

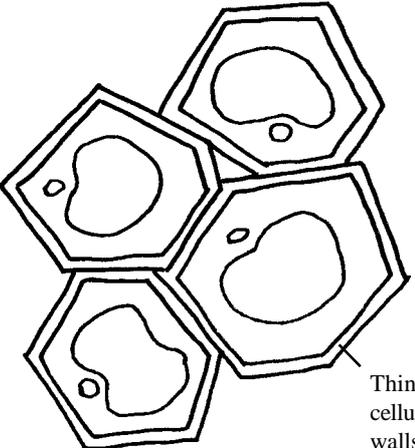
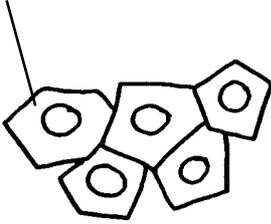
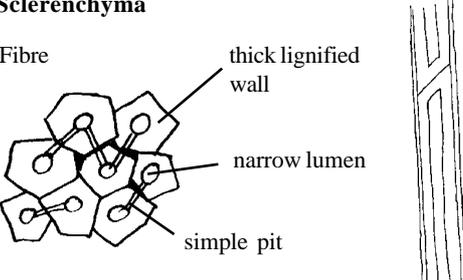
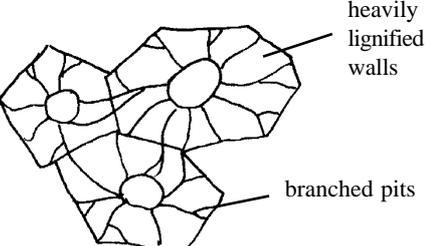
Bio Factsheet

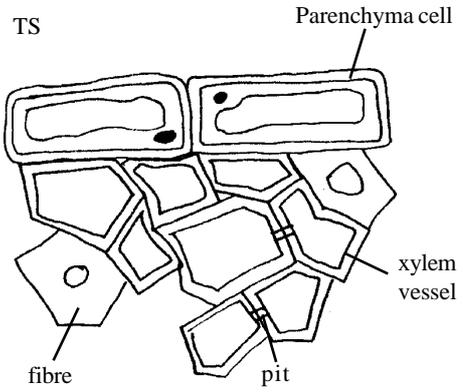
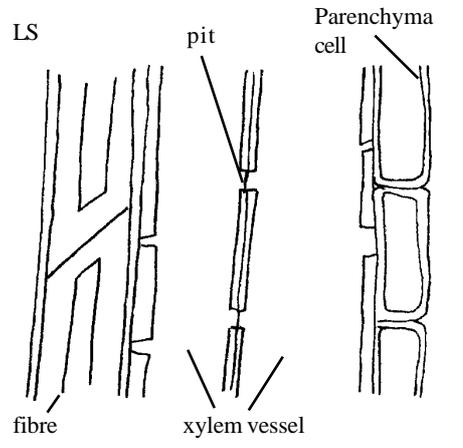
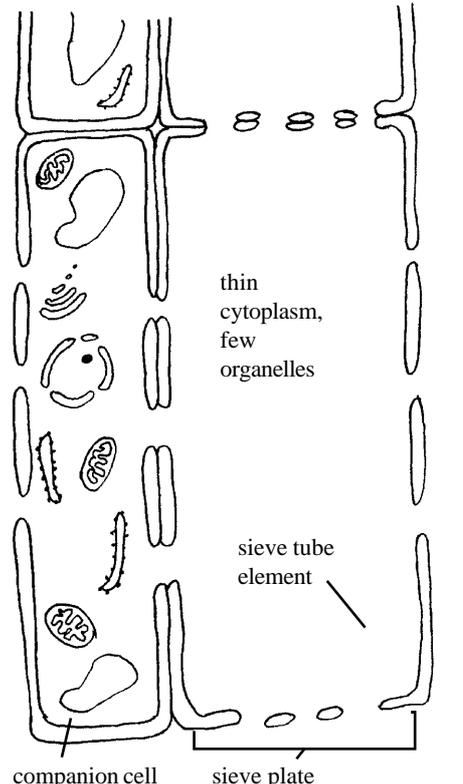


Number 19

Plant Tissues

This Factsheet will summarise the structure and function of simple and complex plant tissues.

Tissue	Structure
<p>Parenchyma</p>  <p>Thin cellulose walls</p>	<p>Parenchyma Individual cells are spherical or isodiametric (having equal diameters in all directions) - allows cells to be packed together very tightly. Often referred to as packing tissue because it makes up the bulk of tissue in the cortex of stems and roots and in the storage organs eg. potato tubers, where it is packed with starch.</p> <p>Cells are living with thin cellulose cell walls and are usually turgid - provides mechanical support for stems and roots.</p> <p>Retain ability to divide and can redifferentiate to form different cells. Following wounding, parenchyma cells can redifferentiate into meristematic cells, capable of producing new cells and tissue.</p> <p>May become specialised for particular functions. Chlorenchyma = parenchyma specialised for photosynthesis eg. palisade mesophyll cells with many chloroplasts. Aerenchyma = parenchyma specialised for gas exchange eg. spongy mesophyll and in aquatic plants, to provide buoyancy.</p>
<p>Collenchyma</p> <p>Thick cellulose walls</p> 	<p>Collenchyma Found just below epidermis in stems and petioles. Makes up the ridges in ridged stems and forms the stringy parts of celery. Provides a cylinder of flexible but strong tissue around the outside of the stem and petiole. This allows them to bend in the wind. The percentage of collenchyma in young stems increases as exposure to the wind increases.</p> <p>Tightly packed cells, with few if any air spaces but cell walls are unevenly thickened, having extra cellulose deposited in the corners - extra cellulose provides mechanical strength.</p> <p>Cells are living, i.e. non lignified - allows tissue to stretch and provides flexible support.</p> <p>Not found in roots - roots not exposed to wind so no need for flexible support.</p>
<p>Sclerenchyma</p> <p>Fibre</p>  <p>thick lignified wall narrow lumen simple pit</p> <p>Sclereids</p>  <p>heavily lignified walls branched pits</p>	<p>Sclerenchyma There are two types of sclerenchyma cell but both have rigid, lignified walls which cannot stretch.</p> <p>Fibres are long, narrow cells with thick lignified walls and narrow lumens. Their walls have simple pits. Their pointed, tapering ends overlap with the fibres above and below them - provide mechanical strength and protection to non growing regions.</p> <p>Fibres are found in xylem and phloem and form bundle caps in dicotyledon stems. In transverse section they form a cylinder of mechanically strong tissue around the perimeter of stems allowing stems to withstand lateral forces. Fibres are economically important - in ropes and fine linen etc.</p> <p>Sclereids are shorter and fatter than fibres but, like fibres, the cells have no living contents and have heavily lignified walls - provides mechanical strength.</p> <p>Sclereids may occur in isolation in the cortex, pith, xylem and phloem or may occur in groups in the testa of seeds eg. shell of walnut - provides protection against physical, chemical and biological agents and contributes to firmness of fruit tissues.</p>

Tissue	Structure
<p>Xylem</p> <p>TS</p>  <p>LS</p> 	<p>Xylem Contains 4 types of cell 1. vessels 2. tracheids 3. parenchyma 4. fibres</p> <p>Vessels consist of dead, hollow cells with wide lumens. Cells are linked end to end in a drainpipe fashion. End walls have one or more perforations - allows rapid transport of large volumes of water from roots up through the stem.</p> <p>Vessels have thick lignified walls - prevents the cells collapsing, enabling them to withstand the negative pressures generated as water is pulled up through their lumens. Lignin also provides waterproofing.</p> <p>Side walls may have bordered pits (unlignified areas) - allows lateral movement of water. If, for example, one xylem vessel becomes blocked, water moves sideways to another vessel and then upwards again.</p> <p>Vessels are the main conducting cells in angiosperms - Large leaf surface areas mean transpiration losses, hence water demand, is very high. Large diameter vessels enable large volumes of water to be moved through the plant.</p> <p>Tracheids Dead, hollow cells with narrower lumens than vessels. Tracheids are connected vertically to each other via bordered pits - Conduct water in conifers which, because they have needles, do not lose as much water as, for example, broadleaved trees. Narrower lumens encourages capillarity.</p> <p>Have tapering end walls which dovetail together and various patterns of lignified thickening - provides mechanical strength.</p> <p>Parenchyma Thin cellulose walls with living contents - contribute to support via turgidity.</p> <p>Fibres Similar to fibres in sclerenchyma - provide strength.</p>
<p>Phloem</p> 	<p>Phloem Consists of 4 types of cell: 1. sieve tube elements 2. companion cells 3. parenchyma 4. fibres</p> <p>Sieve tube elements Living, tubular cells linked end to end. End walls are perforated and form a sieve plate - allows bidirectional flow of solutes and hormones</p> <p>Cytoplasm of sieve tube element is thin and peripheral. Few organelles, no nucleus - so flow of solutes not impeded</p> <p>Cellulose cell walls - allows exchange of substances across them.</p> <p>Each sieve tube element is directly connected via strands of cytoplasm known as plasmodesmata to its own companion cell. The companion cell controls movement of solutes in the sieve tube element. Plasmodesmata allow exchange of substances between the sieve tube element and the companion cell.</p> <p>Companion cell Dense cytoplasm. Has nucleus and abundant other organelles e.g. ribosomes, mitochondria and golgi body - Nucleus control activities of sieve tube element. Ribosomes allow production of enzymes and carriers. Mitochondria produce ATP for active transport in sieve tube element.</p> <p>Parenchyma Provide support through turgidity.</p> <p>Fibres Provide support and some protection for delicate sieve tube elements.</p>

Distribution of tissues in stem and roots

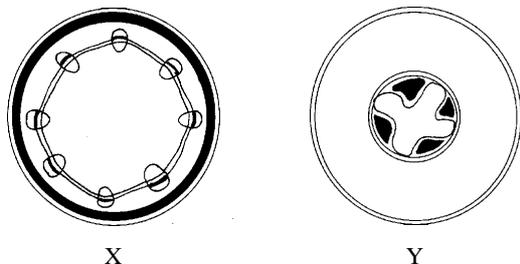
Stem	Root
Vascular bundles arranged in a ring around periphery to provide flexibility and support	Vascular bundle in central position. This reduces damage by friction as root penetrates soil
Sclerenchyma forms vascular bundle caps	No sclerenchyma - not needed, soil provides support
Collenchyma found in cortex beneath epidermis, provides flexible support in wind	No collenchyma - not needed, soil provides support
Chlorenchyma - may be found below epidermis - allows growing shoot to photosynthesise	No chlorenchyma - roots not exposed to sun therefore could not photosynthesise
Stomata or lenticels may be present - allows gaseous exchange for photosynthesis and respiration	No stomata or lenticels - gaseous exchange occurs via root hairs
No endoderm	Endoderm around vascular cylinder

Practice Questions

- Complete the table which relates the structure of some plant tissues to their functions.

Tissue/Cell	Feature	Function
Parenchyma	Thin cell walls	-
-	Angular thickening of cellulose	-

- The figure shows transverse sections of two plant organs labelled X and Y.



- Identify organs X and Y, giving reasons for your answers. (4 marks)

- Suggest why 'ring barking' - the removal of a strip of bark around the total circumference of a young tree - will kill the tree. (2 marks)

Answers

Marking points are shown by semicolons (owtte = or words to that effect)

-

Tissue/Cell	Feature	Function
Parenchyma	Thin cell walls	Transmit turgidity/ Allow diffusion
Collenchyma	Angular thickening of cellulose	Provides flexibility/ flexible strength

- X = Stem;
vascular tissue arranged concentrically;
in bundles;
Y = Root;
vascular tissue central;
no discrete bundles/no central pith;
 - Phloem is situated below epidermis/around outer edge of stem;
essential to maintain translocation/owtte.

Acknowledgements;

This Factsheet was researched and written by Kevin Byrne
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