



Department of biology



Department of biology

BOTANY (PLANT BIOLOGY)

First stage

(2)

Plant Cell Structure

By

Prof. Dr. Dhurgham Ali Al-Sultany



Department of biology



Plant Cell Structure

What is a Botany?

The science of plant biology is primarily the study of flowering plants or angiosperms. Flowering plants are by far the most important group of plants in the world, providing the overwhelming majority of plant species (over 250 000 in all) and most of the biomass on land, and they are the basis for nearly all our food.

Plants are multicellular organisms composed of millions of cells with specialized function. All plant cells have the same basic eukaryotic organization.

Unifying features of plants: To characterize the features that define plants as different from other eukaryotes is almost impossible since every feature has exceptions, but usually these exceptions are among plants that have lost the feature or are among the algae on the boundary between protists and plants.

- They are photosynthetic and obtain all their nutrients from inorganic sources, i.e. they are autotrophic and the start of a food chain. Many protists, particularly among the plankton, are also photosynthetic. A few plants derive all or part of their nutrients from other organisms but these are closely related to other, photosynthetic, flowering plants.
- The photosynthetic pigment is chlorophyll, and in all plants except some algae, there are two forms, a and b, contained within chloroplasts.
- The cells have a cell wall made predominantly of the polysaccharide cellulose, and a vacuole in addition to the cytoplasm.
- There is an alternation of diploid and haploid generations. Often one of these is much reduced and may not live independently.

THE PLANT CELL

Cytoskeleton

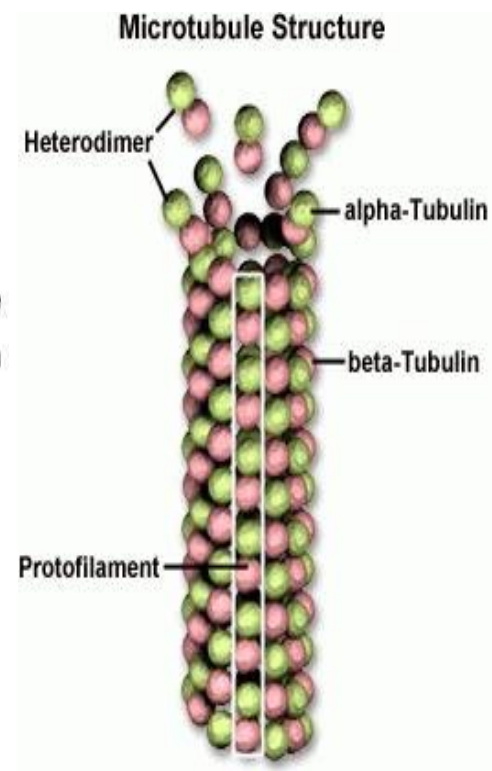
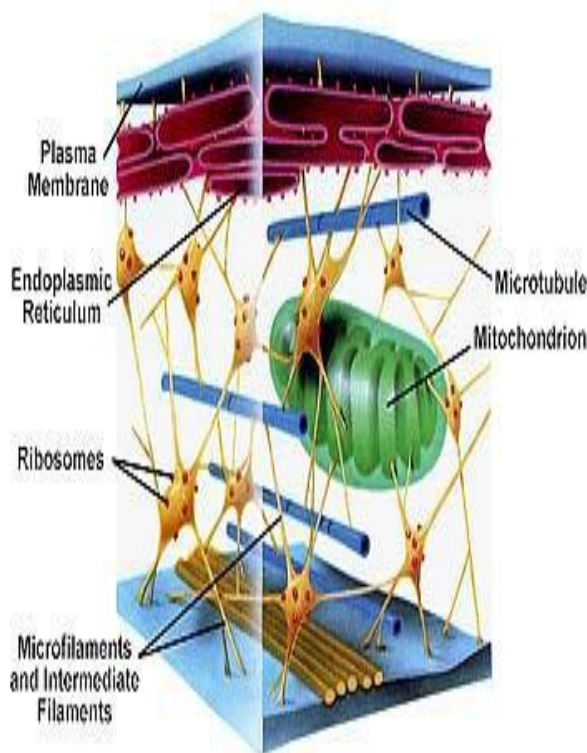
- **The cytosol** is organized into a 3-dimensional network of filamentous proteins called 'cytoskeleton'.



Department of biology



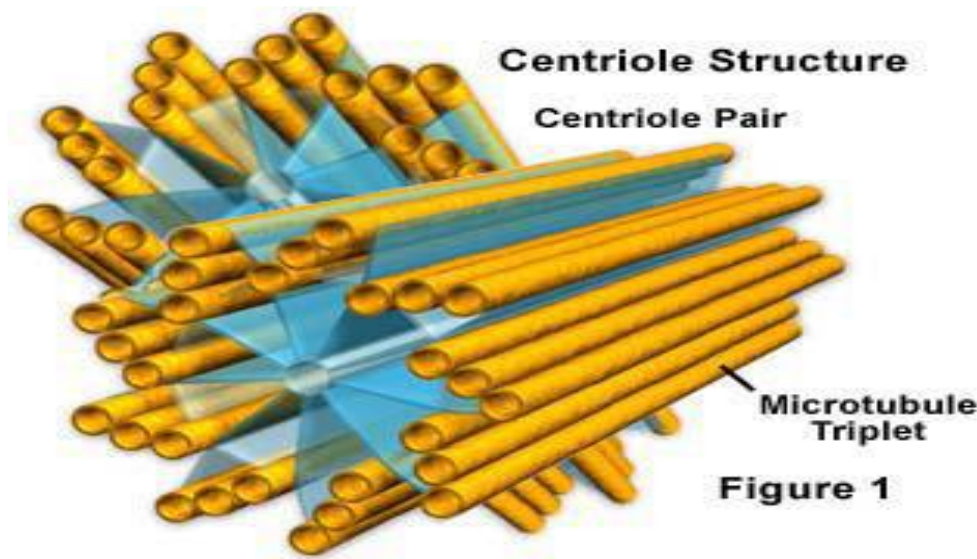
- **Cytoskeleton serves** as scaffolding for the movement of organelles and other components.
- **Cytoskeleton plays an important role** in maintenance of cell shape as well as in cell division.
- **Basically two types of cytoskeletal elements** are found in plant cells; microtubules and microfilaments.
- **Microtubules** are hollow cylinders with an outer diameter of 25 nm.
- **Microtubules are composed of** polymers of the globular protein 'tubulin'.
- **A single microtubule consists** of thousands of tubulin monomers arranged in 13 columns called protofilaments.
- **Microfilaments** are solid with 7 nm diameter.
- **Microfilaments are composed of** protein globular actin (or G-actin).
- **A microfilament consists** of two chains of polymerized actin subunits that intertwined in a helical fashion.
- **Microtubules have three functions:**
 - a. To maintain the shape of the cell.
 - b. To serve as tracks for organelles to move along within the cell.
 - c. They form the **centriole**.





Centriole

- 1- This consists of two bundles of microtubules at right-angles to each other.
- 2- Each bundle contains 9 tubes in a very characteristic arrangement
- 3- At the start of mitosis and meiosis, the centriole divides, and one half moves to each end of the cell, forming the spindle.
- 4- The spindle fibers are later shortened to pull the chromosomes apart.



Cell Wall

- A fundamental difference between plant and animal cells is that the plant cell is surrounded by a rigid cell wall, mostly made of polysaccharides (cellulose, hemi-cellulose, pectin) and lignin.
- Plants have two types of cell walls, primary and secondary.
- Primary cell walls are thin and characteristic of young, growing cells.
- Secondary cell walls are thicker and stronger, and they are deposited when most cell enlargement has ended.
- Secondary cell walls have their strength and toughness due to lignin; a glue like material.
- The lignified secondary walls provide the plants the structural reinforcement necessary to grow vertically above the soil.



Department of biology



- **Bryophytes** which lack the lignified cell walls are unable to grow more than a few centimeters above the ground.
- **In plants**, the neighboring cells are cemented together by a middle lamella (intercellular layer).

