
CELLS

Structure and Function

Cell Structure

All plant and animal tissue consist of cells.

Cells are microscopic in size.

In general, each cell performs all the characteristics of life and, though in reality there is no such thing as 'typical' cell, most cells have many structures in common.

Cell Structure cont' d

■ Cell membrane

- ❑ Typically, all cells have an outer living structure called the cell membrane (also referred to as the plasma membrane).
 - ❑ It consists of a thin layer of fat and protein molecules.
 - ❑ The cell membrane and the protoplasm, comprise the living material of the cell.
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Cell Structure cont' d

■ Cell wall

- ❑ In addition, plant cells have a cell wall that is found outside the cell membrane.
 - ❑ Cell wall are rigid non-living structures composed mainly of a material called **CELLULOSE**
 - ❑ The cell wall also gives the plant cell its shape
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Cell Structure cont' d

- The cell wall and membrane enclose a jelly-like mass, the protoplasm
 - Protoplasm consists of two main parts,
 - the nucleus
 - And the cytoplasm
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■ Nucleus

- The nucleus is a spherical or ovoid structure located in the cytoplasm.
 - It is surrounded by a membrane, the nuclear membrane, which is similar to the cell membrane.
 - Within the nucleus are the chromosomes, elongated structures made of a material referred to as DNA.
 - Normally, chromosomes can only be observed under the microscope when the cell is dividing.
 - When the cell is not dividing they become longer and thinner and cannot be seen.
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Cell Structure cont' d

■ Cytoplasm

- ❑ The cytoplasm is a clear jelly-like substance consisting mainly of water.
 - ❑ It contains many dissolved substances as well as several small structures, referred to as organelles.
 - ❑ These structures include mitochondria, vacuoles
 - ❑ And in some plant cells, chloroplasts
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Cell Structure cont' d

- Mitochondria (power house of the cell)
 - These are tiny cylindrical structures found in all living cells.
 - They are more numerous in some cells than in others.
 - They are vital to all cells for energy production.
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Cell Structure cont' d

■ Vacuoles

- ❑ These are fluid-filled spaces surrounded by a membrane
 - ❑ In plant cells, vacuoles are large and permanent, often filling most of the cell.
 - ❑ In animals cells, they are usually small or absent and only temporary
 - ❑ Fluid in vacuoles also known as **CELL SAP**
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Cell Structure cont' d

■ Chloroplasts

- ❑ These are relatively large oval-shaped bodies found in the green parts of plants.
 - ❑ They contain the pigment **CHLOROPHYLL**.
 - ❑ Starch grains are also often found inside of them.
 - ❑ Photosynthesis takes place in chloroplasts.
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Cell Structure cont' d

- Main structural differences between plant and animal cells:
 - All plant and animal cells have three components in common
 - The cell membrane
 - The cytoplasm
 - (which contains mitochondria)
 - The nucleus
 - However, there are some differences between the two types of cells
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Cell Structure cont' d

■ PLANT CELL

- ❑ Contains cell walls and cellulose
- ❑ Some cells contain chloroplasts with chlorophyll
- ❑ Starch granules often found
- ❑ Large permanent vacuoles present (cytoplasm forced against cell wall in a thin layer)
- ❑ Rigid shape due to cell wall
- ❑ Generally larger than animal cells

■ ANIMAL CELL

- ❑ No cell walls or cellulose
 - ❑ No chloroplasts or chlorophyll
 - ❑ No starch found; glycogen often found
 - ❑ Vacuoles, if present, small and temporary (cytoplasm fills the entire structure)
 - ❑ Shape not rigid
 - ❑ Generally smaller than plant cells
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Cell Function

- Each structure has a definite role to play in maintaining the constant composition and overall function of the cell.
 - These roles are important to the proper functioning of the tissues of which they form a part and the organism as a whole.
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Cell Function cont' d

■ Cell membrane

- The cell membrane acts as a regulator by selectively allowing the passage of certain substances in and out of the cells
 - E.g. food materials and waste products
 - The membrane is said to be selectively permeable.
 - In this way a constant environment is maintained within the cell
 - The two main processes involved in the movement of substances across the membrane are **diffusion and osmosis**
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Cell Function cont' d

■ Cell Wall

- Have the following characteristics
 - Gives **Shape**
 - To some extent provides **Strength** and
 - **Protection**
 - **Fully permeable** (therefore does not have a regulatory role as does the cell membrane)
 - Because of the rigid wall, plant cells can become turgid when the vacuole is full.
 - This is an important means of support for some tissues
 - Cells that are turgid also stop taking in water so the wall helps to control the movement of water from cell to cell.
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Cell Function cont' d

- Nucleus
 - The chromosomes in the nucleus control activities and characteristics of the cell
 - E.g. its size, shape, growth and division
 - Without the nucleus the activities of the cell become irregular and the cell soon dies
 - The chromosomes
 - are only visible during cell division.
 - carry hereditary information
 - are referred to as the genetic material of the cell
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Cell Function cont' d

■ Cytoplasm

- ❑ Most of the metabolic activities of the cell take place in the cytoplasm
 - ❑ The water in the cytoplasm dissolves and distributes nutrients and waste
 - ❑ Throughout the cytoplasm there are many different structures or organelles which carry out the specific functions of the cell.
 - ❑ These include mitochondria and chloroplasts
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Cell Function cont' d

■ Mitochondria

- These are referred to as the power-houses of the cell.
 - They are the sites of respiration during which energy needed by the cell is released from food molecules.
 - They are numerous in cells of active tissues and organs, such as muscles and the liver of animals and in the growing points of plants and germinating seeds.
 - A single muscle cell may contain thousands of mitochondria.
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Cell Function cont' d

■ Chloroplasts

- These contain chlorophyll
 - They capture the energy of the sunlight and use it during photosynthesis for the manufacture of carbohydrates in the form of sugars.
 - These sugars are passed into the cytoplasm where they are used to form other compounds, such as starch for storage, proteins or cellulose for cell wall formation.
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Cell Function cont' d

■ Vacuoles

- Plant vacuoles contain cell sap
 - Cell Sap is a dilute solution of sugars, salts and some waste products.
 - The plant vacuole and cell sap assist in
 - supporting the tissues,
 - transporting materials from cell to cell
 - acting as a site for storing materials.
 - In Animal cells the small temporary vacuoles may contain water, food materials or waste, which they transport around the cytoplasm.
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Questions

1. Name 3 substances/compounds which must enter or leave an animal or plant cell?
 2. What part of a plant cell, the cell wall or the cell membrane, controls what enters or leaves the cell?
 3. Does the cell membrane have the same function in both plant and animal cells?
 4. What are the main functions of the cell wall?
 5. What is the general term used to describe what takes place in the cytoplasm of all cells?
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Questions cont' d

6. Chlorophyll absorbs light. Some plant cells contain chloroplasts but animal cells do not. Why do you think this is so? 3 marks
 7. Do you think most of the cells of a tree contain chloroplasts? Explain your answer. 2 marks
 8. Mitochondria are called the powerhouses of the cell. What do you think is their role? 2 marks
 9. If the nucleus of a cell is removed (i) its activities become disorganized and (ii) it soon dies. Why is this so? 2 marks What are the main functions of the nucleus? 1 mark
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