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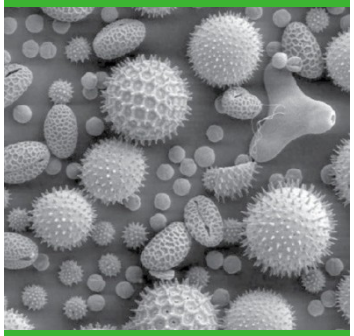
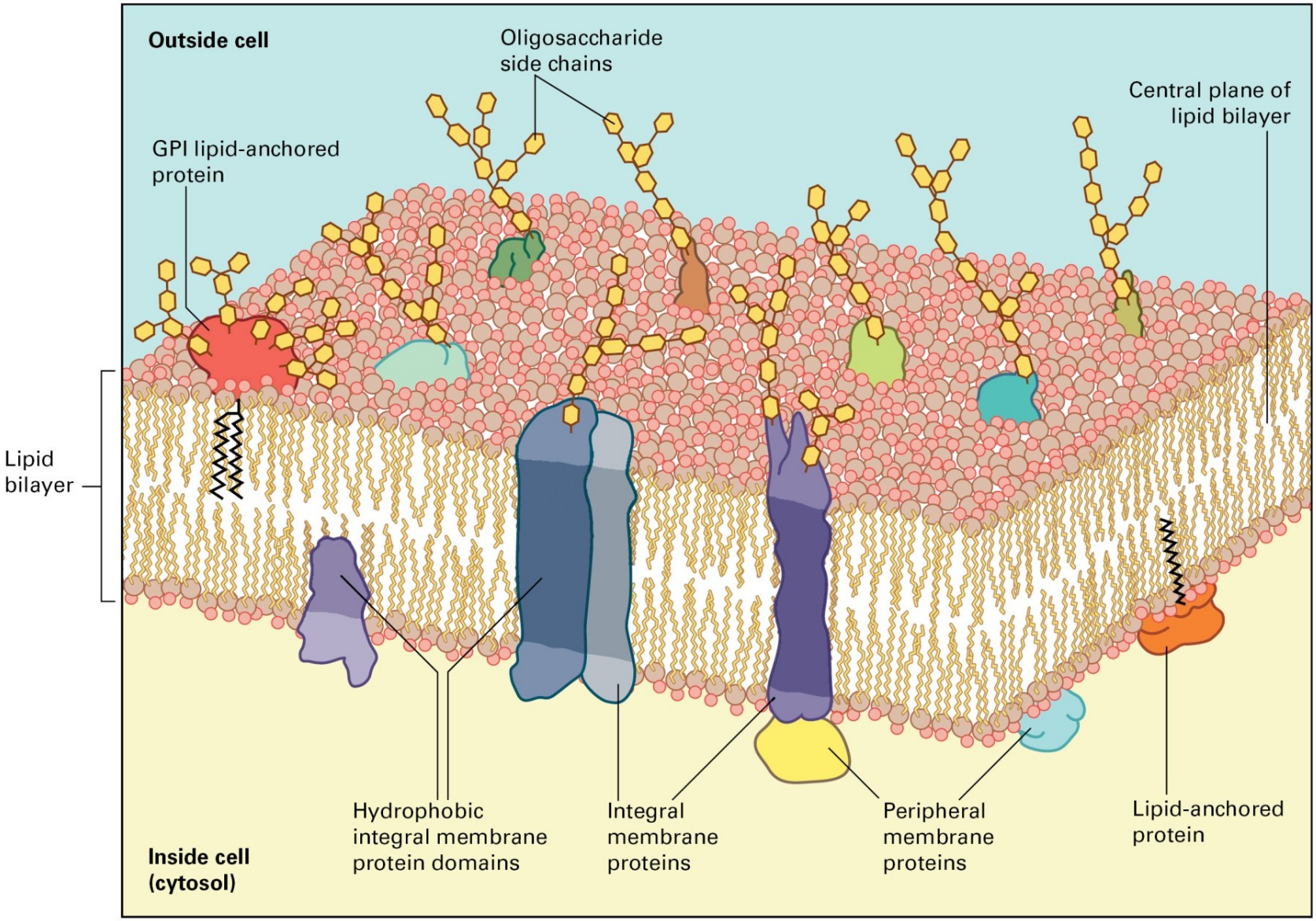


Membrane and Cell Wall

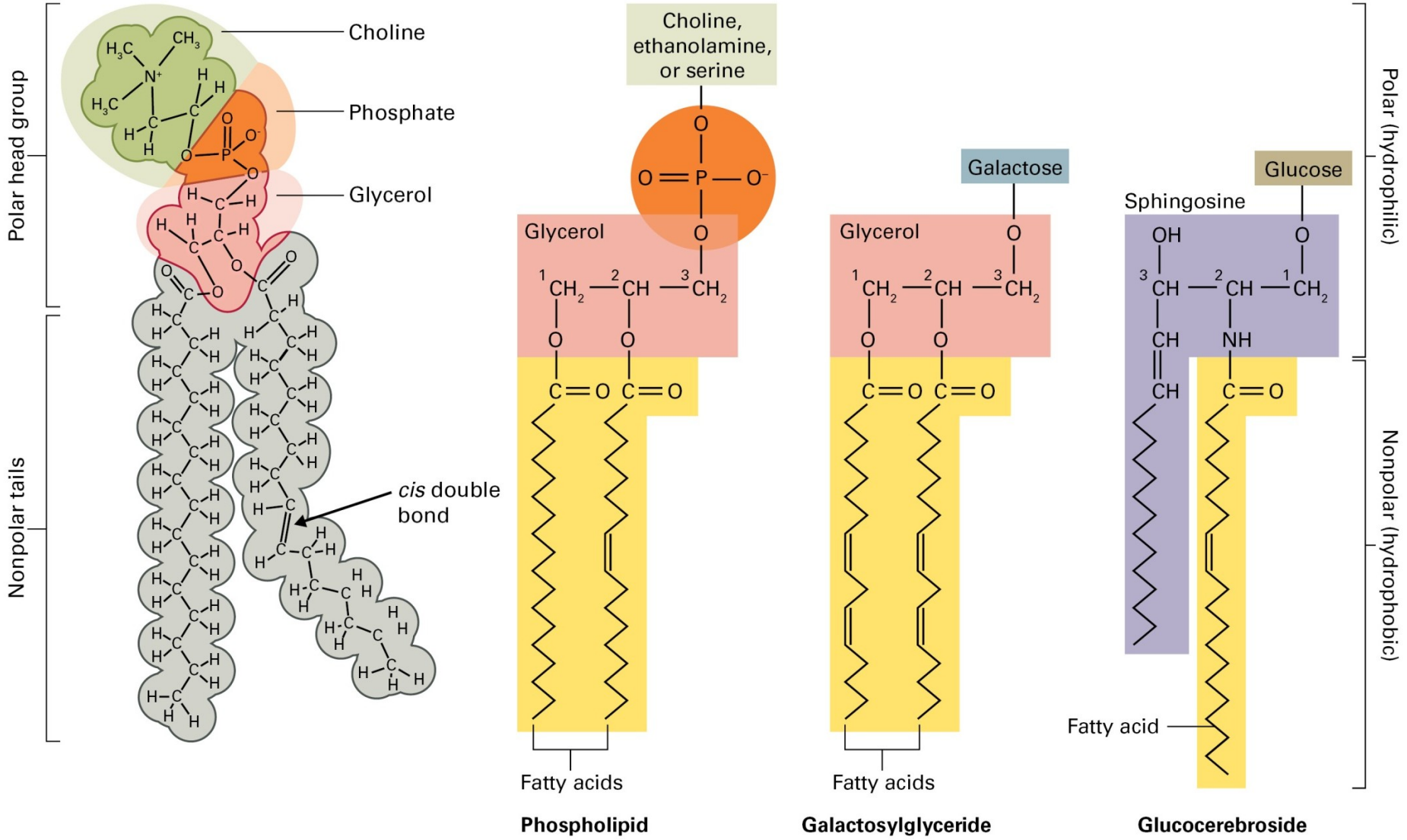
Katerina Dadakova, Department of Biochemistry

Figures adopted from Buchanan et al., Biochemistry & molecular biology of plants

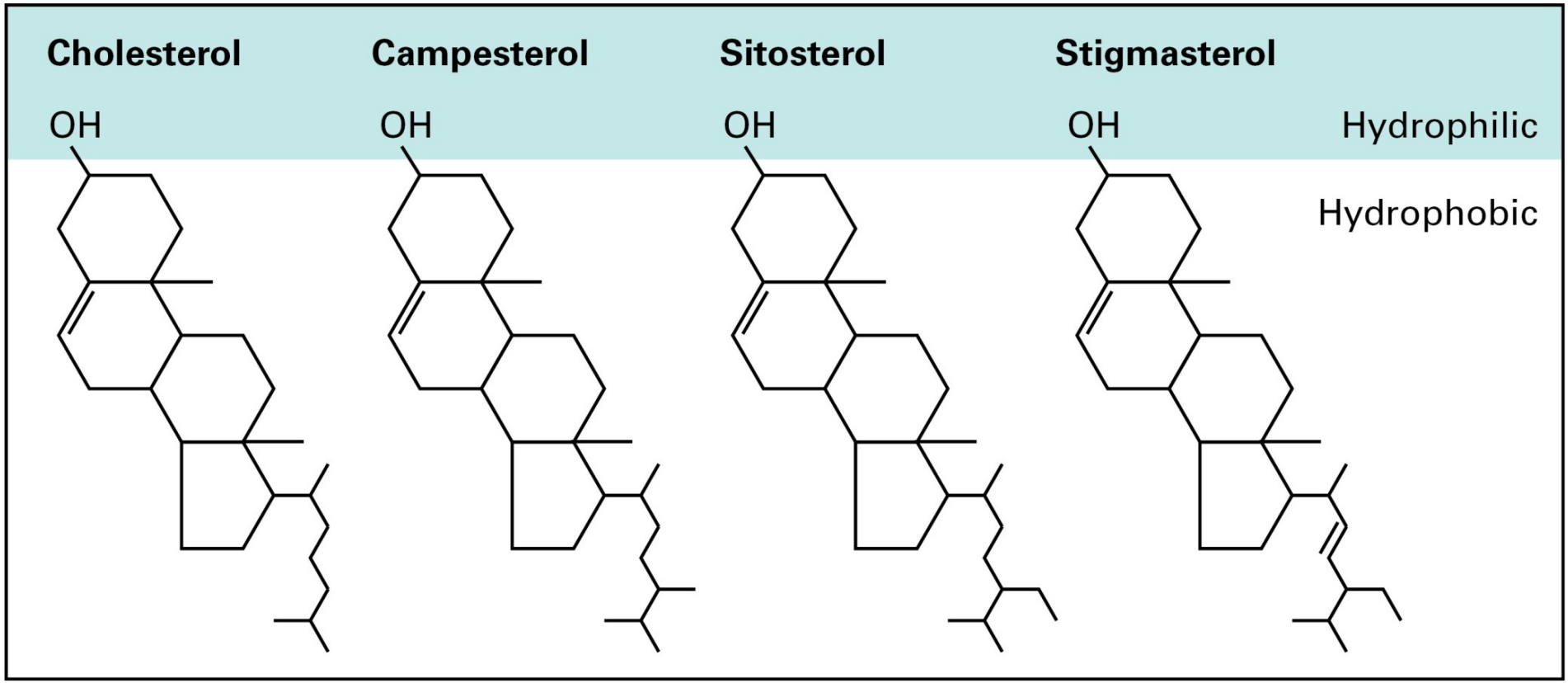
Plant membrane



Plant membrane lipids



Plant membrane lipids



Plasma membrane

- Transport of molecules

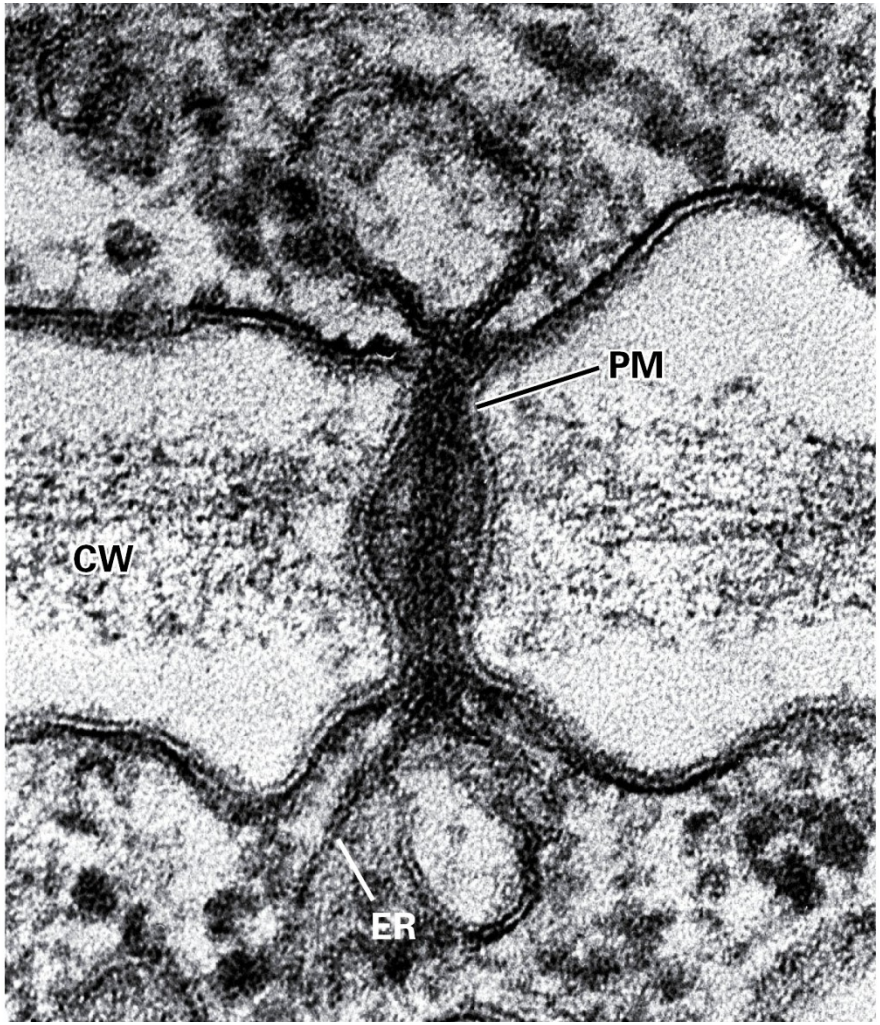
H^+-ATPase, aquaporins,...

- Signal transduction

receptors

- Cell wall synthesis

cellulose synthase, callose synthase



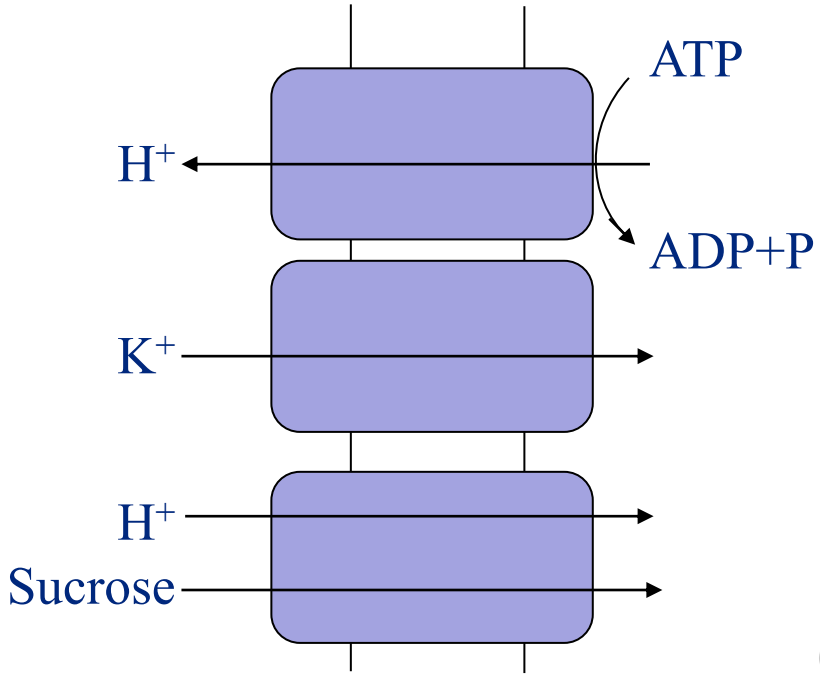
Plasmodesma
PM, plasma membrane
ER, endoplasmic reticulum
CW, cell wall

Membrane transport

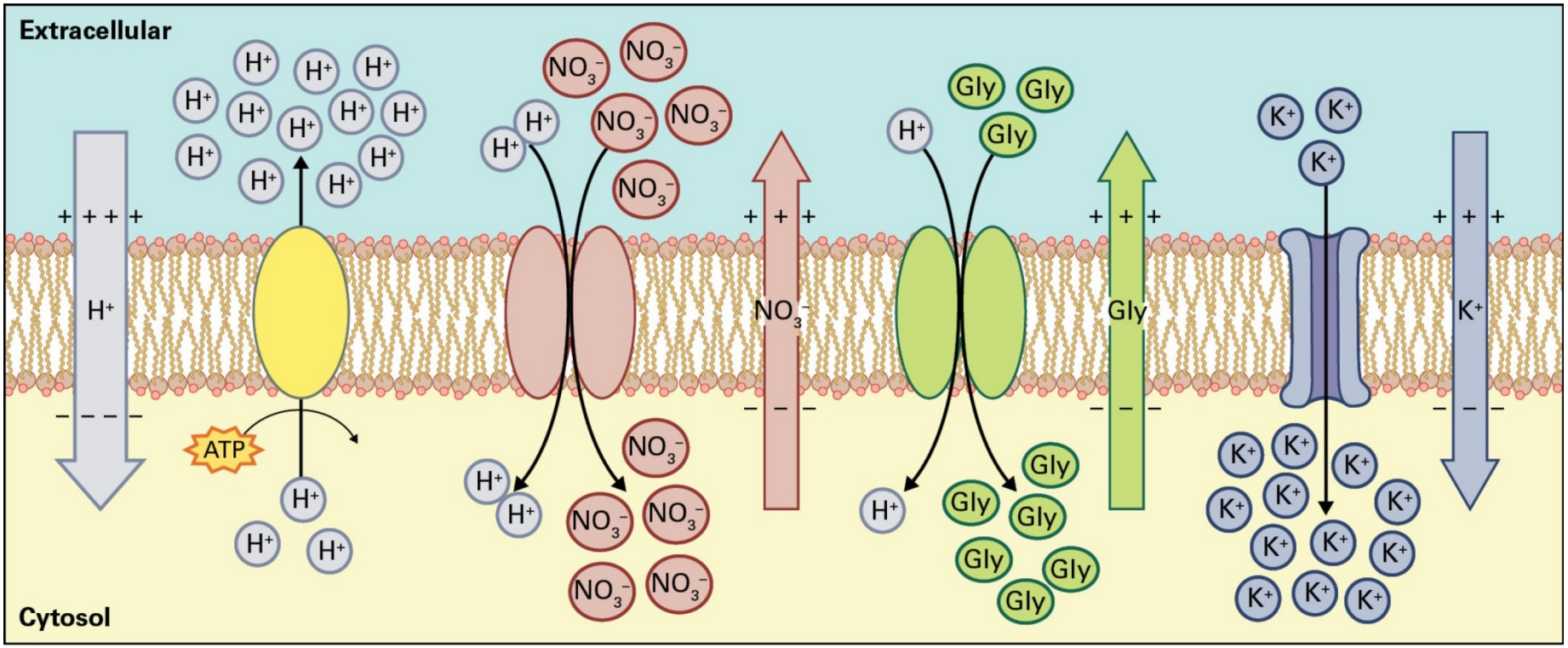
- Nutrient acquisition
- Metabolite distribution
- Compartmentalization of metabolites
- Energy transduction
- Turgor generation
- Waste product excretion
- Signal transduction

Membrane transport systems:

- Pumps
- Channels
- Cotransporters



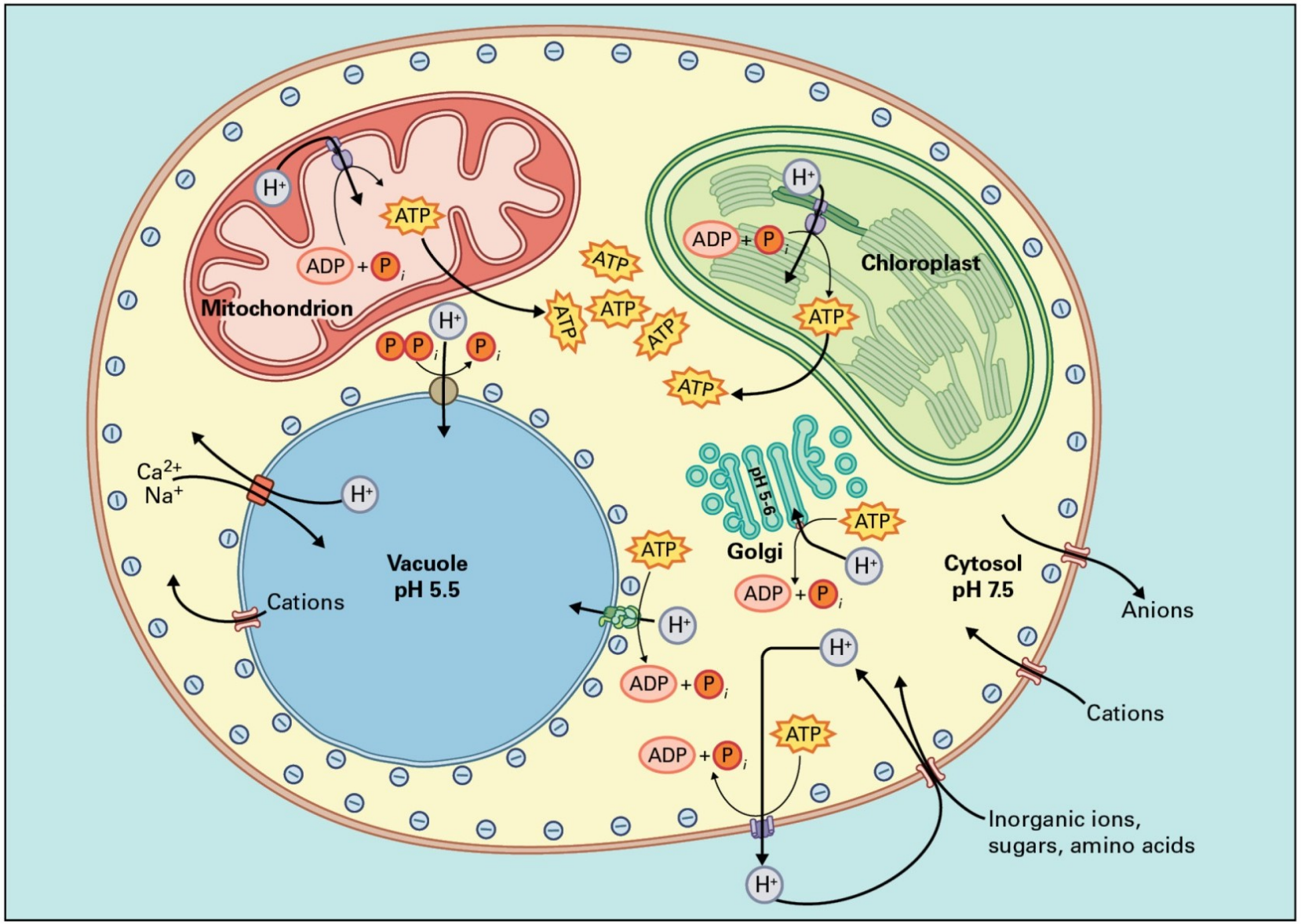
Transmembrane electrochemical potential



Electrochemical potential:

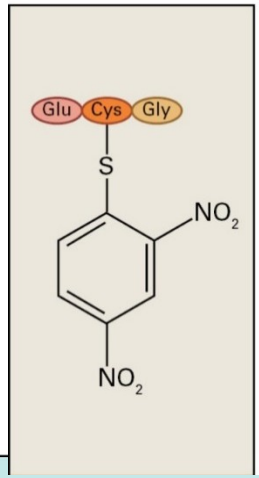
- concentration
- charge
- membrane voltage

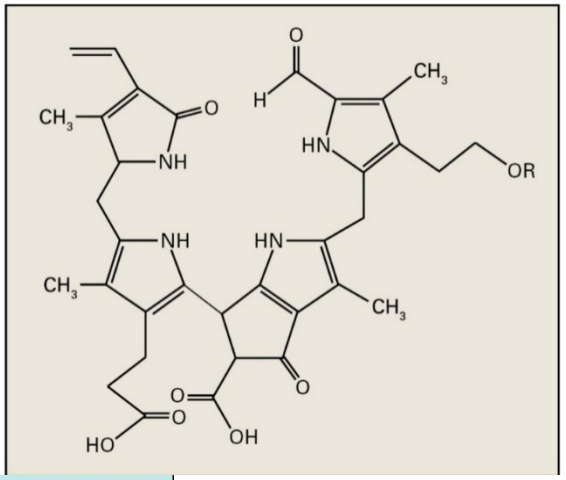
H^+ pumps


H+
ATP
ADP + P i
Mitochondrion
Chloroplast
Ca2+
Na+
Vacuole
pH 5.5
Cations
pH 5-6
Golgi
Cytosol
pH 7.5
Anions
Inorganic ions,
sugars, amino acids

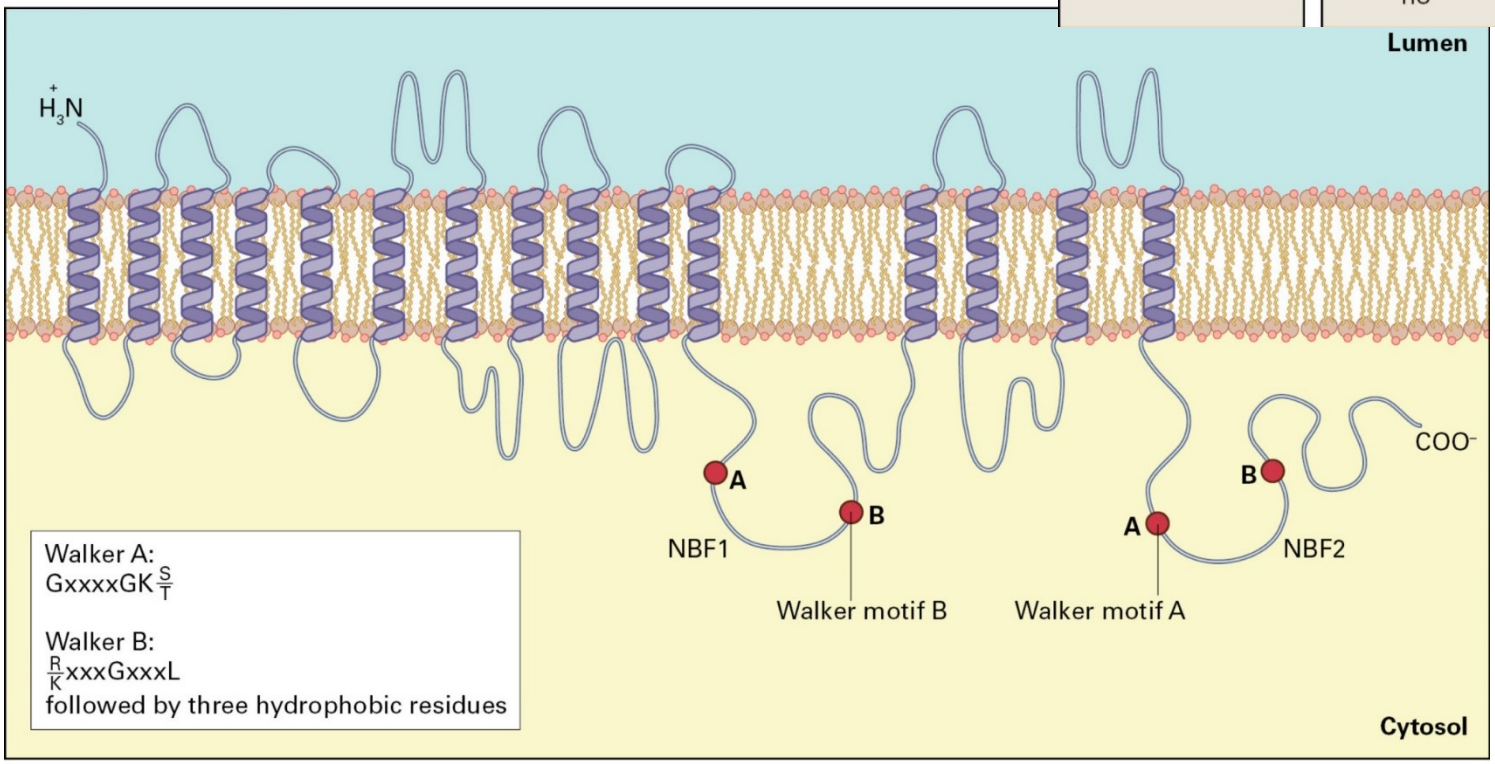
ABC-type pumps

A glutathione-conjugated xenobiotic and a chlorophyll catabolite

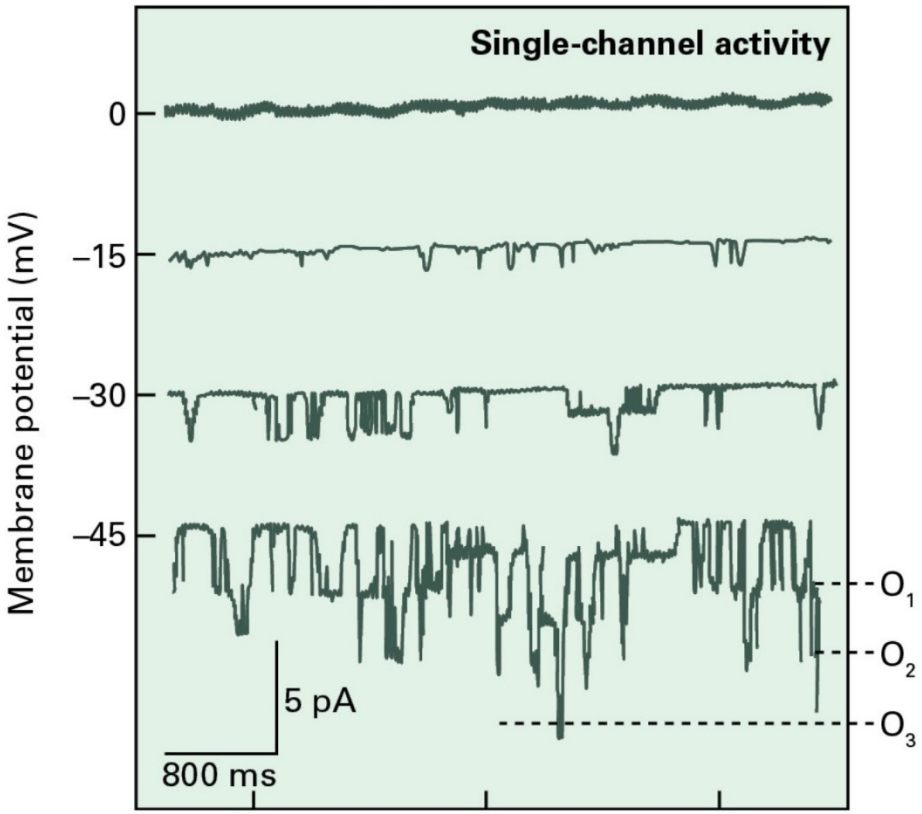




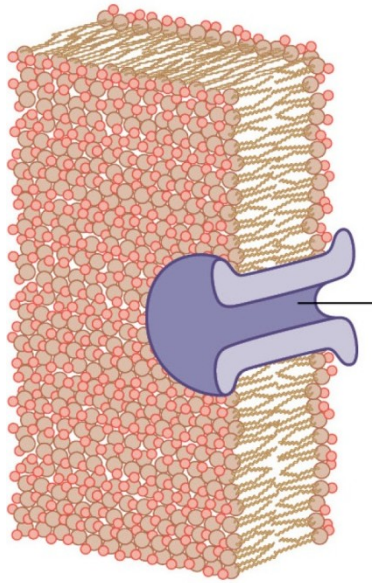
ATP-binding cassette transporter



Ion channels



Activity of channels in tonoplast. The prevalence of open state is influenced by membrane voltage. $O_{1,2}$, or $_3$ is the number of channels open.

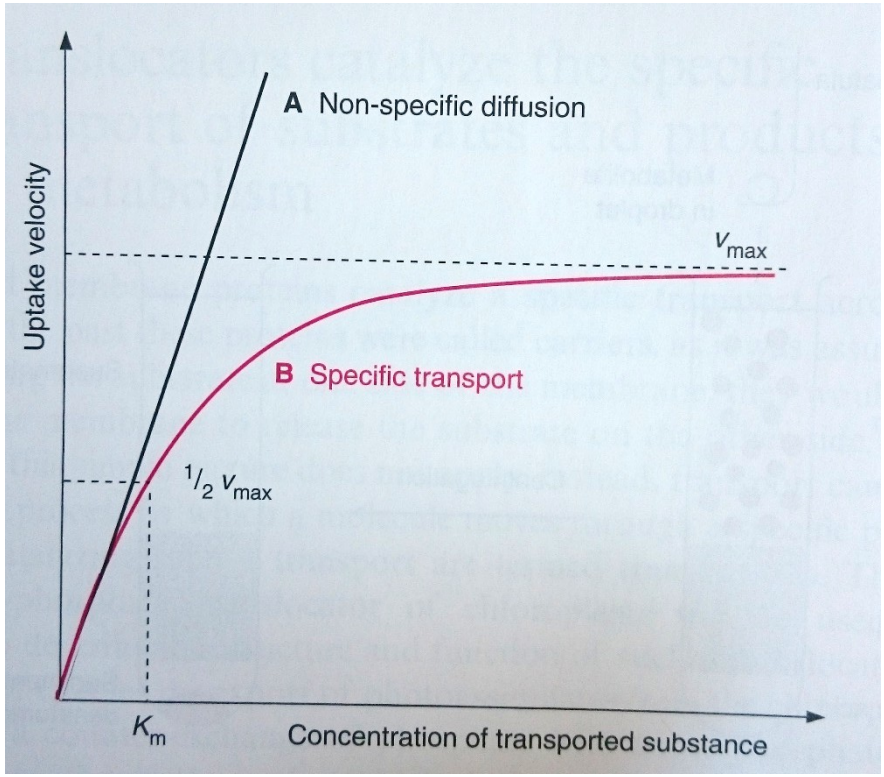


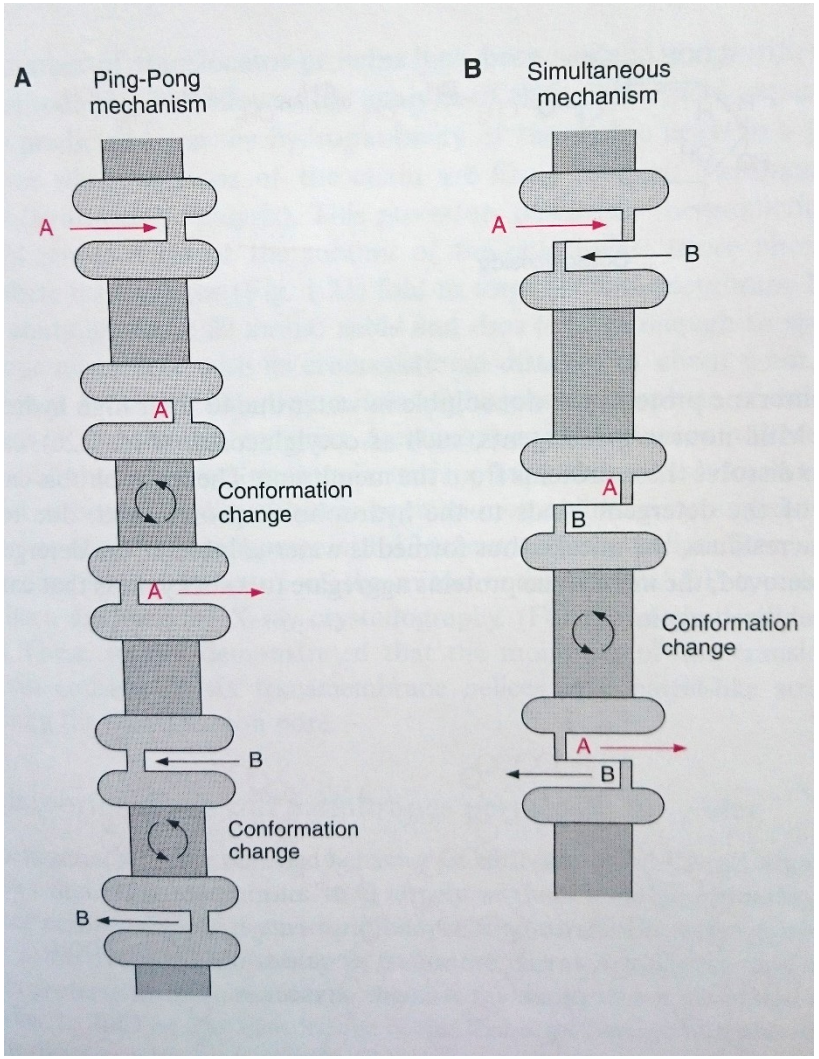
Ion channels are:

- passive
- selective (to some degree)
- regulated

Cotransporters

Transport process mechanisms

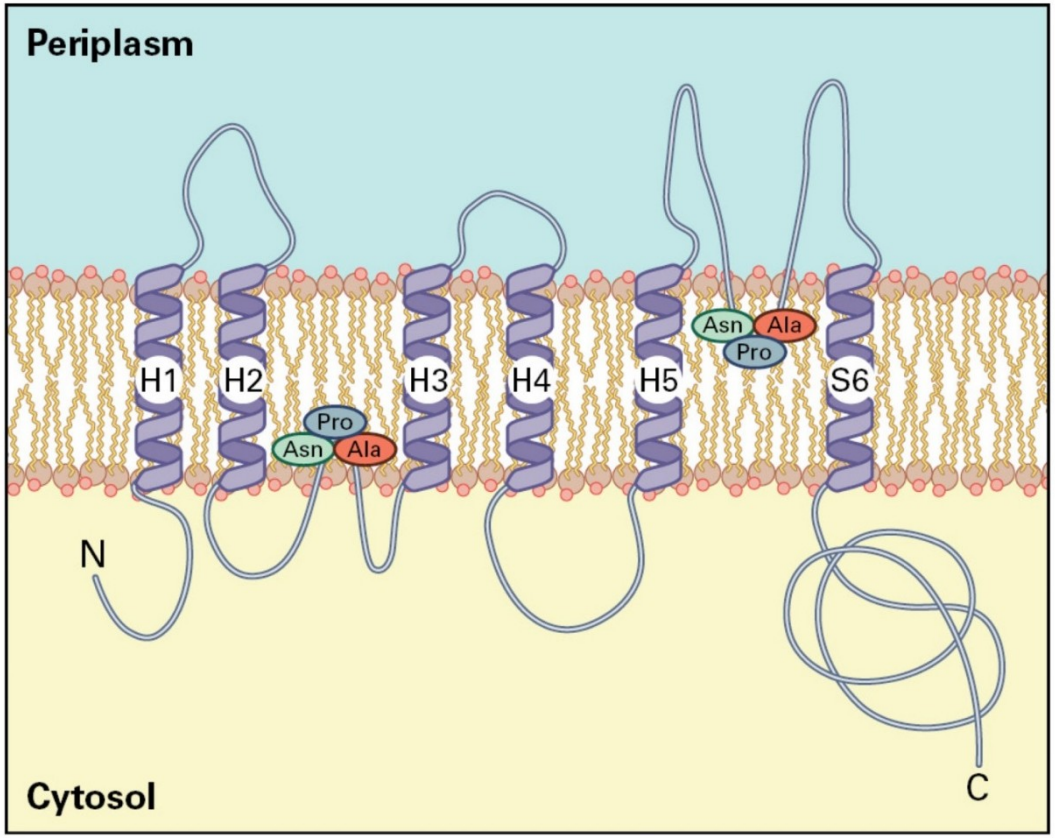


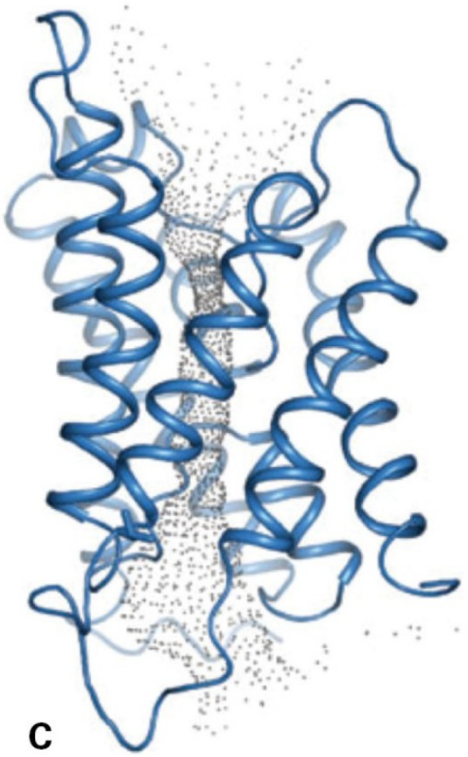


Aquaporins

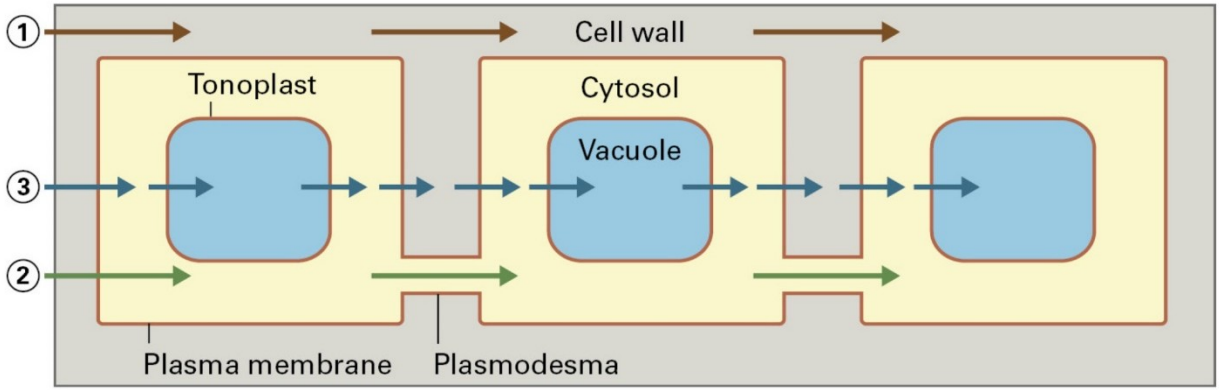
Plant membranes are highly permeable for water

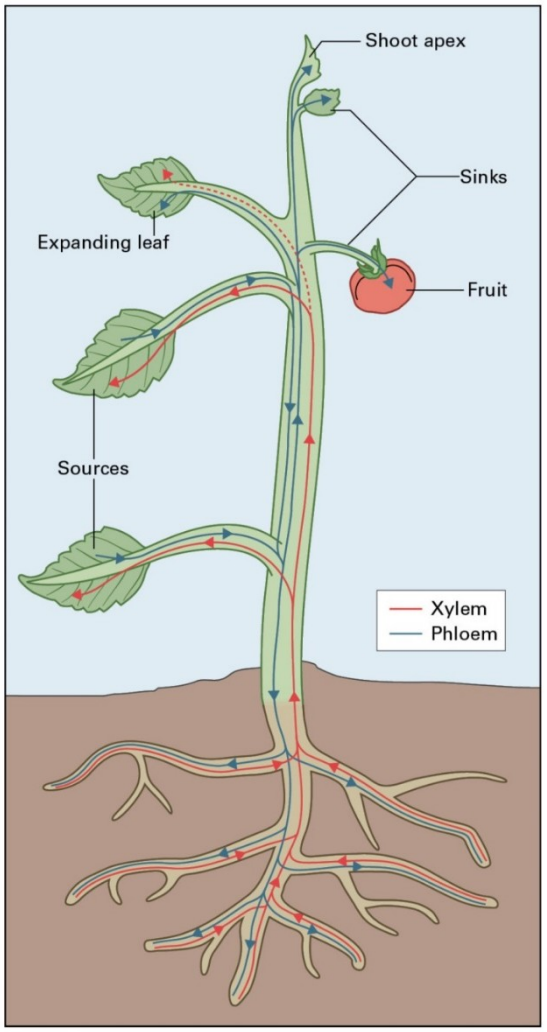
The direction of water transport across membranes is determined by hydrostatic and osmotic pressures.





Cell-to-cell transport

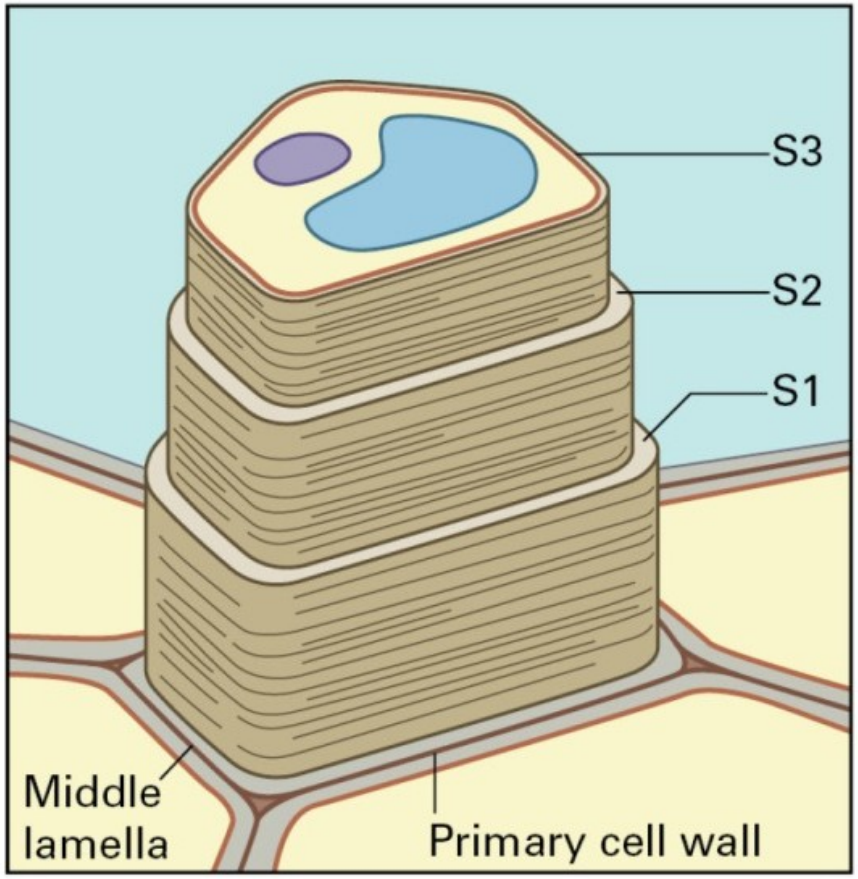


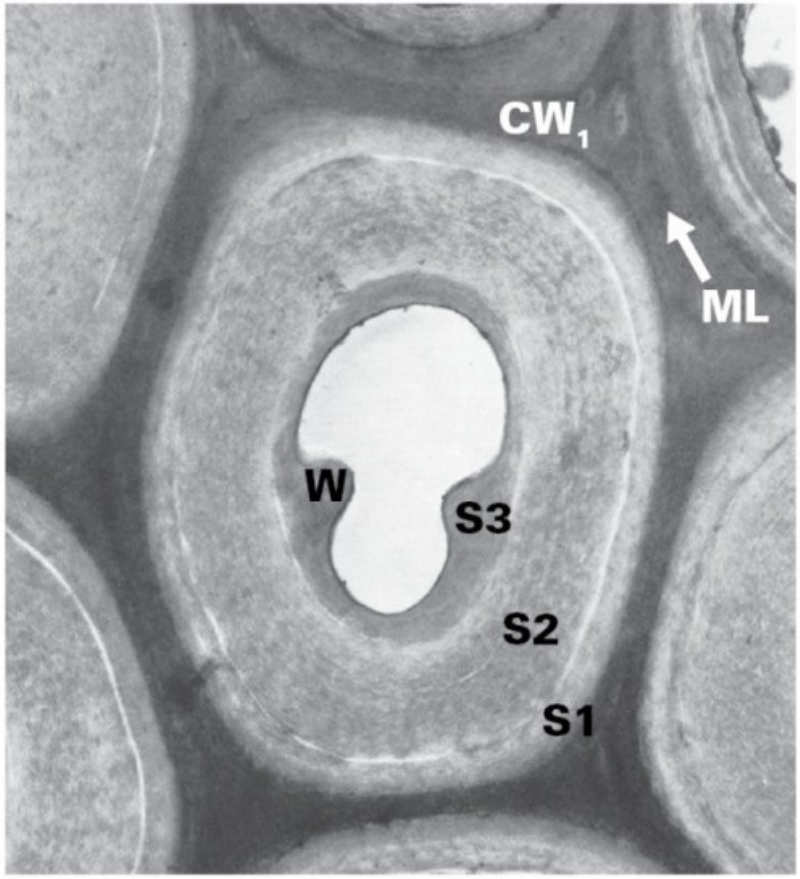


Intercellular transport can occur along apoplastic, symplastic, and transcellular routes

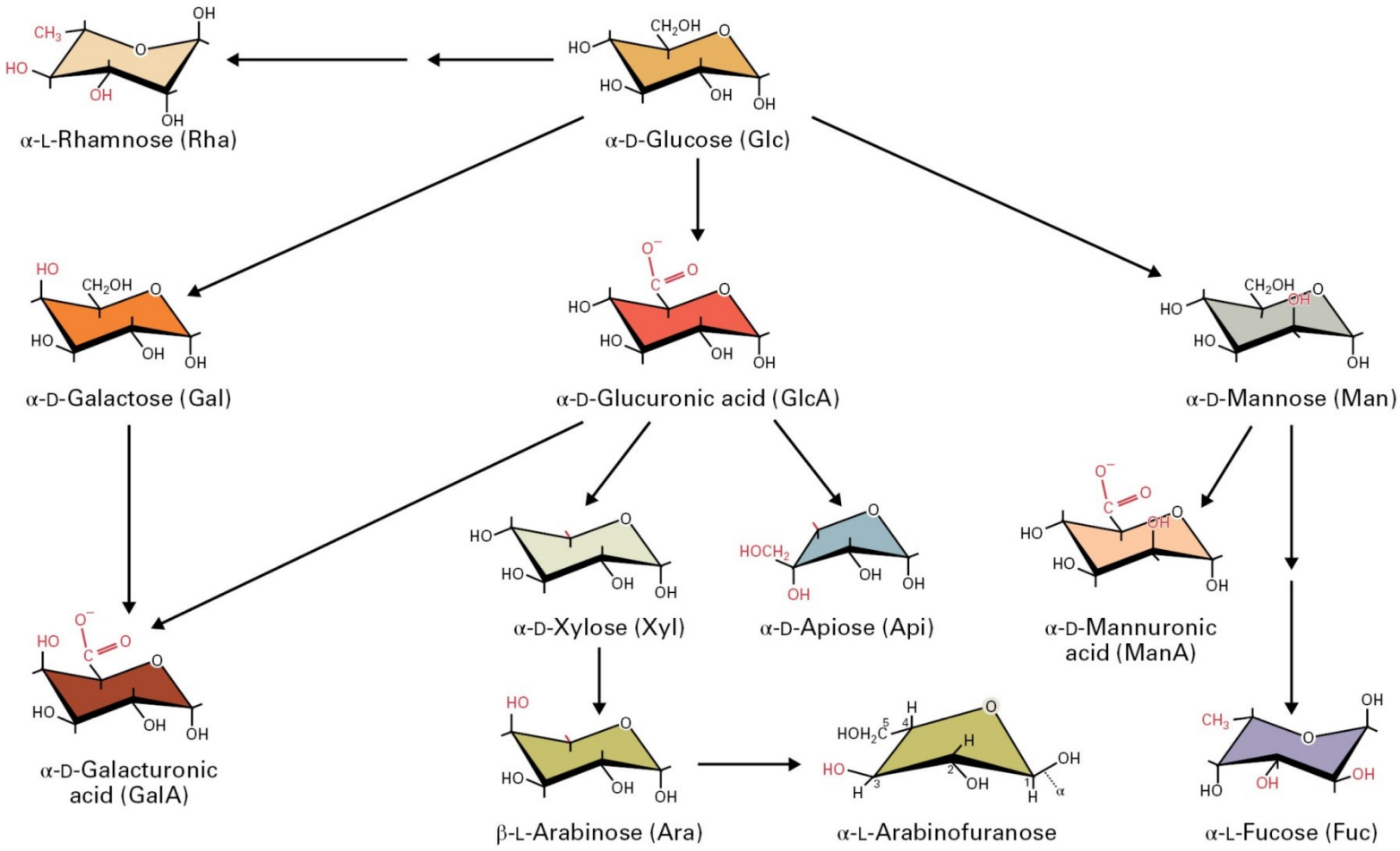
Long-distance transport follows two pathways: xylem and phloem

Cell wall

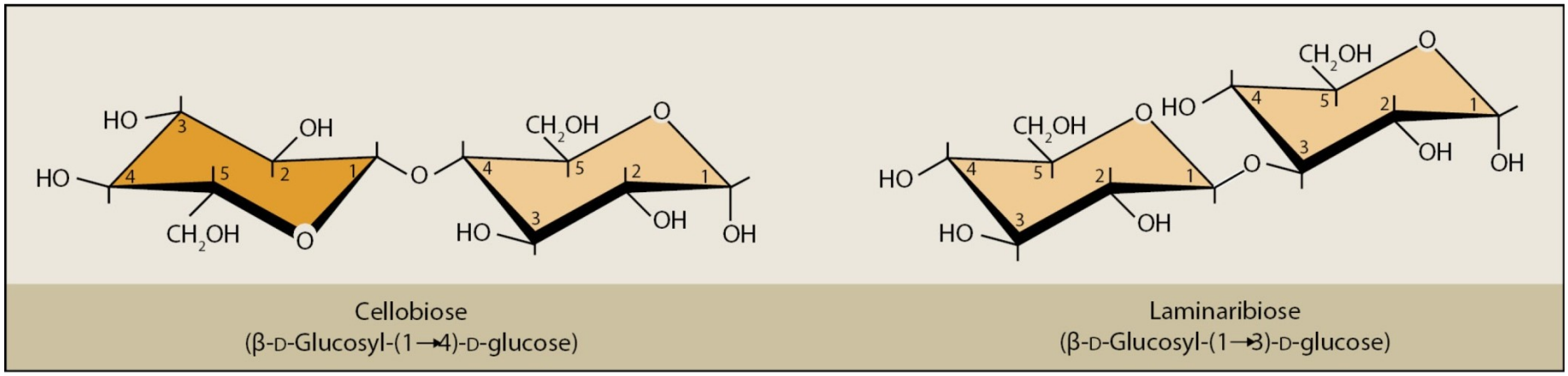


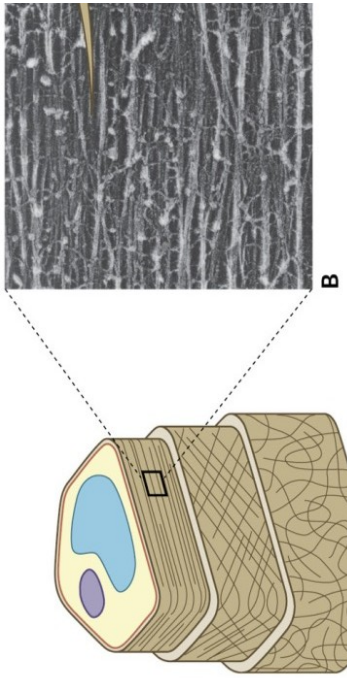


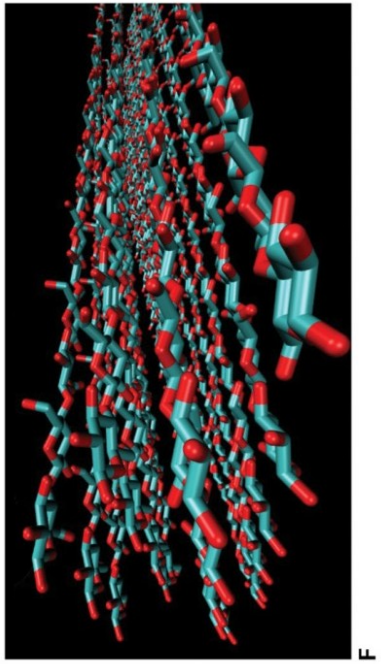
Cell wall sugars

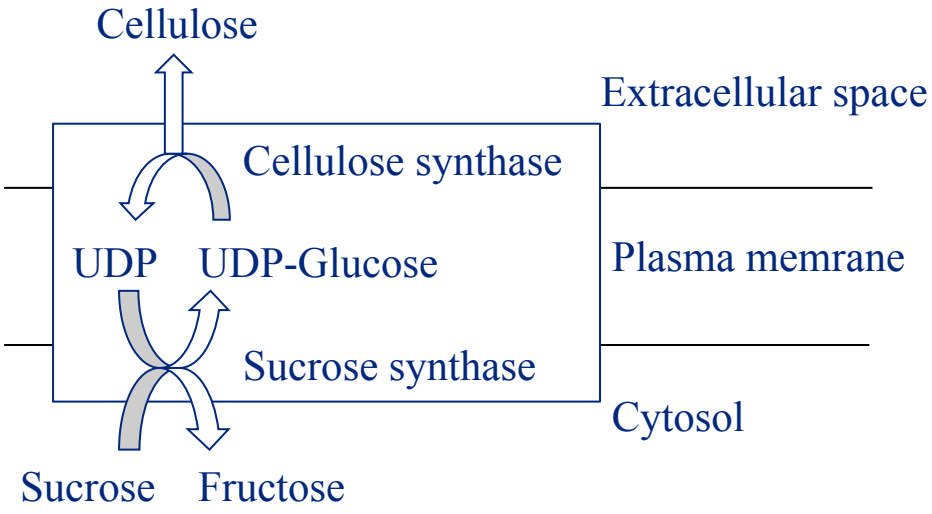


Cell wall polysaccharides

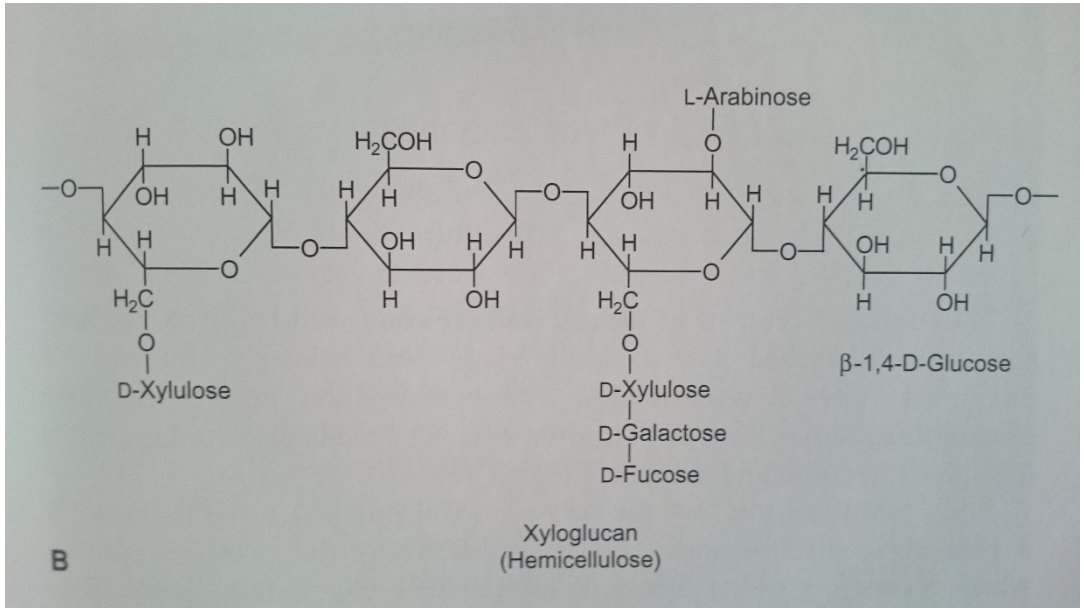


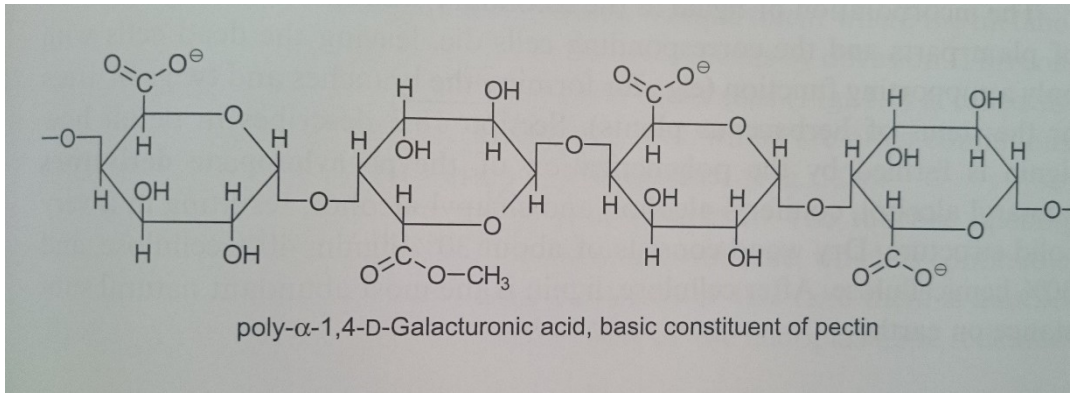


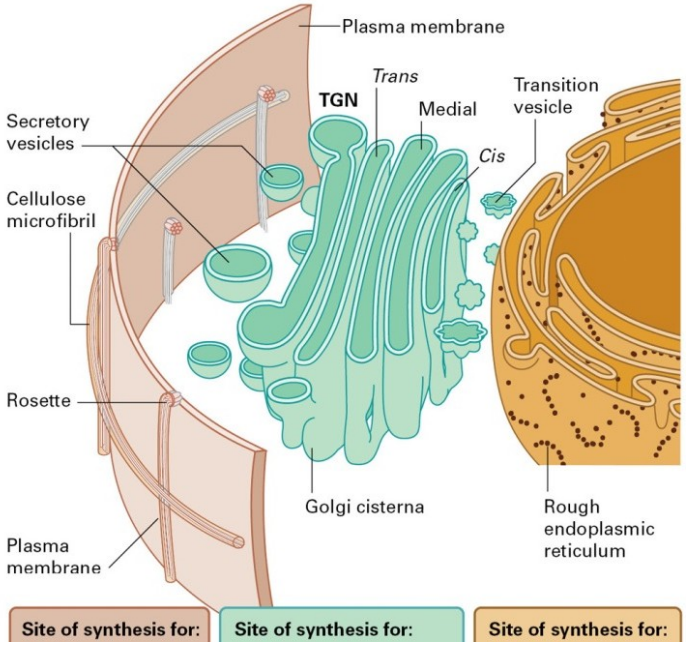




Crosslinking glycans and pectin polymers





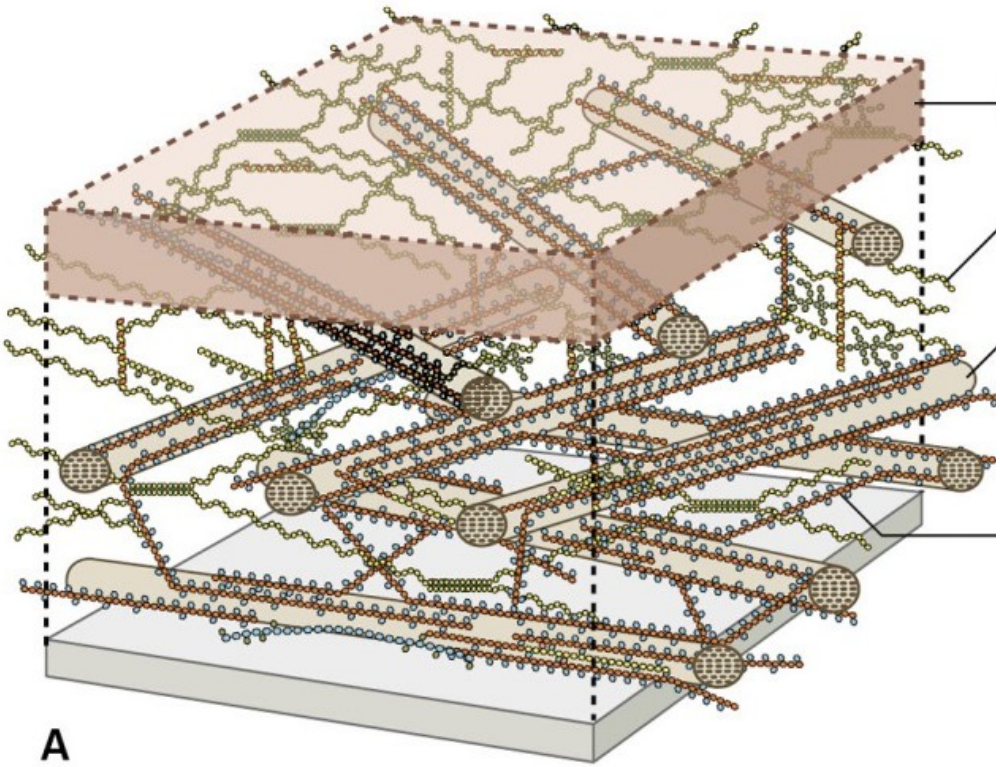


Cellulose
Callose

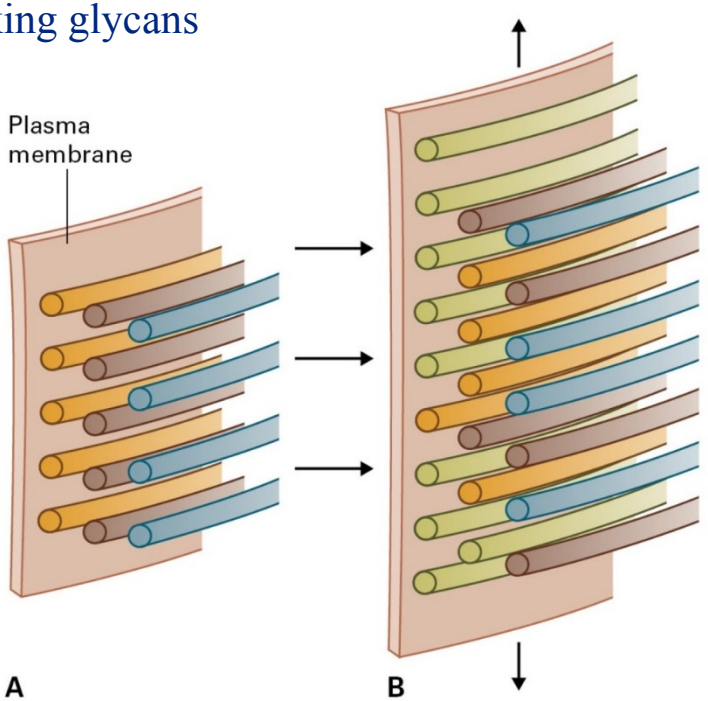
Pectins
Crosslinking glycans

Cell wall proteins

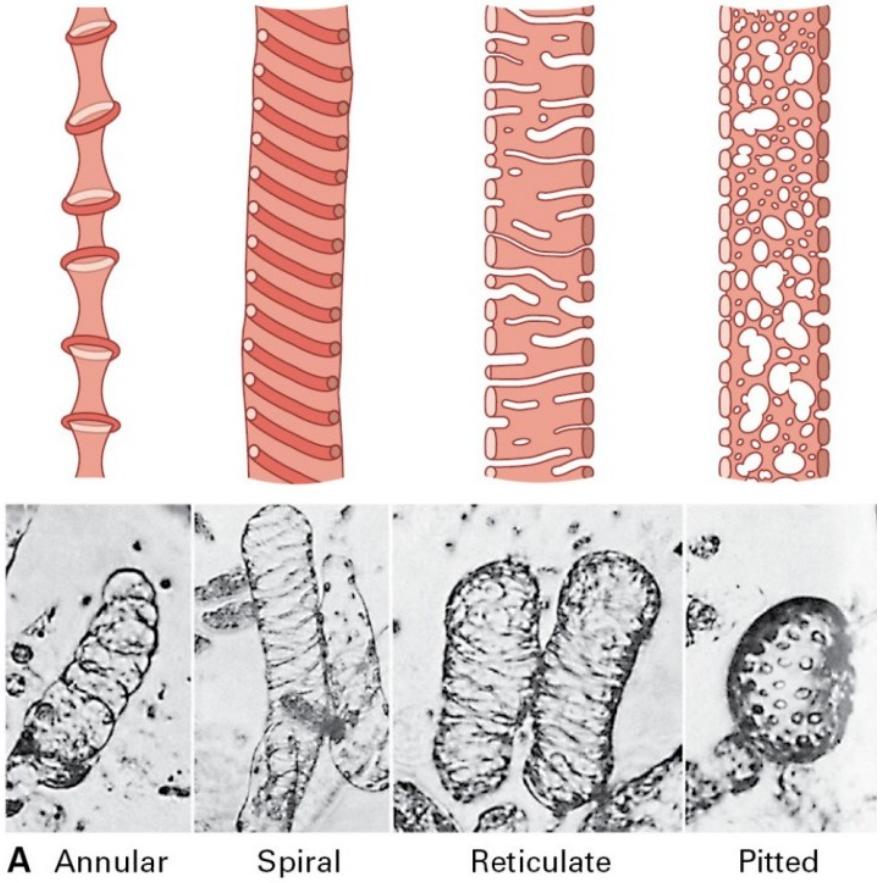
Cell wall architecture



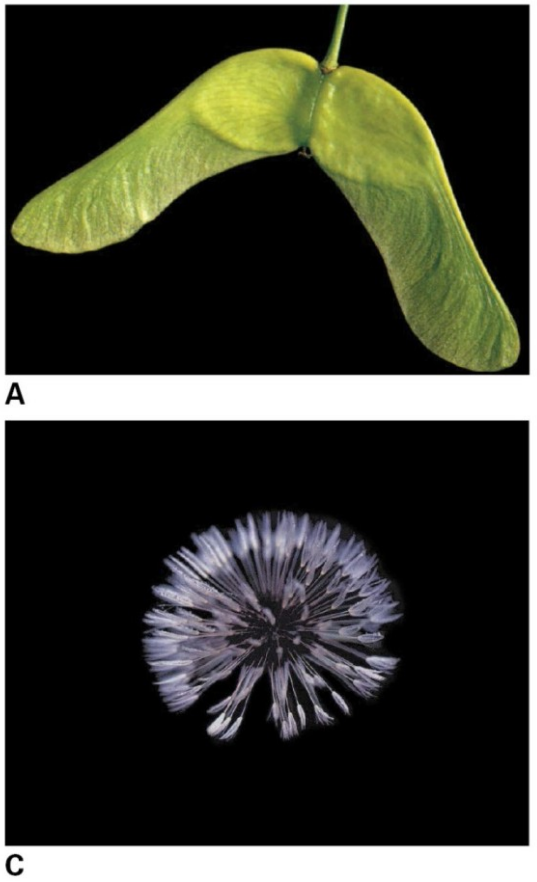
Cell growth

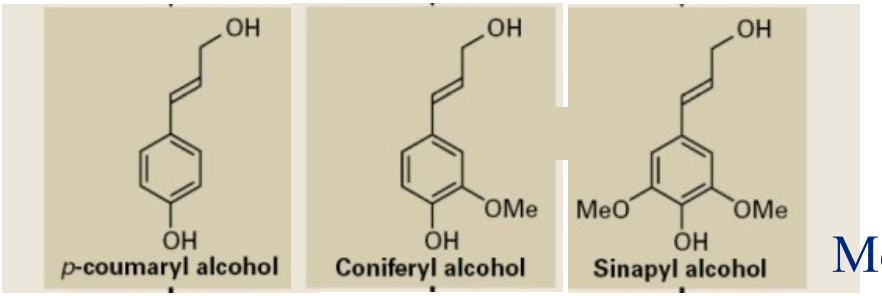


Secondary wall



Vessel elements





Monolignols