

(iii) Sclerenchyma

- They are dead cells, and act as purely mechanical.
- The cells are long, narrow and pointed at both ends. The cell walls are lignified and have simple pits.
- The cell walls are very thick with the result that the cell cavity becomes narrow.

Types of Sclerenchyma: It is of two types: **A. Fibers** **B. Sclereids**

A. Fibers

Cells long, narrow and thick walls pointed at both ends and lignified. Cell wall has simple or bordered pits. Fiber types:

1- Cortical fibers in cortex.

2- Pericyclic fibers in pericycle, Pericyclic fibers are also called perivascular fibers.

3- Phloem fibers in phloem. Phloem fibers are also called bast fibers.

4- Bundle sheath fibers as below.



5- Septate fibers: are long lived fibers occurs in phloem in some plants.



Hard fibers and Soft fibers

(a) Hard fibers: The hard fibers are monocot leaf fibers with very thick lignified walls.

(b) Soft fibers: are bast fibers e.g.; Hemp, Flax. Jute, etc.

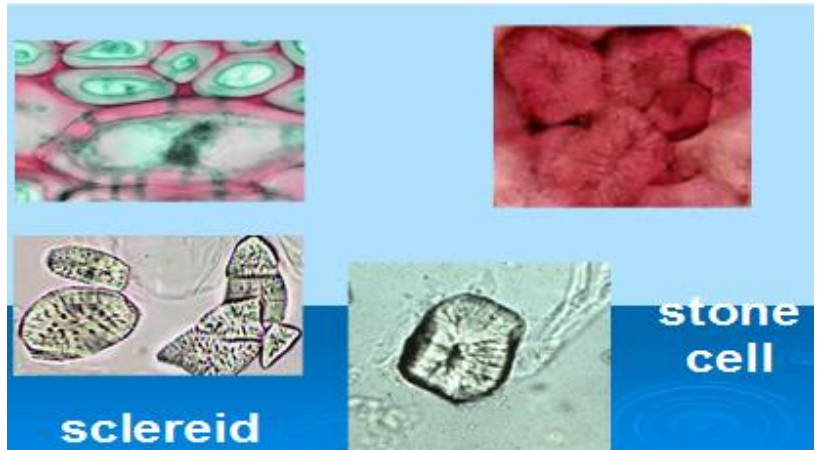
B. Sclereids

These are not much longer than their breadth. They have also extremely thick wall of lignin with narrow lumen. The cells have no definite shape.

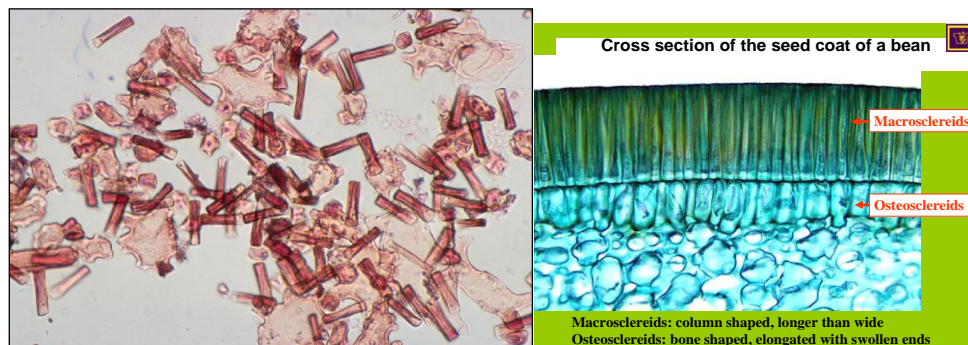
Types of Sclereids:

(a) **Brachysclereids** or **Stone cells:** These are

small, oval or rounded cells. They are found in cortex, phloem and pith of stems and fleshy pericarp of certain fruits (e.g. pear, apple, and guava). Stone cells are also present in hard parts like endocarp of coconut and hard seed coats.

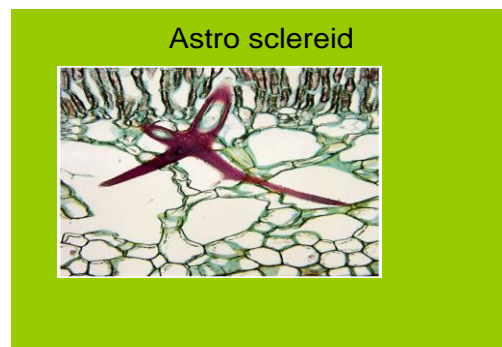


(b) **Macrosclereids:** These are rod-like or columnar cells. They are common in the seed-coats of many leguminous plants (e.g. pea).



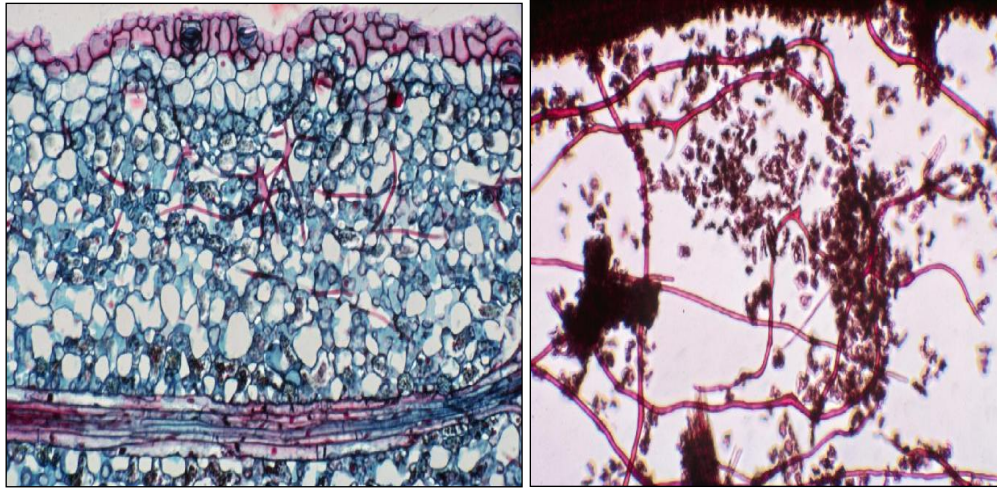
(c) **Osteosclereids:** These are bone-shaped cells and look like as bones. They are found in leaves and seed-coats of several monocotyledons.

(d) **Asterosclereids:** These are star-shaped cells. They are found in the petioles of



Nymphaea.

(e) **Trichosclereids:** These are hair-like, branched or unbranched cells. They are found in the intercellular spaces of leaves and stems of some aquatic plants.



Sclereids provide mechanical strength to the part of the plant where they are present. They contribute to hardness of the part concerned. Develops resistance in plant against unfavorable conditions.

B. COMPLEX TISSUES:

The complex tissues are made up of living and non-living cells which perform different functions. The complex tissues act as single units. The complex tissues are also known as vascular tissues. They are of two types: **Xylem** and **Phloem**.

(i) Xylem or wood or Hadrome

It is also called as wood because the major part of stem and root in vascular plants is constituted by xylem. The function of xylem is to conduct water and mineral salts upwards from the root to the leaf and to **give mechanical strength to the plant body. It is composed of four different kinds of elements:**

- (a) **Tracheids**
- (b) **Vessels**
- (c) **Xylem fibers**
- (d) **Xylem parenchyma**

(a) Tracheids

- A single tracheid is highly elongated or tube-like cell with hard, thick and lignified walls and a large cavity.
- The secondary wall layers possess various kinds of thickenings in them and may be distinguished as annular, spiral, reticulate, scalariform or pitted.
- Tracheids occur alone in the xylem of ferns and gymnosperms. Whereas in the xylem of

angiosperms they occur with the vessels.

Functions: These carry out transport of water, hormones and solutes from the root to the stem, leaves and floral parts. It gives mechanical support to the plant body.

(b) Vessels

- A vessel is a long, cylindrical, tube-like structure with lignified walls and a wide central cavity.
- The cells are dead and without protoplast.
- These are arranged in longitudinal series in which the transverse walls (the end plates) are perforated and as such the entire structure looks like a water pipe.
- The perforations may be simple (only one pore) or multiple (several pores). Vessels also have various types of thickenings similar to tracheids.
- Vessels are found only in some pteridophytes and gymnosperms. However they are present in almost all angiosperms.

Functions: They serve as a more efficient mode of transport of water and minerals as compared to tracheids due to the presence of perforation plates. These also give mechanical support to the plant body.

(c) Xylem fiber

Sclerenchymatous cells associated with xylem are called xylem fibers. They are long, narrow, thick and lignified cells; usually pointed at both ends. Xylem fibers are of two types:

1. Libriform fibers
2. Fiber tracheids

Libriform fibers have very thick walls and simple pits. Fiber tracheids have thin walls and bordered pits.

Functions: Xylem fibers provide mechanical strength to the xylem and to the plant body as a whole.

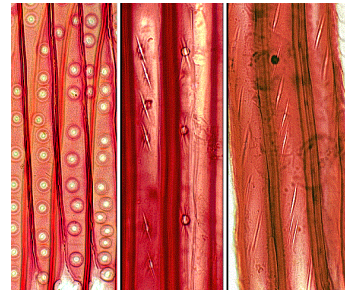
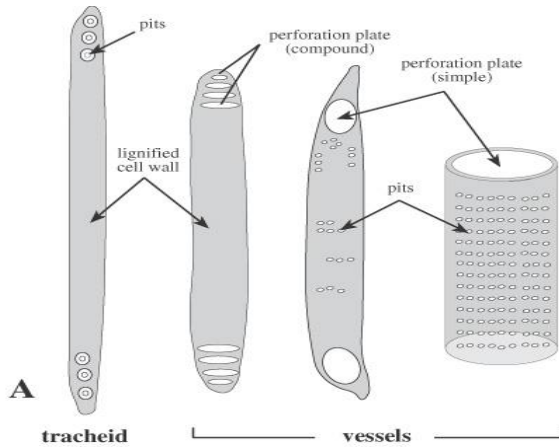
(d) Xylem parenchyma

- The parenchyma cells found in xylem are living and isodiametric.
- Xylem parenchyma cells are more common in primary xylem than secondary

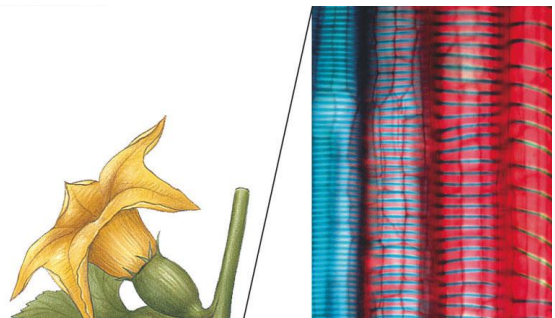
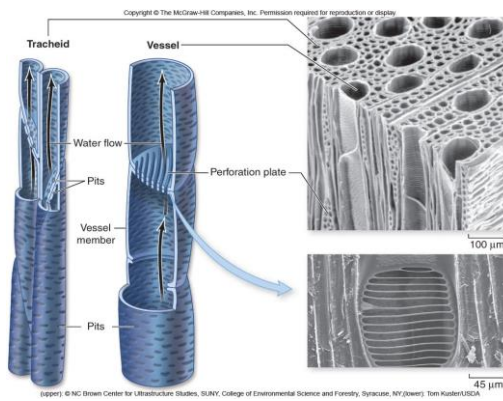
xylem.

- are thin-walled and made up of cellulose, while those found in secondary' xylem are thick-walled and made up of lignin.

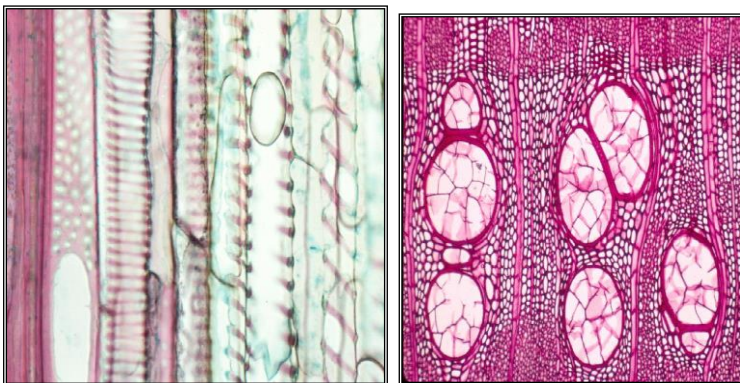
Functions: It serves for food storage. It helps in the conduction of water upwards.



Tracheids, fiber tracheids, xylary (libriform) fibers



Different shapes cell wall vessel thickening



Different shapes of cell wall vessel thickening & tyloses