

Topic 1 - cell structure

- Abundant in phagocytic cells, e.g. macrophages and neutrophils (WBC)

Cilia and Undulipodia:

- Undulipodia (like a flagella) and cilia are **protrusions from the cell** found in **eukaryotes**
- They **contain microtubules** and are made by the **centrioles**
- '9+2' arrangement of microtubules in cilia and undulipodia
- The epithelial cells lining the airways each have many hundreds of cilia that beat and move the band of mucus
- Nearly all cells in the body have one cilium acting as an **antenna**
- Only one human cell has an **undulipodia** (longer cilium): **spermatozoon** – to move

Organelles without membranes:

Ribosomes:

- Involved in **protein production**, 20nm diameter, small and spherical
- Made of **ribosomal RNA** in the nucleus as two separate subunits, that combine when passed through nuclear envelope into cytoplasm
- Some are **free in cytoplasm** – **site of assembly of proteins** that will be used **inside** the cell
- Some attach to **endoplasmic reticulum** – **synthesise proteins** to be **transported out** of cell

Centrioles:

- Consist of **2 bundles of microtubules at right angles**
- Microtubules are made of **tubulin** protein subunits arranged in a **cylinder**
- Before a cell divides, the spindle (threads of tubulin) forms from the centrioles
- **Chromosomes** attach to the middle of the spindle and motor proteins walk along the **tubulin** threads, pilling chromosomes to opposite ends of the cell
- Centrioles are involved in formation of cilia/undulipodia:
 - **Centrioles multiply** and line up **beneath** the **cell surface membrane**
 - **Microtubules** then sprout **outwards** from each centriole, forming **cilia**
- Not normally present in plants, but are in some unicellular algae

Cytoskeleton:

- Network of **fibrous proteins** that maintain the cells shape, consist of:
 - **Rod-like filaments** – polymers of actin protein, 7nm
 - **Intermediate filaments**, 10nm
 - **Straight, cylindrical microtubules** – made of tubulin protein, 18-30nm
 - **Cytoskeletal motor proteins** (myosins, kinesins and dyneins) – molecular motors and enzymes which allow hydrolysis of ATP
- Microfilaments give **support** and **mechanical strength**, microtubules – see centrioles
- Intermediate filaments anchor nucleus in cell and enable cell-cell signalling
- Some fibres (actin filaments) can **move against each other**, allowing some cells to 'move' (e.g. white blood cells – phagocytes) and allowing organelles to move around inside cells

Cellulose cell wall:

- Made of bundles of **cellulose fibres**, outside plasma membrane
- **Strong** and can **prevent plant cells bursting** when turgid, provides **support** for whole plant, maintains cell shape, **permeable** and allow solutions to pass through
- Fungi have cell walls made of **chitin** not cellulose

Making and secreting a protein:

How insulin is made in a beta cell in an Islet of Langerhans

1. Gene that has coded instructions for a protein housed on chromatin in the nucleus, is **transcribed** into a length of **mRNA**
2. Many copies of mRNA are made & pass through pores in nuclear envelope to **ribosomes**
3. mRNA attaches to ribosome (on RER), instructions are translated & **insulin molecules** assembled
4. Insulin molecules pass into **cisternae of RER** and along these hollow sacs
5. Vesicles containing insulin are '**pinched off**' from RER and transported to the **Golgi apparatus**, via microtubules and motor proteins
6. Vesicle fuses with Golgi apparatus - **processes & packages** insulin molecules for release
7. Packaged insulin molecules travel to the plasma membrane in the vesicles
8. Vesicle **fuses** to the **plasma membrane**
9. Plasma membrane opens to **release insulin molecules outside**

Microscopes:

Magnification: how much an image has increased in size compared to the actual image