Lecture 1 - Introduction to Cells

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- **Cells are the basic unit of structure in every living thing**
- Cells were discovered in 1665 by Robert Hooke, who coined the term 'cell'
- **Mathias Schleiden, Theodor Schwann and Rudolf Virchow** - their work led to the Cell Theory

CELL THEORY:

- **All organisms are composed of cells**
- **Cells are the smallest living things**
- **Cells arise only from pre-existing cells**

- Cells are an organism's basic units of structure and function
- All cells are enclosed by a membrane and use DNA as genetic information
- The ability of cells to divide is the basis of all reproduction, growth and repair of multicellular organisms
- Cell size is limited - Larger sized cells means cell metabolism takes longer to perform as it takes longer for material to diffuse across the cell membrane, the **surface area to volume ratio** limits the size of the cell

- Two cell types: **prokaryotes and eukaryotes**
- **Prokaryotes -** principally referring to bacteria - lack membrane-bound organelles, simples internal structure, genetic material (DNA) is free in cytoplasm (in the nucleoid), much smaller than eukaryotes (0.5-5nm), thrive in harsh conditions, mostly unicellular, can form colonies, have a cell wall which can be **Gram positive or Gram negative - used to identify bacteria**
- Motility (movement) - most motile bacteria propel themselves by flagella

- **Eukaryotes** contain a membrane-bound nucleus which contains genetic material (DNA), contain membrane-bound organelles, much more complex cells, larger than prokaryotes (10-100nm), endomembrane system
- Cytoplasm: cytosol and organelles --> functions of cytosol include location of specific chemical reactions, storage of fat, carbohydrates as inclusions, and storage of secretory vesicles
- Plasma membrane --> phospholipid bilayer, selectively permeable, regulates what enters and exits the cell
- Nucleus - contains **MOST** of the DNA, not all
- Ribosomes - site of protein synthesis in the cell
- Endomembrane system - series of membranes throughout the cytoplasm that divides cell into compartments where different functions occur - regulates protein traffic and performs metabolic functions in the cell
- ER - Smooth --> lacks ribosomes, synthesis of membrane lipids, calcium storage, detoxification of foreign substances
    - Rough --> ribosomes stud its surface, synthesis of proteins
- Golgi apparatus - flattened sacks of interconnected membranes, synthesis of cell wall components (plant cells), packaging and distribution of materials to different part of cells
- Lysosomes - membrane-bound vesicles containing enzymes to break down macromolecules - destroys cell/foreign matter that the cell has engulfed during

phagocytosis

- Vacuoles - membrane-bound structures, storage, pump excess water out of cells, central vacuole usually contains water
- Mitochondria - site of respiration, present in all types of eukaryotic cells, **contain their own DNA**
- Chloroplasts - present in plant cells and some eukaryotes, contain chlorophyll for photosynthesis
- **Endosymbiosis -** theory that mitochondria and chloroplasts evolved through a symbiotic relationship - one cell engulfed the other cell and the relationship formed - evidence includes: both organelles have 2 membranes, possess DNA and ribosomes, divide similarly to bacteria
- Cytoskeleton - network of protein fibres found in all eukaryotic cells, supports shape of cells, keeps organelles in fixed locations, helps move materials within the cell, cell motility
- Microfilaments - help with muscles contraction, structural support for cell projections (microvilli), separation of cytoplasm during cell division
- Microtubules - provide strength to the cytoskeleton, major component of cilia and flagella, determine shape of cell