PHARM.D • YEAR 2

Pharmacognosy & Phytopharmaceuti

CHAPTER 6

Study of Cell Wall Constituents and Cell Inclusions

PPT CHAPTER COVER

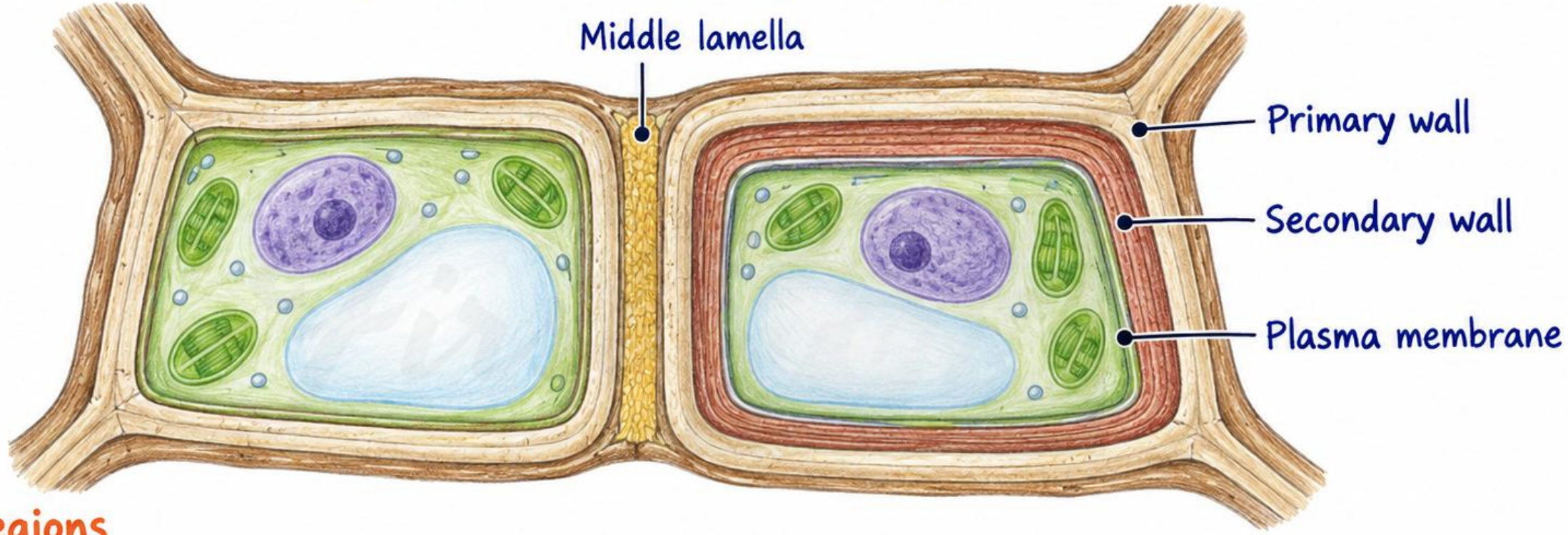


DOCTOR OF PHARMACY

Cell-wall layers: outside the membrane

Cell wall

An extracellular structure that gives plant cells shape, support and protection.



Three regions

Middle lamella: pectin-rich material binding adjacent cells.

Primary wall: thin, flexible wall of growing cells, containing cellulose, hemicelluloses and pectins.

Secondary wall: deposited inside the primary wall, commonly after expansion; often thick and lignified in vessels and fibres.

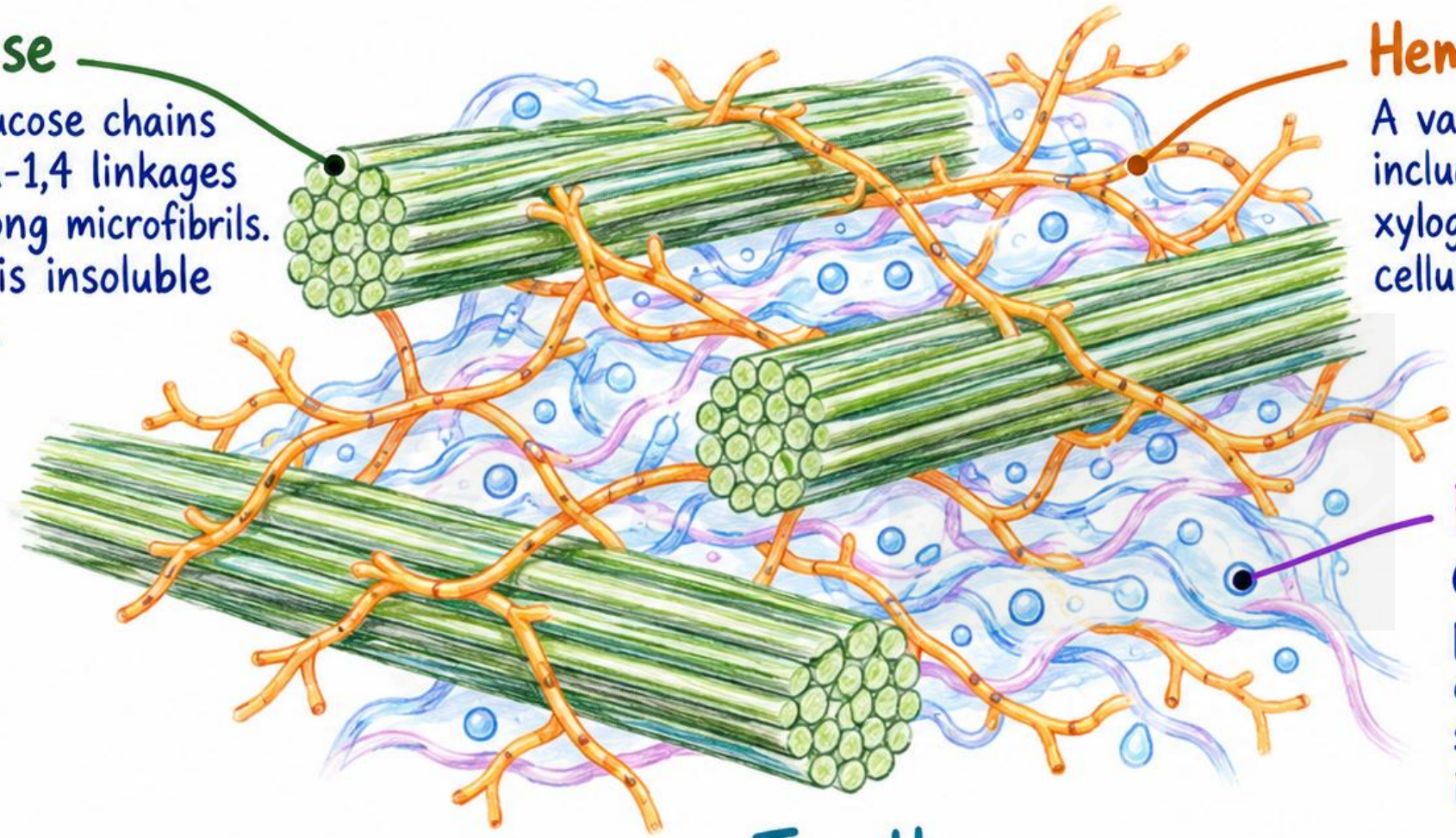
Pharmacognostic value

Wall thickness, composition and arrangement help identify tissues and powdered crude drugs.
The plasma membrane lies inside the wall and is a separate structure.

The wall matrix: strength and flexibility

Cellulose

Linear glucose chains with beta-1,4 linkages form strong microfibrils. Cellulose is insoluble in water.



Hemicelluloses

A varied group of polysaccharides, including xylans, mannans and xyloglucans, that associate with cellulose within the wall network.

Pectins

Galacturonic-acid-rich polysaccharides form a hydrated matrix and support adhesion, especially in the middle lamella.

Together

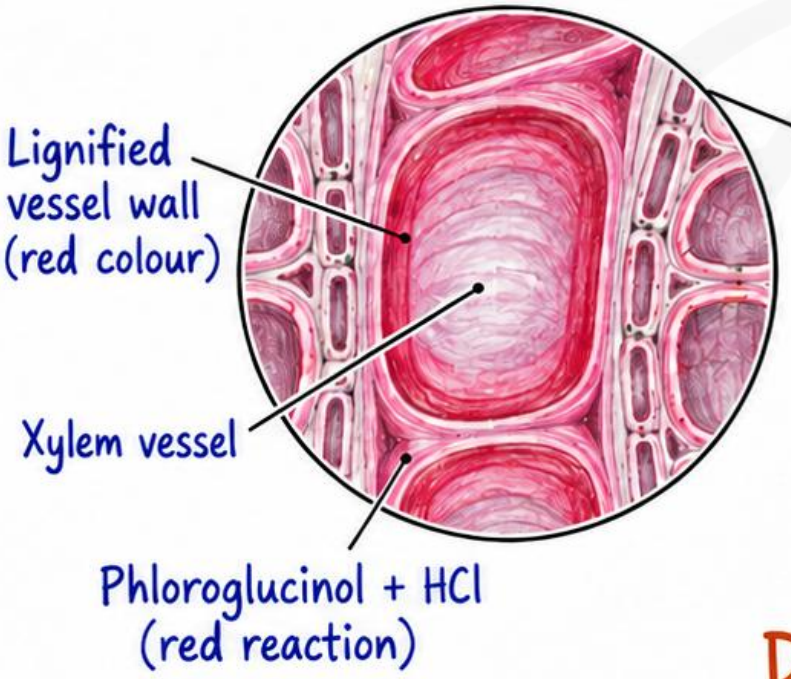
The fibres and matrix give growing walls both strength and flexibility. Pectin's gel-forming properties are also useful in pharmaceutical formulations; not every wall pectin fraction is freely water-soluble.

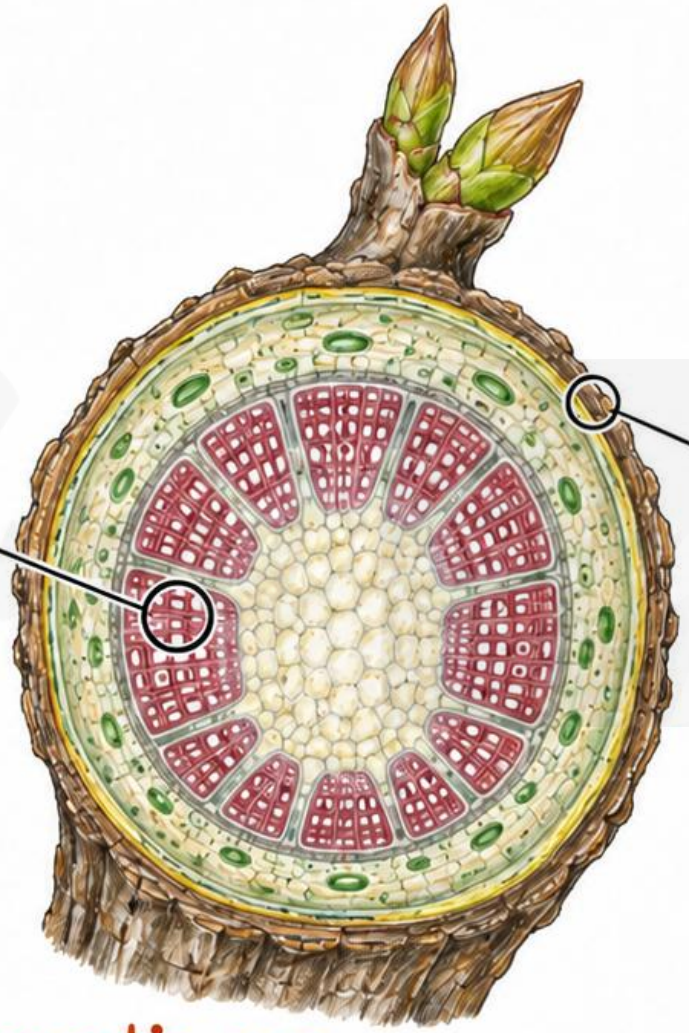
Lignin, cutin and suberin

Lignin

A phenolic polymer that strengthens many secondary walls, especially in xylem and sclerenchyma.

Phloroglucinol with hydrochloric acid gives a red reaction in lignified tissue.

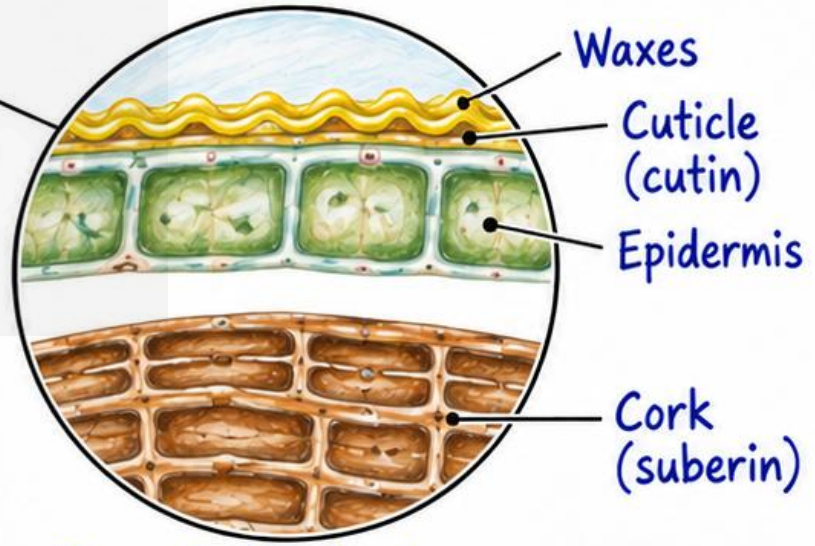




Protective lipids

Cutin is a polyester component of the cuticle; associated waxes reduce water loss.

Suberin has aliphatic and phenolic components and occurs prominently in cork and other barrier tissues.



Separate barrier tissues

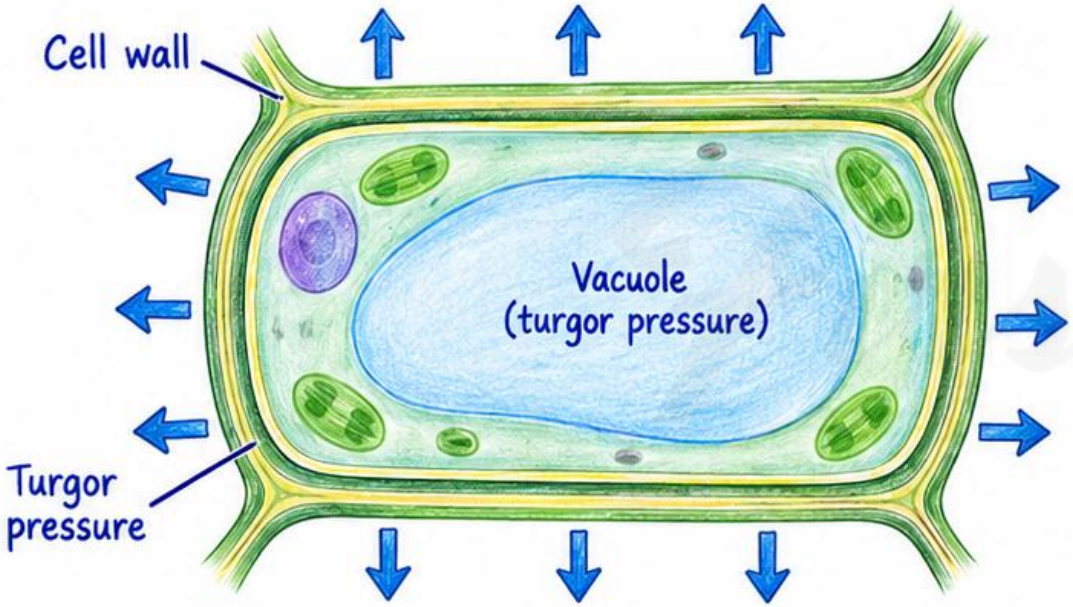
Diagnostic use

Compare lignified vessels or fibres with the protective surface of epidermis and cork. These materials differ chemically and should not all be called wax.

Cell-wall functions and remodelling

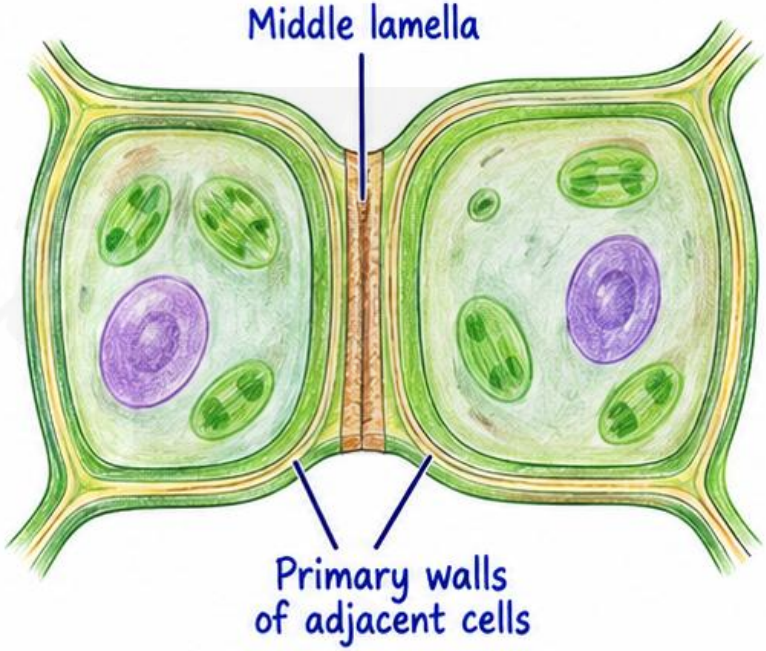
Mechanical roles

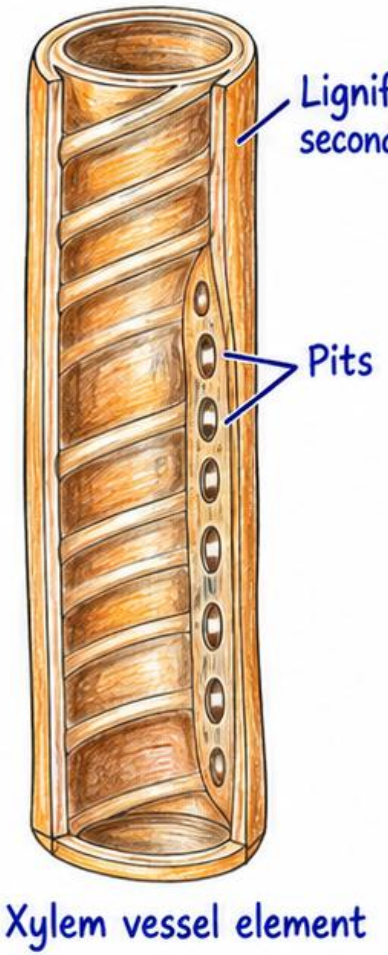
Walls maintain shape, resist turgor pressure and help prevent cell bursting. Flexible primary walls permit controlled expansion; thick secondary walls support mature tissues.



Tissue roles

Middle lamellae bind cells. Porous walls allow movement of water and small solutes; lignified xylem walls support water-conducting elements.





Living adjustment

Structural proteins such as extensins strengthen walls. Pectinases, cellulases and peroxidases participate in wall modification.

Wall architecture affects access of extraction solvents.

Many tannins and other metabolites are stored in cells or secretory structures, not as universal wall components.

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