Ormiston Victory Academy

Subject: Biology T1

Victory Vitals

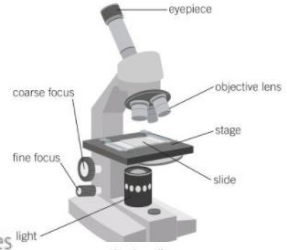
B1 Cell Structure and Transport

$$\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$$

Eukaryotic cell
Cytoplasm, **cell** organelles include mitochondria, chloroplasts in plants and ribosomes

Prokaryotic cell
Cytoplasm, ribosomes, no mitochondria or chloroplasts

Specialised cells - **Animals**: sperm, muscle cell, nerve cell. **Plants**: Root hair cells, Phloem cells, Xylem cells



plant cell

The **nucleus** – controls all the activities of the cell and is surrounded by the nuclear membrane. It contains the genes on the chromosomes that carry the instructions for making the proteins needed to build new cells or new organisms. The average diameter is around 10 µm.

The **cytoplasm** – a liquid gel in which the organelles are suspended and where most of the chemical reactions needed for life take place.

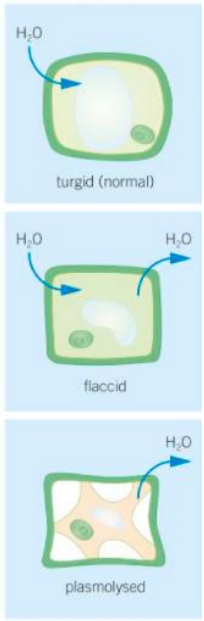
The **cell membrane** – controls the passage of substances such as glucose and mineral ions into the cell. It also controls the movement of substances such as urea or hormones out of the cell.

The **mitochondria** – structures in the cytoplasm where aerobic respiration takes place, releasing energy for the cell. They are very small: 1–2 µm in length and only 0.2–0.7 µm in diameter.

The **ribosomes** – where protein synthesis takes place, making all the proteins needed in the cell.

Chloroplasts are found in all the green parts of a plant. They are green because they contain the green substance **chlorophyll**. Chlorophyll absorbs light so the plant can make food by photosynthesis. Each chloroplast is around 3–5 µm long. Root cells do not have chloroplasts because they are underground and do not photosynthesise.

A **permanent vacuole** is a space in the cytoplasm filled with cell sap. This is important for keeping the cells rigid to support the plant.



Osmosis in plant cells

Adaptations for exchanging materials

There are various adaptations to make the process of exchange more efficient. The effectiveness of an exchange surface can be increased by:

- having a large surface area over which exchange can take place
- having a thin membrane or being thin to provide a short diffusion path
- in animals, having an efficient blood supply moves the diffusing substances away from the exchange surfaces and maintains a steep concentration (diffusion) gradient

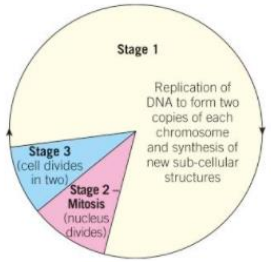
Process	Movement of	Condition	Additional requirements
Diffusion	Molecules/ ions	High conc. to low conc.	Down a conc. gradient
Osmosis	Water molecules	High water potential to low water potential	Across a partially permeable membrane
Active transport	Particles of substances	Low conc. to high conc.	Against a conc. Gradient; Energy required

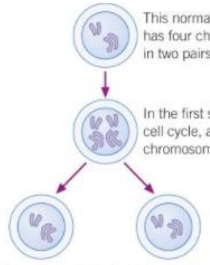
B2 Cell Division

The cell cycle and mitosis

Body cells divide in a series of stages known as the **cell cycle** (Figure 2). Cell division in the cell cycle involves a process called **mitosis** and it produces two identical cells. As a result, all your normal body cells have the same chromosomes and so the same genetic information. Cell division by mitosis produces the additional cells needed for growth and development in multicellular organisms, and for the replacement of worn out or damaged cells.

In asexual reproduction, the cells of the offspring are produced by mitosis from the cells of their parent. This is why they contain exactly the same genes as their parent with little or no genetic variation.





The function of stem cells

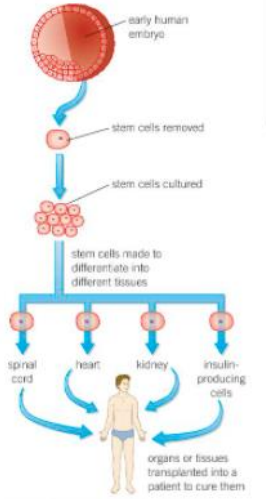
An egg and sperm cell fuse to form a **zygote**, a single new cell. That cell divides and becomes a hollow ball of cells – the embryo. The inner cells of this ball are the **embryonic stem cells** that differentiate to form all of the specialised cells of your body. Even when you are an adult, some of your stem cells remain. An adult stem cell is an undifferentiated cell of an organism that can give rise to many more cells of the same type. Certain other types of cell can also arise from stem cells by differentiation. Your bone marrow is a good source of **adult stem cells**. Scientists now think there may be a tiny number of stem cells in most of the different tissues in your body including your blood, brain, muscle, and liver.

Differentiation in animal cells

In the early development of animal and plant embryos, the cells are unspecialised. Each one of them (known as a **stem cell**) can become any type of cell that is needed.

Differentiation in plant cells

In contrast to animal cells, most plant cells are able to differentiate all through their lives. Undifferentiated cells are formed at active regions of the stems and roots, known as the meristems (Figure 2). In these areas, mitosis takes place almost continuously. The cells then elongate and grow before they finally differentiate.



At the moment, after years of relatively slow progress, hopes are high again that stem cells will change the future of medicine. Currently, in the UK, stem cell research is being carried out into potential therapies to treat:

- spinal cord after injuries
- diabetes
- heart after damage in a heart attack
- eyesight in the blind
- damaged bone and cartilage.

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Vocabulary:

active transport - the movement of substances from a dilute solution to a more concentrated solution against a concentration gradient, requiring energy from respiration

bacteria -single-celled prokaryotic organisms

cellulose - the complex carbohydrate that makes up plant and algal cell walls and gives them strength

chlorophyll - the green pigment contained in the chloroplasts

hypertonic (osmosis) -a solution that is more concentrated than the cell contents

hypotonic (osmosis) - a solution that is less concentrated than the cell contents

isotonic (osmosis) - a solution that is the same concentration as the cell contents

plasmolysis - the state of plant cells when so much water is lost from the cell by osmosis that the vacuole and cytoplasm shrink and the cell membrane pulls away from the cell wall

resolving power - a measure of the ability to distinguish between two separate points that are very close together

stomata - openings in the leaves of plants, particularly on the underside and opened and closed by guard cells, allowing gases to enter and leave the leaf

turgor - the pressure inside a plant cell exerted by the cell contents pressing on the cell wall

xylem - the non-living transport tissue in plants that transports water from the roots to the leaves and shoots

adult stem cells - stem cells that are found in adults that can differentiate and form a limited number of cells

cell cycle - the three-stage process of cell division in a body cell that involves mitosis and results in the formation of two identical daughter cells

cloning - the production of identical offspring by asexual reproduction

differentiate - the process where cells become specialised for a particular function

embryonic stem cells - stem cells from an early embryo that can differentiate to form the specialised cells of the body

mitosis - part of the cell cycle where one set of new chromosomes is pulled to each end of the cell forming two identical nuclei during cell division

stem cells - undifferentiated cells with the potential to form a wide variety of different cell types

therapeutic cloning - a process where an embryo is produced that is genetically identical to the patient so the cells can then be used in medical treatments

Videos

Quizzes