



THIRUTHANGAL NADAR COLLEGE

(Belongs to the Chennaivazh Thiruthangal Hindu Nadar Uravinmurai Dharma Fund)

Selavayal, Chennai-51.

A Self-Financing Co-educational College of Arts & Science

Affiliated to the University of Madras

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An ISO 9001: 2015 Certified Institution

NAME OF THE DEPARTMENT: PLANT BIOLOGY & PLANT BIOTECHNOLOGY

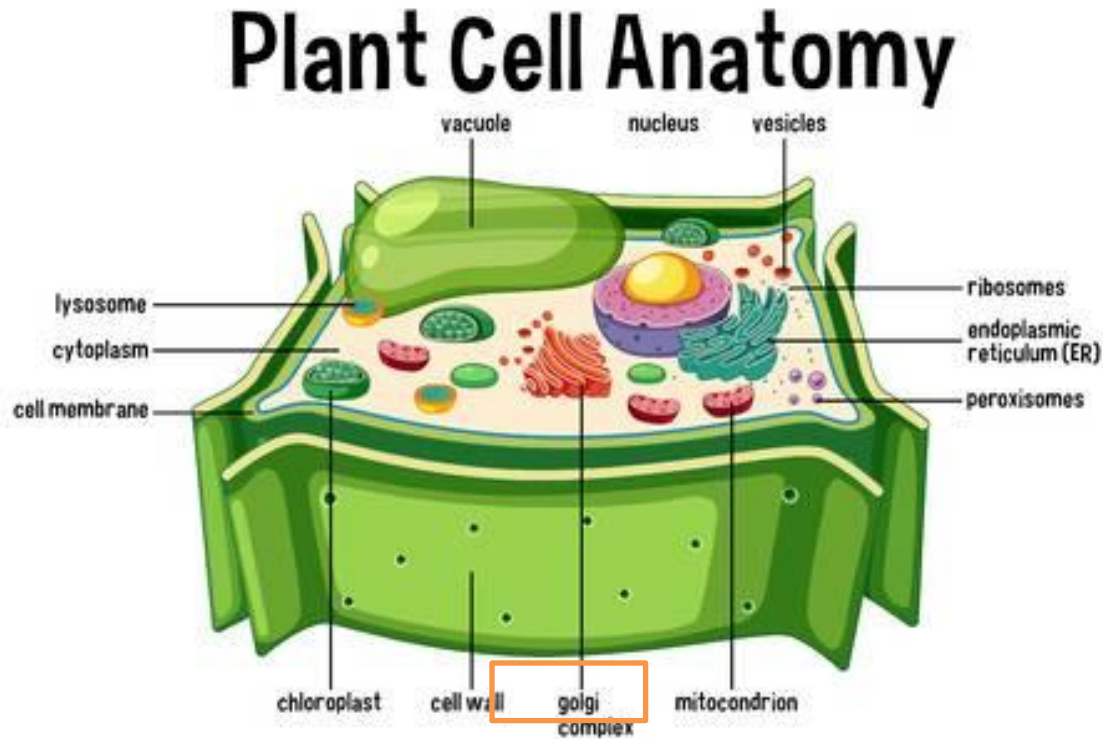
SUBJECT : PLANT ANATOMY & EMBRYOLOGY

TOPIC : CELL WALL

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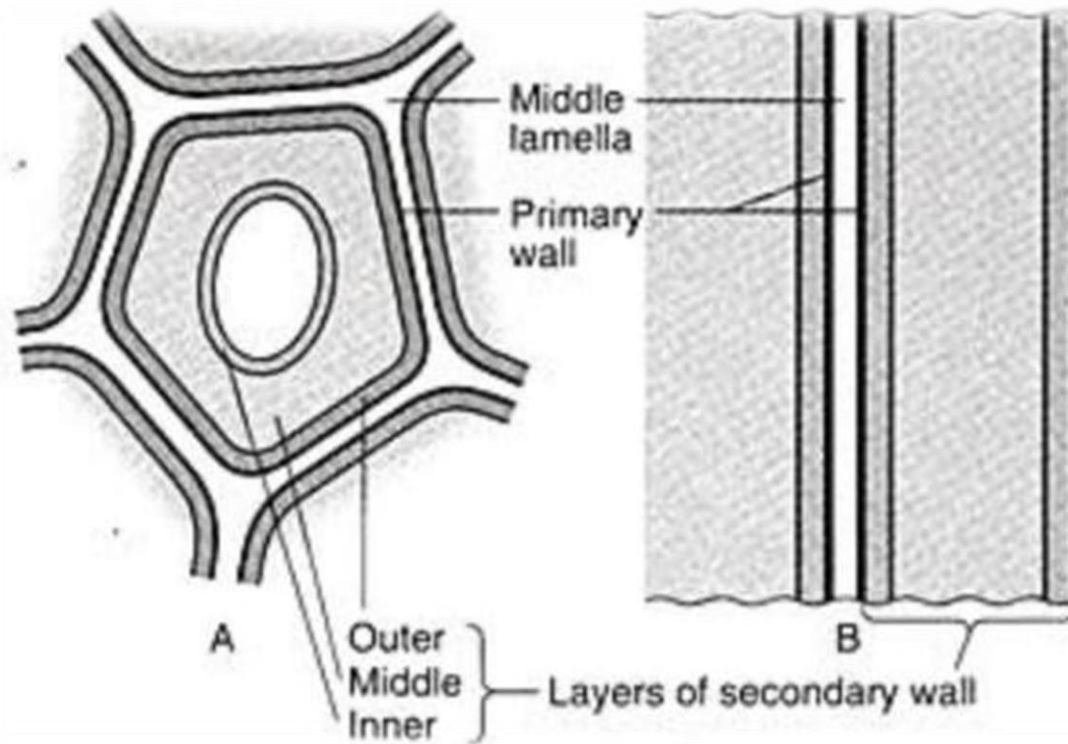
PLANT CELL

- Unique part of a plant cell which provide definite shape and structure and protect the cell.



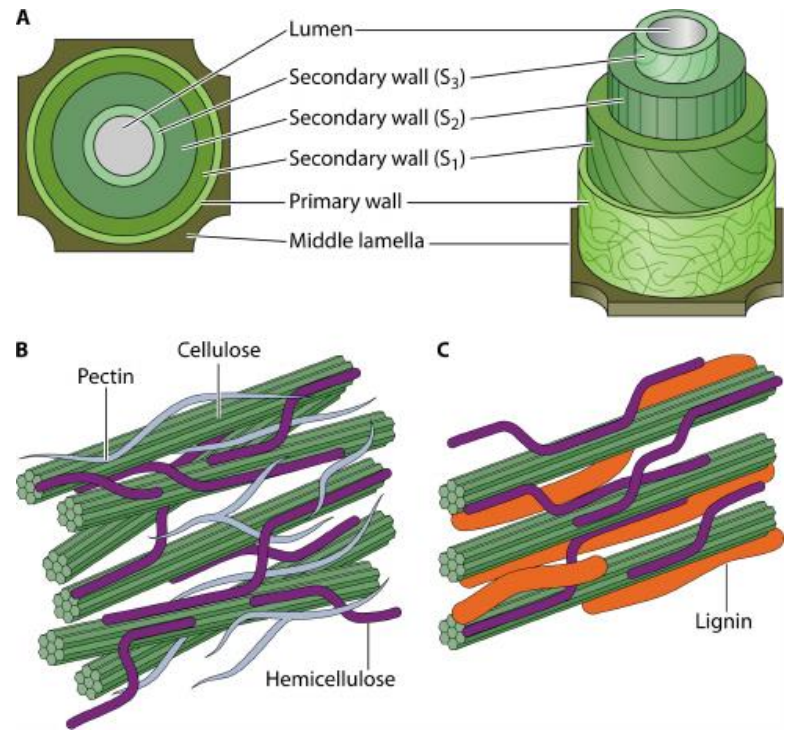
CELL WALL - STRUCTURE

- Types of cell wall – Primary, Middle lamella and Secondary wall



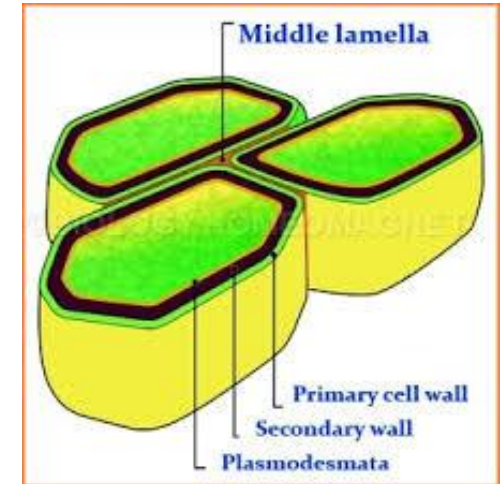
Primary wall

- The membrane developed on the surface of the cell plate denotes the 1st stage .
- The walls of dividing and growing meristematic cells are primary.
- It is usually associated with living protoplasm.
- It consists of **cellulose, pectic compounds, non cellulosic polysaccharides and hemicelluloses.**
- Primary wall change its shape and volume according to the growth of young protoplast, **changes are reversible.**
Eg. (i) Cambial walls show seasonal changes in thickness
(ii) primary walls of the endosperm in many seeds are digested during germination.



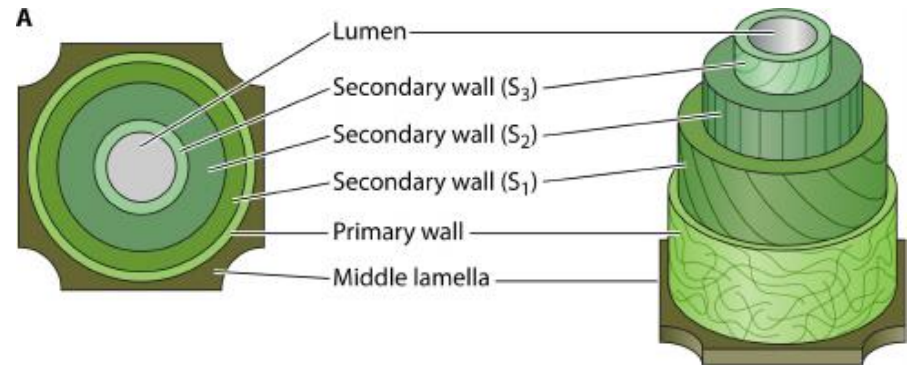
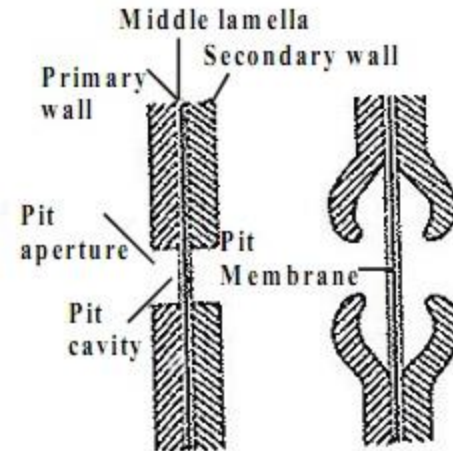
Middle lamella

- It is the intercellular substance which **cements** two contiguous cells very firmly.
- It is **amorphous, colloidal and optically inactive**.
- It is composed mainly of **a pectic compound** which is a mixture of calcium and magnesium pectate.
- In woody tissues, it is commonly **lignified**.
- In tracheids and fibres, which typically develop prominent secondary walls, the two primary walls of adjacent cells and the intervening middle lamella appear as a unit, this triple structure is often known as middle lamella.



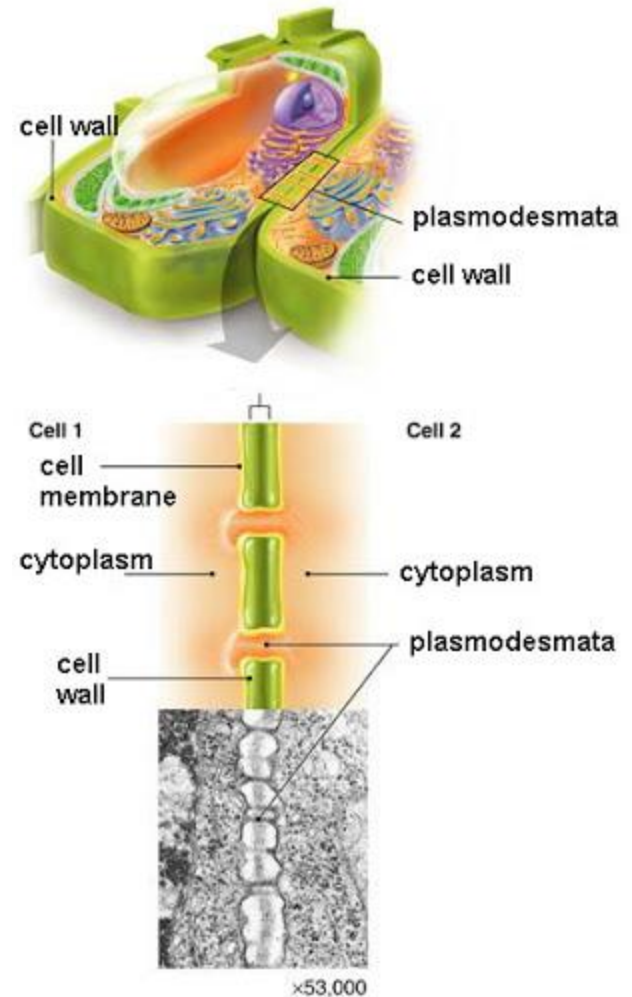
Secondary wall

- It may be considered as supplementary wall whose primary function is **mechanical**.
- Cells with this wall layer are **devoid of protoplast at maturity**.
- It **undergo irreversible changes in their development**.
- It is laid down over the primary wall except over the pit membrane.
- In the tracheids and vessels - in protoxylem the secondary wall forms as rings, spiral bands and bars over the delicate primary wall.
- **It is more massive**, in most thick-walled cells, it constitutes the major part of the cell.
- Usually secondary wall constitutes 3 layers – inner, middle and outer.
- It consists of **cellulose or mixture of cellulose, non-cellulosic polysaccharides and hemicelluloses**.



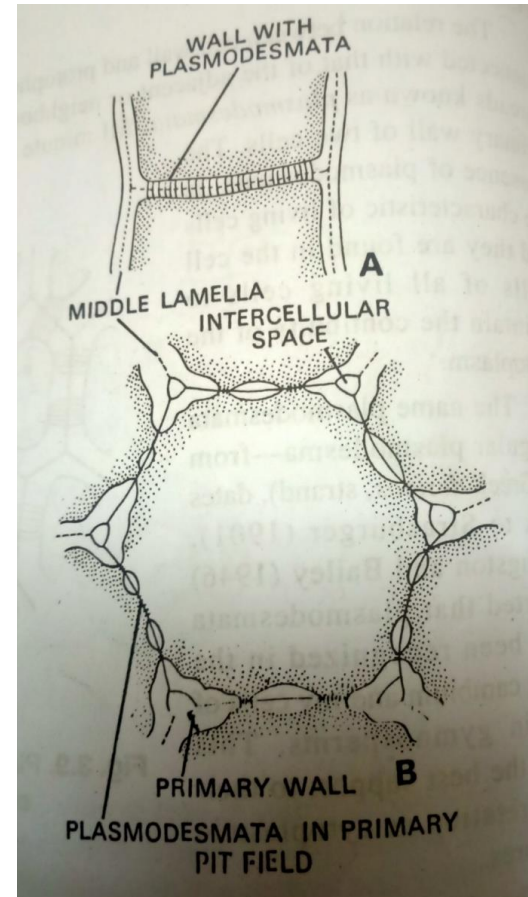
Plasmodesmata

- The protoplast of one cell remains connected with that of the adjacent or neighbouring cell by delicate threads of cytoplasm known as plasmodesmata (singular plasmodesma – from the Greek desmos, strand).
- It is present in all the living cells to maintain the continuity of the protoplasm.
- It is present in red algae, liverworts, mosses, vascular cryptogams, gymnosperms and angiosperms.



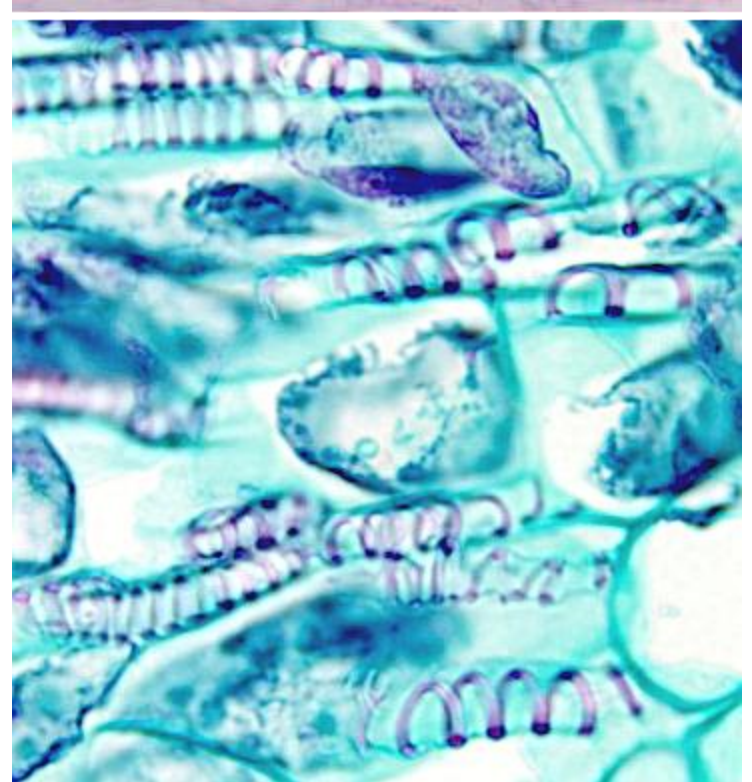
Plasmodesmata

- Present in all living tissues of a plant including the meristematic tissues.
- Either occur in groups or distributed throughout a wall.
- Plasmodesmata found in groups are frequently localized in the primary pit fields.
- It is common that all primary pit fields of living cells are traversed by plasmodesmata.
- Origin - It is formed in older walls.
- Function – concerned with material transport and conduction of stimuli.
- It is most readily seen in the endosperm of some seeds (*eg. Phoenix, Aesculus*) where food storage has greatly increased wall thickness.



Thickening of the cell wall

- A mature cell become modified according to the function they have to perform.
- During this process they undergo additional or secondary thickening deposition of new materials such as cellulose, lignin, suberin, cutin etc.
- Some cells remain unthickened (parenchyma), some cells undergo heavy thickening on their walls (xylem, phloem).
- The thickening materials of the cells are secreted by the protoplasm.
- Due to the deposition, cell wall becomes stratified in appearance.

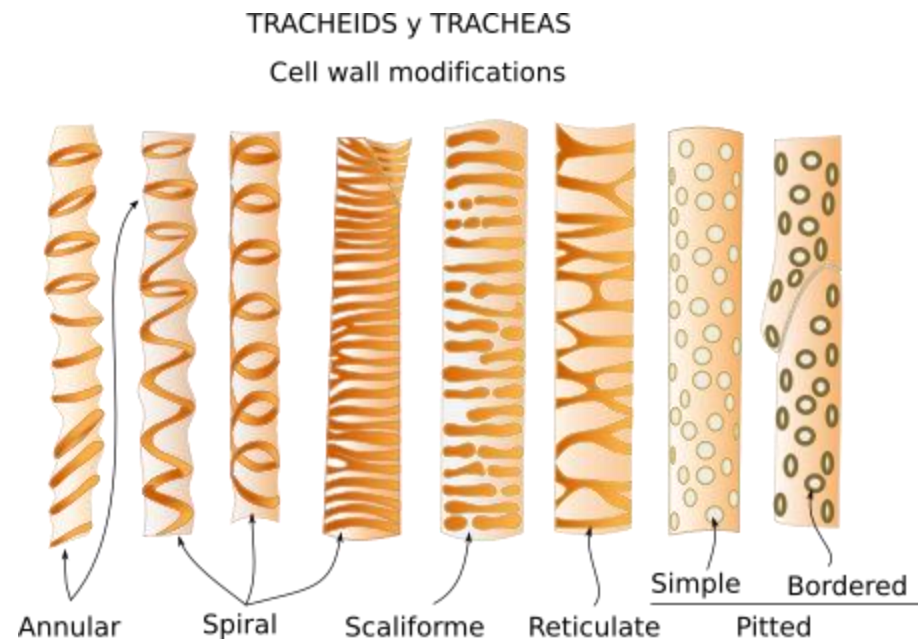


Thickening of the cell wall

- The cells which ultimately develop into vessels, tracheids and fibres show the thickening of the cell wall in various ways.
- This thickening takes place due to the deposition of a hard substance lignin, on the inner surface of the cell wall.
- The thickening material of the secondary wall is not laid down in uniform thickness but it may form the special patterns such annular, spiral, scalariform, reticulate and pitted.

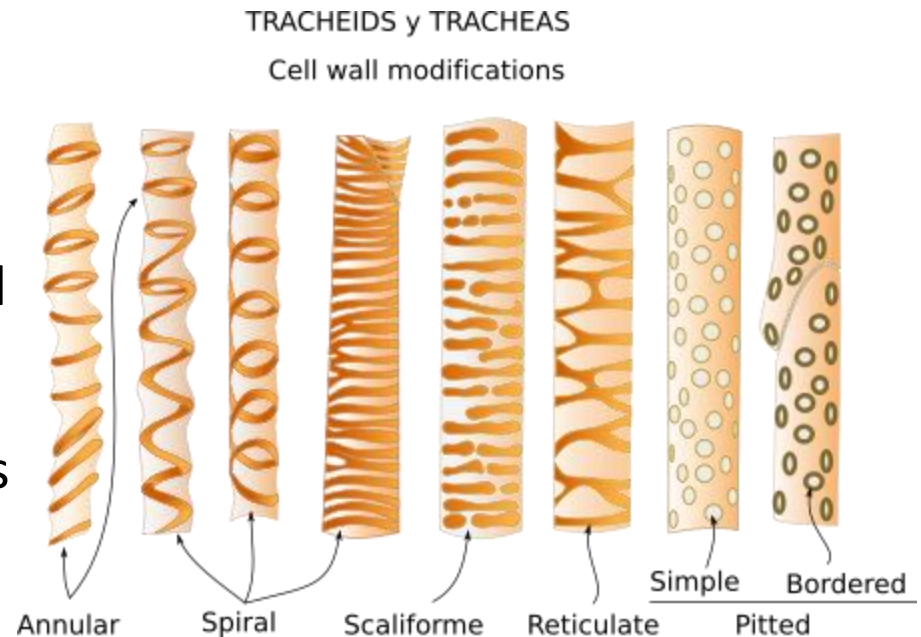
Thickening of the cell wall

- **Annular or ring-like thickenings** – Deposition of lignin in the form of rings on the inner surface of the cell wall one above the other. Gaps remain unthickened. Found in vessels and tracheids
- **Spiral thickenings** – Deposition of lignin in the form of complete spiral bands. Number varies from one or more than one. Found in vessels of angiosperms.
- **Scalariform or ladder-like thickening** – lignin is being deposited in the form of the transverse rods of the ladder. Found in xylem vessels and tracheids of protoxylem.



Thickening of the cell wall

- **Reticulate or net-like thickenings** – lignin is deposited in the form of a net or reticulum. Unthickened areas of the cell wall are irregular in shape. Found in vessels of the stems, roots and leaves of angiosperms and in the tracheids of protoxylem.
- **Pitted** – the whole inner wall is more or less uniformly thickened, leaving here and there some small unthickened areas, the pits.



Pits

- Pits are formed in pairs lying against each other on the opposite sides of the wall – morphologically called as pit pairs.
- Pit pair – structural and directional unit constituted by two pits lying opposite to each other of contiguous cells.

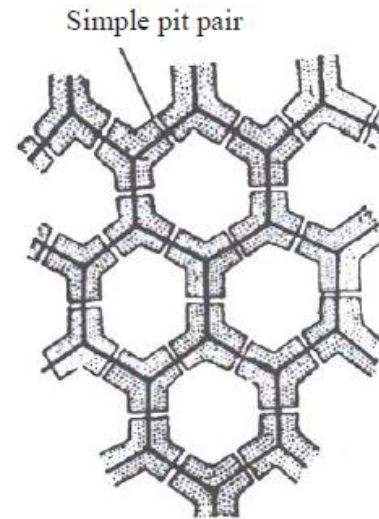


Fig. : T.S. of Sclerenchyma fibre

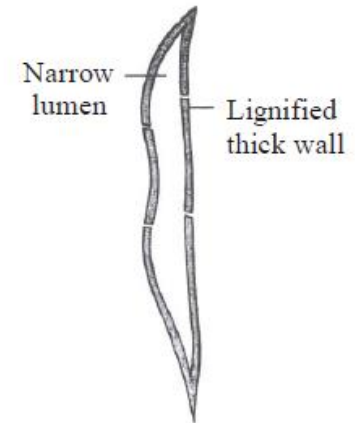
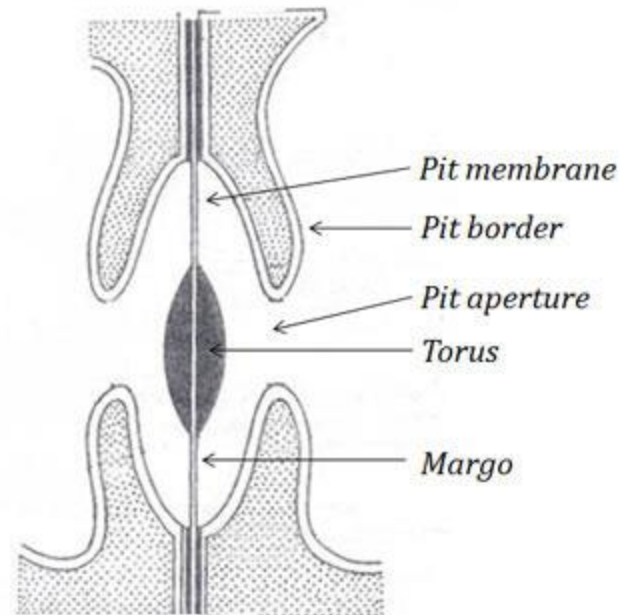


Fig. : L.S. of Single Sclerenchyma fibre

Structure of a Pit

- **Pit cavity or pit chamber** – space found inside the pit.
- **Pit membrane** – consist of two primary walls and a middle lamella. It is common to both pits of a pit pair.
- A pit has **2 pit cavities, two pit apertures, and one pit or closing membrane.**
- Usually two types of pits are found in various plants they **are simple pits and bordered pits.**
- Two simple pits make up a simple pit pair and two bordered pits make up a bordered pit pair.
- **Blind pit** – A pit occurs opposite an intercellular space has no complementary pit.



Ultra-structure of Bordered Pit

Types of pit

- **Bordered pit** has secondary wall arching over the pit cavity which forms the actual border and becomes narrow like a funnel towards the lumen of the cell.
- In **simple pit** no such arching of the secondary wall and narrowing of the pit towards lumen of the cells occurs.

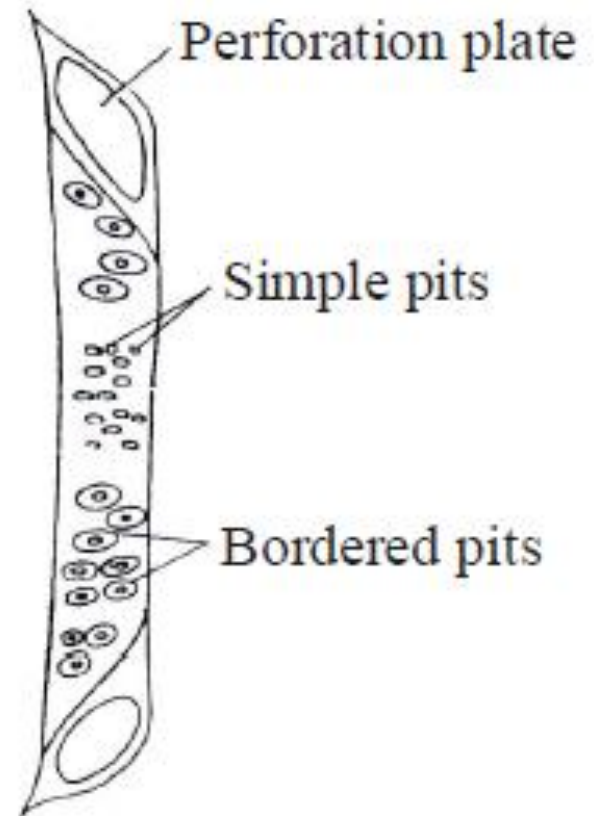


Fig. : Vessels

Types of pits

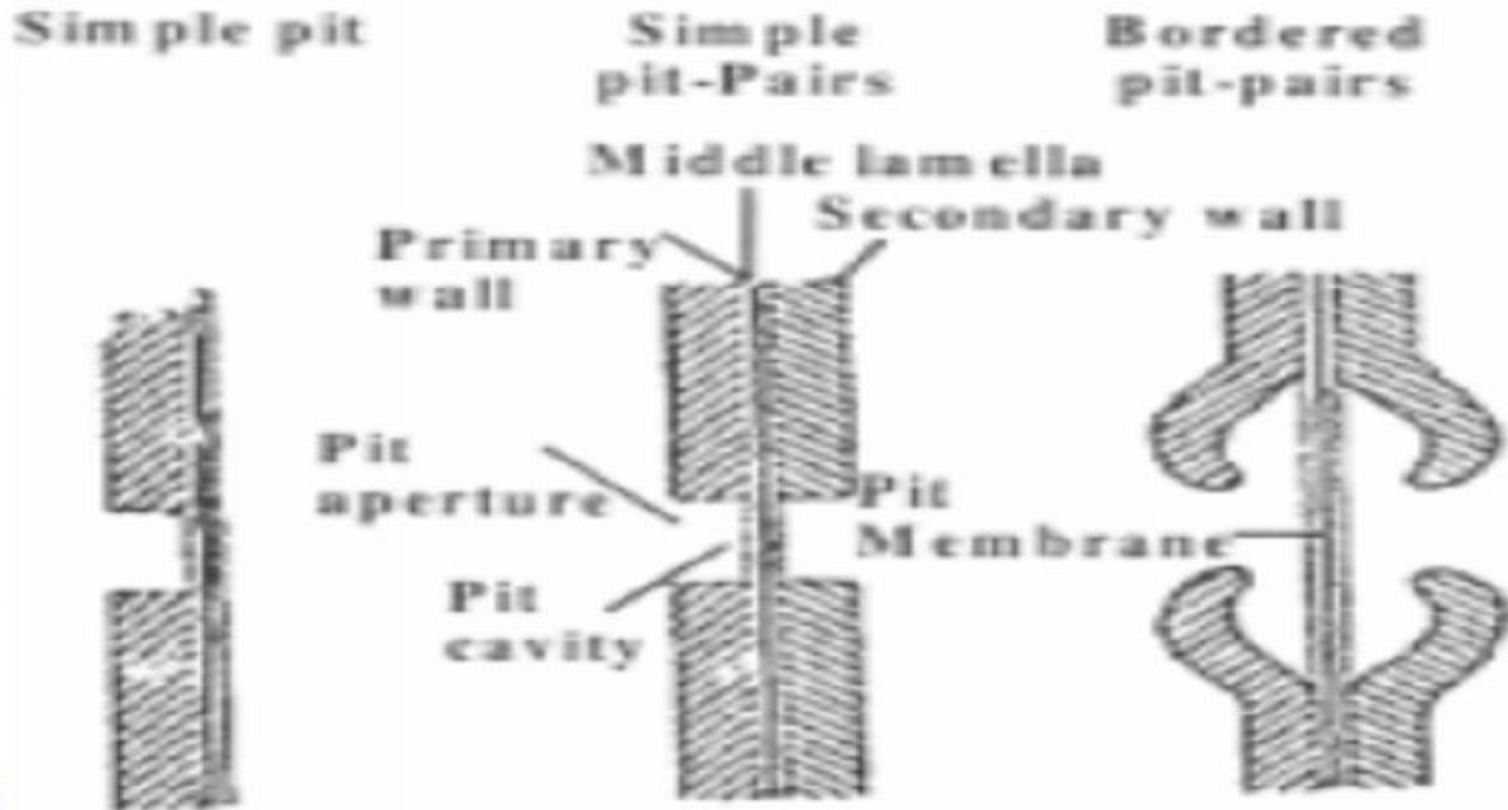


Fig : 12.5 Structure of pits

Difference between simple pit and bordered pit

Simple pit

- Present in parenchyma cells, in medullary rays, in phloem fibres, companion cells and in tracheids of several flowering plants.
- Pit border is absent
- Pit cavity remains the same diameter and the pit or closing membrane also remains simple and uniform in its structure

Bordered pit

- Present abundantly in the vessels of many angiosperms and in the tracheids of many conifers.
- Pit border (overarching secondary wall layer over the pit cavity) is present.
- The border divides cavity into two chambers.

THANK YOU