



E-Study material
For 1st Semester Botany Honours (CBCS)
Course Code: BC102 T
Core Course II: BIO-MOLECULES AND CELL
BIOLOGY
Unit 1: The cell, cell wall and plasma membrane
Topic: Microtubule and microfilament

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Microtubule and microfilament

Microtubules and microfilaments support the extensive system of membranes developed in the relatively fluid cytoplasmic matrix. They collectively form cytoskeleton of the cell. These organelles also keep other organelles, such as mitochondria and ribosomes, separated from one another to avoid interference in one another's activities. They maintain the cell shape too.

A. Microtubules:

The microtubules were first seen in **1953** by **Robertis and Franchi** in the axons of medullated nerve fibres. They called them neurotubules. The term 'microtubule' was coined by **Slautter Back (1953)**. The microtubules are found in the cytoplasmic matrix of all eukaryotic cells. They also occur in cilia, flagella, centrioles and basal bodies, mitotic apparatus, sperm tail, processes of nerve cells, and supporting elements of protozoans. The microtubules are absent in certain cells, such as amoebae and slime moulds. Prokaryotic cells lack microtubules.

The microtubules are hollow, unbranched cylinders, generally about 200 to 270 Å thick and several micrometres long. The microtubules may occur singly or in bundles and radiate from the centrioles to the periphery of the cell. The wall of a microtubule is composed of 13 parallel protofilaments that

enclose a central lumen about 150 Å wide. Each protofilament is made up of a protein **tubulin**.

Functions

1. These help in the spindle and astral ray formation during cell division.
2. These form the cytoskeleton of cilia and flagella.
3. These help in generating the shape, rigidity and form of the cell and cell mobility.
4. Microtubules help in the anaphase movement of chromosomes to their proper positions during cell division.
5. These help in driving the food into the gullet in certain protozoans.
6. Microtubules help in the intracellular transport of nutrients and inorganic ions.
7. These bring about cyclosis and amoeboid movements in certain protozoans.
8. During cell division, these cause cleavage or furrow to divide the parental cells into two daughter cells.
9. Microtubules together with microfilaments function as cytoskeleton.
10. Microtubules maintain the shape of some cell processes such as axons and dendrites.
11. They transport molecules and granules within the cells, thus function as microcirculatory system.
12. They help in spindle fibre formation during cell division.
13. They provide frame work for cyclosis.

B. Microfilaments:

The microfilaments are found in almost all eukaryotic cells. They form an extensive network in the cytoplasm of cells and may be associated with plasma membrane. They cause movements of microvilli to quicken absorption of food. The microfilaments are most prominent in the muscle cells. Here they are called myofilaments. The microfilaments are absent in the prokaryotic cells.

The microfilaments are solid, unbranched, rod-like fibrils of indefinite length and about 50-60 Å in diameter. They are composed mainly of a globular protein actin but have some filamentous protein myosin also.

Functions

1. The microfilaments form the active and motile part of cytoskeleton of the cell.

2. These represent the contractile system of the cell and are involved in cytoplasmic streaming and amoeboid movements.
3. Microfilaments bring about movements in fibrils due to plasma membrane undulation.
4. Help in pseudopodia formation
5. These help in the formation of furrow cleavage during cell division which divides the parental cell into two daughter cells.
6. These bring about changes in the plasma membrane during the process of endocytosis.