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# Cell and Cell Cycle

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## Introduction

Cell is the basic membrane-bound unit that contains the fundamental molecules of life and of which all living things are composed. A single cell is often a complete organism in itself, such as a bacterium or yeast. Other cells acquire specialized functions as they mature. The smallest known cells are a group of tiny bacteria called mycoplasmas; some of these single-celled organisms are spheres as small as 0.2 μm in diameter, with a total mass of 10−14 gram—equal.

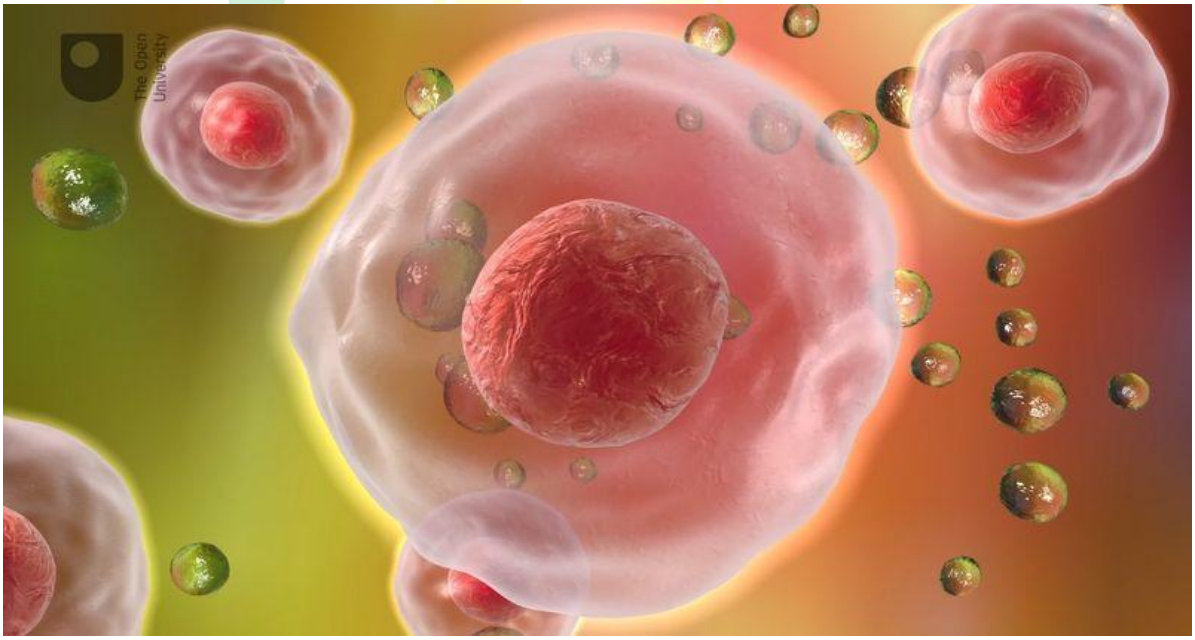


**Fig: 1 Typical cells**

As an individual unit, the cell is capable of metabolizing its own nutrients, synthesizing many types of molecules, providing its own energy, and replicating itself in order to produce succeeding generations. In a multicellular organism, cells become specialized to perform different functions through the process of differentiation. Special

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emphasis is given in this chapter to animal cells, with some discussion of the energy-synthesizing processes and extracellular components peculiar to plants.

Cell is the basic unit of life. Animal cells are typical of the eukaryotic cell, enclosed by a plasma membrane and present in different shapes and containing a membrane-bound nucleus and cell organelles. Discovery of living cells would have been difficult, if not impossible, before the compound microscope was invented by Zacharias Jansen of Holland in 1590. In 1665, Robert Hooke of England discovered “Cell” and applied the term “Cell” to the cavities he saw in sections of cork. In 1675, Marcello Malpighi published an "Anatomy of Plants", the first systematic study of cell structure. In 1839 Theodor Schwann, an animal anatomist, formulated the Cell Theory

**Characteristics of Cells**

Following are the various essential characteristics of cells:

- ✓ Cells provide structure and support to the body of an organism.
- ✓ The cell interior is organised into different individual organelles surrounded by a separate membrane.
- ✓ The nucleus (major organelle) holds genetic information necessary for reproduction and cell growth.
- ✓ Every cell has one nucleus and membrane-bound organelles in the cytoplasm.
- ✓ Mitochondria, a double membrane-bound organelle is mainly responsible for the energy transactions vital for the survival of the cell.
- ✓ Lysosomes digest unwanted materials in the cell.
- ✓ Endoplasmic reticulum plays a significant role in the internal organisation of the cell by synthesising selective molecules and processing, directing and sorting them to their appropriate locations.

**Types of Cells**

Cells are similar to factories with different labourers and departments that work towards a common objective. Various types of cells perform different functions. Based on cellular structure, there are two types of cells:

- ❖ Prokaryotes
- ❖ Eukaryotes

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***Prokaryotic Cells***

1. Prokaryotic cells have no nucleus. Instead, some prokaryotes such as bacteria have a region within the cell where the genetic material is freely suspended. This region is called the nucleoid.
2. They all are single-celled microorganisms. Examples include archaea, bacteria, and cyanobacteria.
3. The cell size ranges from 0.1 to 0.5 µm in diameter.
4. The hereditary material can either be DNA or RNA.
5. Prokaryotes generally reproduce by binary fission, a form of asexual reproduction. They are also known to use conjugation – which is often seen as the prokaryotic

***Eukaryotic Cells***

1. Eukaryotic cells are characterised by a true nucleus.
2. The size of the cells ranges between 10–100 µm in diameter.
3. This broad category involves plants, fungi, protozoans, and animals.
4. The plasma membrane is responsible for monitoring the transport of nutrients and electrolytes in and out of the cells. It is also responsible for cell to cell communication.
5. They reproduce sexually as well as asexually.

**Difference Between Prokaryotic and Eukaryotic Cells**

| Components | Prokaryotes | Eukaryotes |
|---|---|---|
| **Type of Cell** | Always unicellular | Unicellular and multi-cellular |
| **Cell size** | Ranges in size from 0.2 µm – 2.0 µm in diameter | Size ranges from 10 µm – 100 µm in diameter |
| **Cell wall** | Usually present; chemically complex in nature | When present, chemically simple in nature |
| **Nucleus** | Absent. Instead, they have a nucleoid region in the cell | Present |

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| | | |
|---|---|---|
| **Ribosomes** | Present. Smaller in size and spherical in shape | Present. Comparatively larger in size and linear in shape |
| **DNA arrangement** | Circular | Linear |
| **Mitochondria** | Absent | Present |
| **Cytoplasm** | Present, but cell organelles absent | Present, cell organelles present |
| **Endoplasmic reticulum** | Absent | Present |
| **Plasmids** | Present | Very rarely found in eukaryotes |
| **Ribosome** | Small ribosomes | Large ribosomes |
| **Lysosome** | Lysosomes and centrosomes are absent | Lysosomes and centrosomes are present |
| **Cell division** | Through binary fission | Through mitosis |
| **Flagella** | The flagella are smaller in size | The flagella are larger in size |
| **Reproduction** | Asexual | Both asexual and sexual |

**The nature and function of cells**

A cell is enclosed by a plasma membrane, which forms a selective barrier that allows nutrients to enter and waste products to leave.

The interior of the cell is organized into many specialized compartments, or organelles, each surrounded by a separate membrane. One major organelle, the nucleus, contains the genetic information necessary for cell growth and reproduction. Each cell

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contains only one nucleus, whereas other types of organelles are present in multiple copies in the cellular contents, or cytoplasm.

Organelles include mitochondria, which are responsible for the energy transactions necessary for cell survival; lysosomes, which digest unwanted materials within the cell; and the endoplasmic reticulum and the Golgi apparatus, which play important roles in the internal organization of the cell by synthesizing selected molecules and then processing, sorting, and directing them to their proper locations.

In addition, plant cells contain chloroplasts, which are responsible for photosynthesis, whereby the energy of sunlight is used to convert molecules of carbon dioxide (CO2) and water (H2O) into carbohydrates. Between all these organelles is the space in the cytoplasm called the cytosol. The cytosol contains an organized framework of fibrous molecules that constitute the cytoskeleton, which gives a cell its shape, enables organelles to move within the cell, and provides a mechanism by which the cell itself can move. The cytosol also contains more than 10,000 different kinds of molecules that are involved in cellular biosynthesis, the process of making large biological molecules from small ones.