**. This process is catalysed by **ATP hydrolase**.
- The **inorganic phosphate can be used to phosphorylate other compounds**, as a result making them more reactive.
- **Condensation of ADP and inorganic phosphate catalysed by ATP synthase produces ATP** during photosynthesis and respiration.