

4.1.1 Cell structure, Prokaryotic cells

Labels: Cell wall, Cell membrane, Cytoplasm, Central vacuole, Nucleus, Ribosomes, No chloroplasts.

Size: 10-100 µm

Studying cells, Microscopy

Light microscopes use light and lenses to magnify. Individual cells can be seen, as well as large organelles e.g. Nucleus.

Electron microscopes (transmission, scanning electron microscope) use electrons, for a higher magnification and higher resolution.

Magnification calculation

Magnification = $\frac{\text{Image size}}{\text{Actual size}}$

10 µm with a 100x magnification = 1000 µm or 1 mm = 1 cm

Before Resolution: the ability to distinguish between two points which are close together (visual object)

Before Magnification: increasing the size of an object.

Viewing a specimen: use a stain to provide contrast.

Staining a specimen: Stains provide, bits of the same, for colouring or clearing, all from brown, continuous, include magnification.

Size (µm): 100 (Bacteria), 1000 (Liver), 10000 (Sperm), 100000 (Human Egg)

Cell differentiation

Cells specialise at an early stage of embryo development, by turning genes off and on.

Cells which are not specialised are called stem cells and they are found in early stage embryos and some fully developed organs.

4.1.2 Cell division

The nucleus contains genetic information as chromosomes. Chromosomes are coiled lengths of DNA. Each chromosome carries a large number of genes. Each cell has 2 copies of each chromosome. During cell division all genetic information needs to be copied, as the cells go through the cell cycle.



The cell cycle

Formation of new cells for growth and repair. Produces identical daughter cells with the same number of chromosomes. There are 3 stages: Growth and replication of organelles, Mitosis and cell division.

Eukaryotic cells, two nuclei

Labels: Nucleus, Nucleolus, Rough endoplasmic reticulum, Smooth endoplasmic reticulum, Golgi apparatus, Mitochondria.

Size: 10-100 µm

Cell wall, strengthened with cellulose

Mitochondria, site of aerobic respiration

Golgi apparatus

Cell membrane

Nucleus

Mitochondria, site of aerobic respiration

Size: 10-100 µm

Specialised cells

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Cells	Name	Function	Adaptation
	Sperm cell	Fertilise the egg	Half the genetic info, lots of mitochondria to release energy
	Neuron	Carry electrical impulses	Long strand of cytoplasm, branched to connect to other neurones
	Root hair cell (remember this is a plant cell)	Take up water and mineral ions (Osmosis, diffusion and active transport)	Large surface area
	Muscle cell	Contract	Contains lots of mitochondria to release energy
	Xylem	Transport water and minerals up the plant	Dead, hollow tube, transpiration stream
	Phloem	Transport sugars around the plant	Living, tubes joined end to end, translocation

Binary fission: The cell divides into two daughter cells.

Labels: Bacterial dividing, Binary fission, DNA replication, Cell wall, Cytoplasm, Daughter cells.

Bacterial cells divide using binary fission, they copy genetic information and split cytoplasm.

4.1.2 Transport in and out of cells

Three methods of transport:

Diffusion: substances move from an area of high concentration to an area of low concentration. It is random and passive (does not require energy).

Occurs in the capillaries moving from the lungs to the tissues and carbon dioxide moving from the tissues to the lungs, and in the movement of glucose moving from the blood through the gut wall.

Osmosis: The movement of water from a region of high water concentration to a region of low water concentration, across a partially permeable membrane until equilibrium is reached.

Active transport: The movement of a substance against a concentration gradient, from high to low. Requires energy and a carrier protein.

Features of a good exchange surface:

- Good blood supply
- Short diffusion pathways (cells close together)
- Large surface area to volume ratio
- Good ventilation (air or water)
- Thin barrier (e.g. one cell thick)
- Good blood supply (e.g. capillaries)
- Good ventilation (e.g. capillaries)

Examples of exchange surfaces:

- Lungs: Fish gills
- Small intestine (for increased by villi and microvilli)
- Leaf

Labels: Upper epidermis, Palisade mesophyll, Spongy mesophyll, Guard cells, Stoma, Lower epidermis, Xylem, Phloem.

Stem cells in plants

Found just behind the tip of the shoots and roots. Undifferentiated cells which can become any type of cell.

Stem cells in animals

Found in the embryo and in a very early stage. Can become any type of cell.

Uses of stem cells and problems

Uses: Cure diseases, treat paralysis, neurone degeneration in the eye, diabetes.

Problems: Transgenic cloning, use stem cells to clone humans, live rejection as same antigens.

Cloning: Ethical potential, human life, companies working with stem cells have to follow strict rules.

4.1.3 Leaf organisation

Cells have building blocks. Specialise to give a particular function. Muscle cells contract and coordinate with nerves.

Tissues: group of similar cells working together. Muscle tissue.

Organs: different tissues working together. Muscular tissue moves to contract the stomach.

Organ systems: group of organs working together to perform a complex function. Digestive system.

Leaf organisation

Spongy mesophyll: contains air spaces for gas exchange.

Upper epidermis: contains guard cells. Guard cells control the opening and closing of the stomata. The stomata are holes which control the movement of gases into and out of the leaf.

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Daniela Niemeyer



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