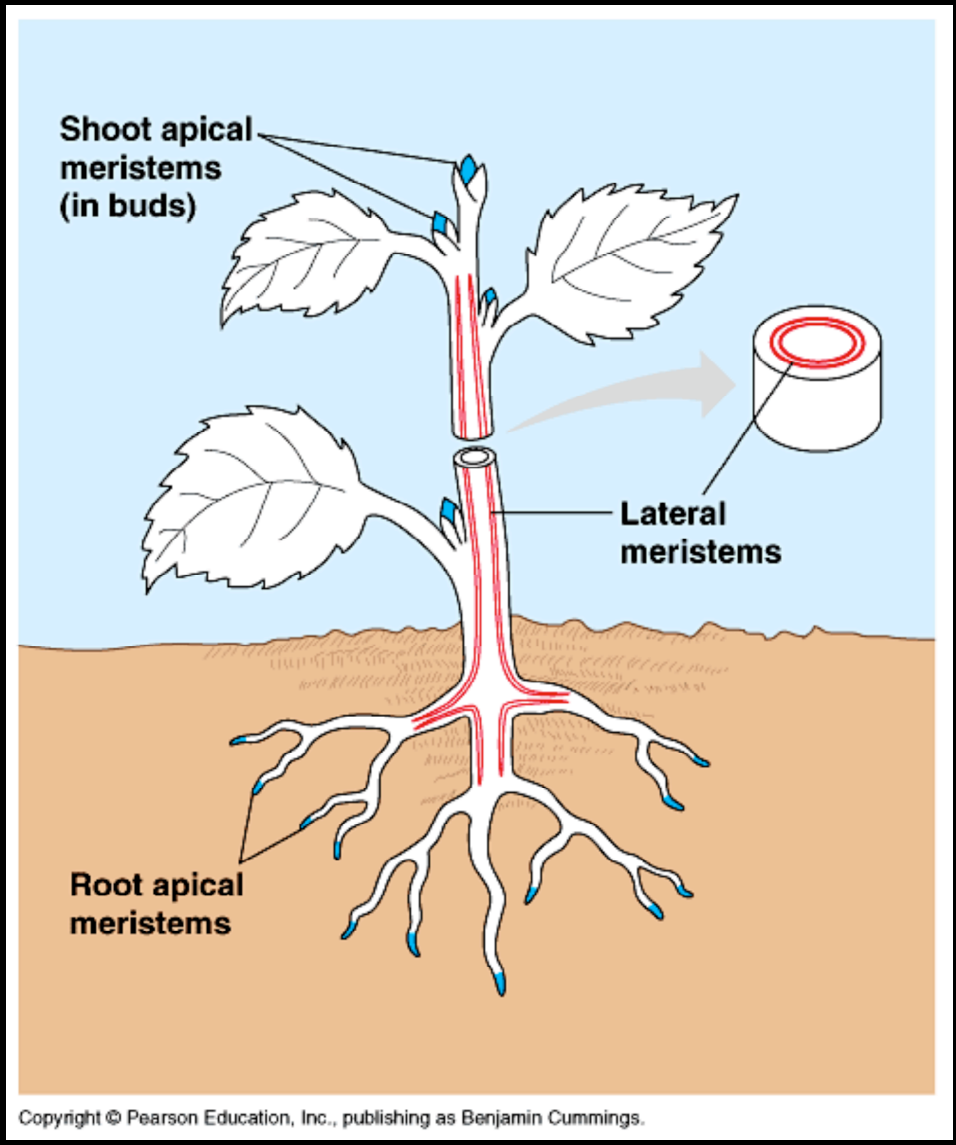
Growth

Meristems

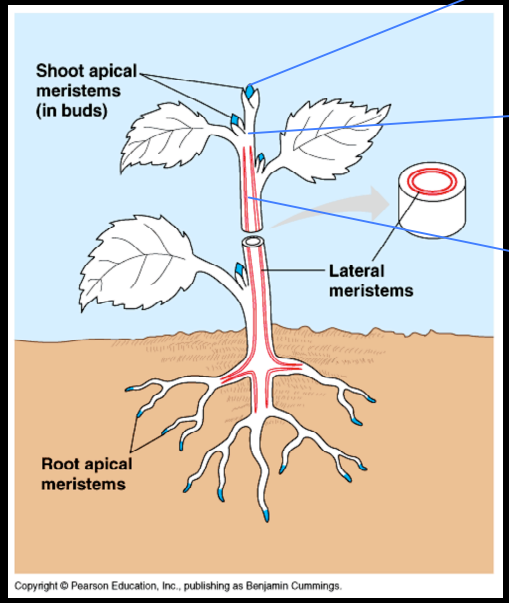
Apical meristems
- Shoot meristems (buds)
- Root meristems

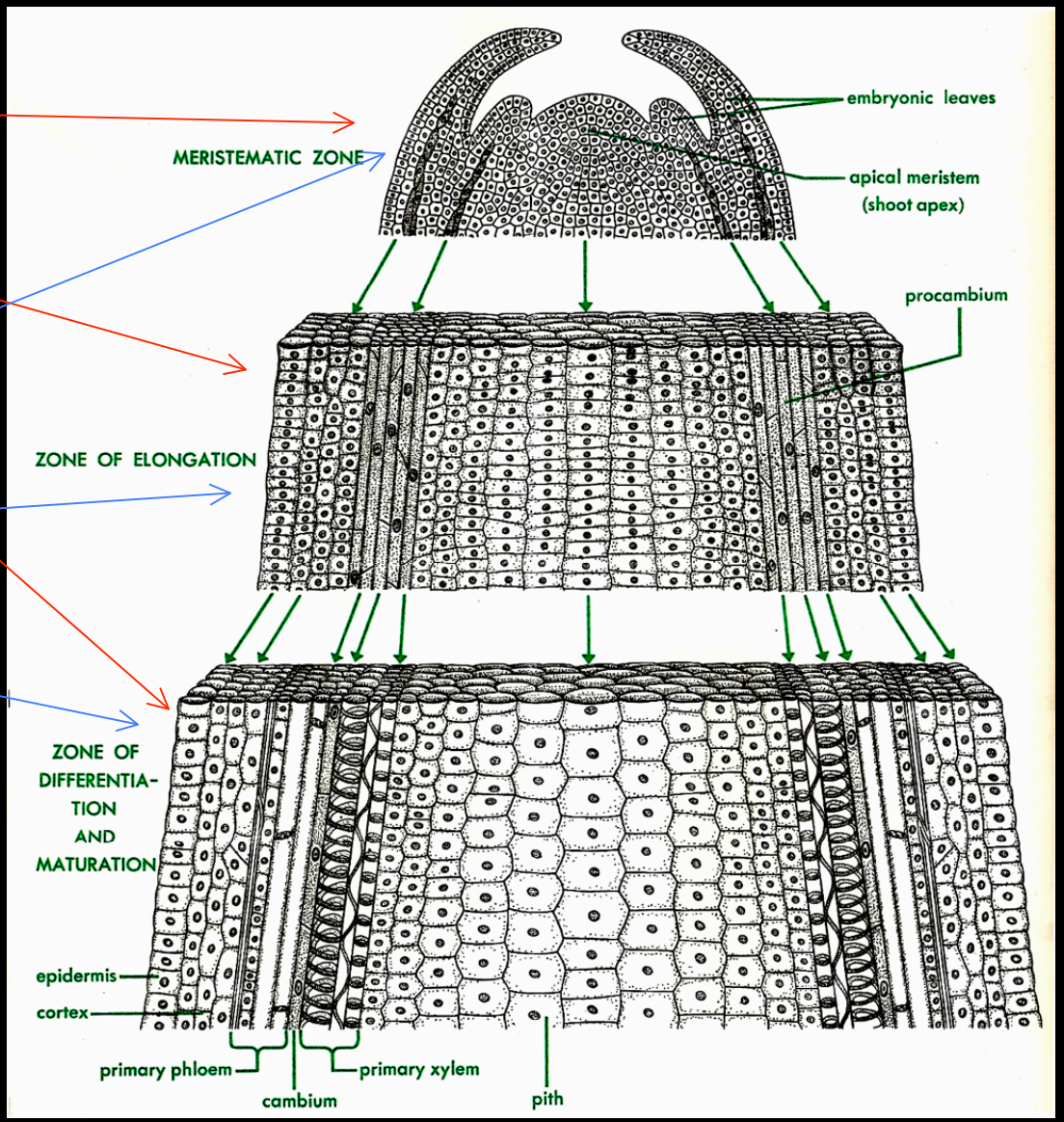
Lateral meristems
- Vascular cambium
- Phellogen



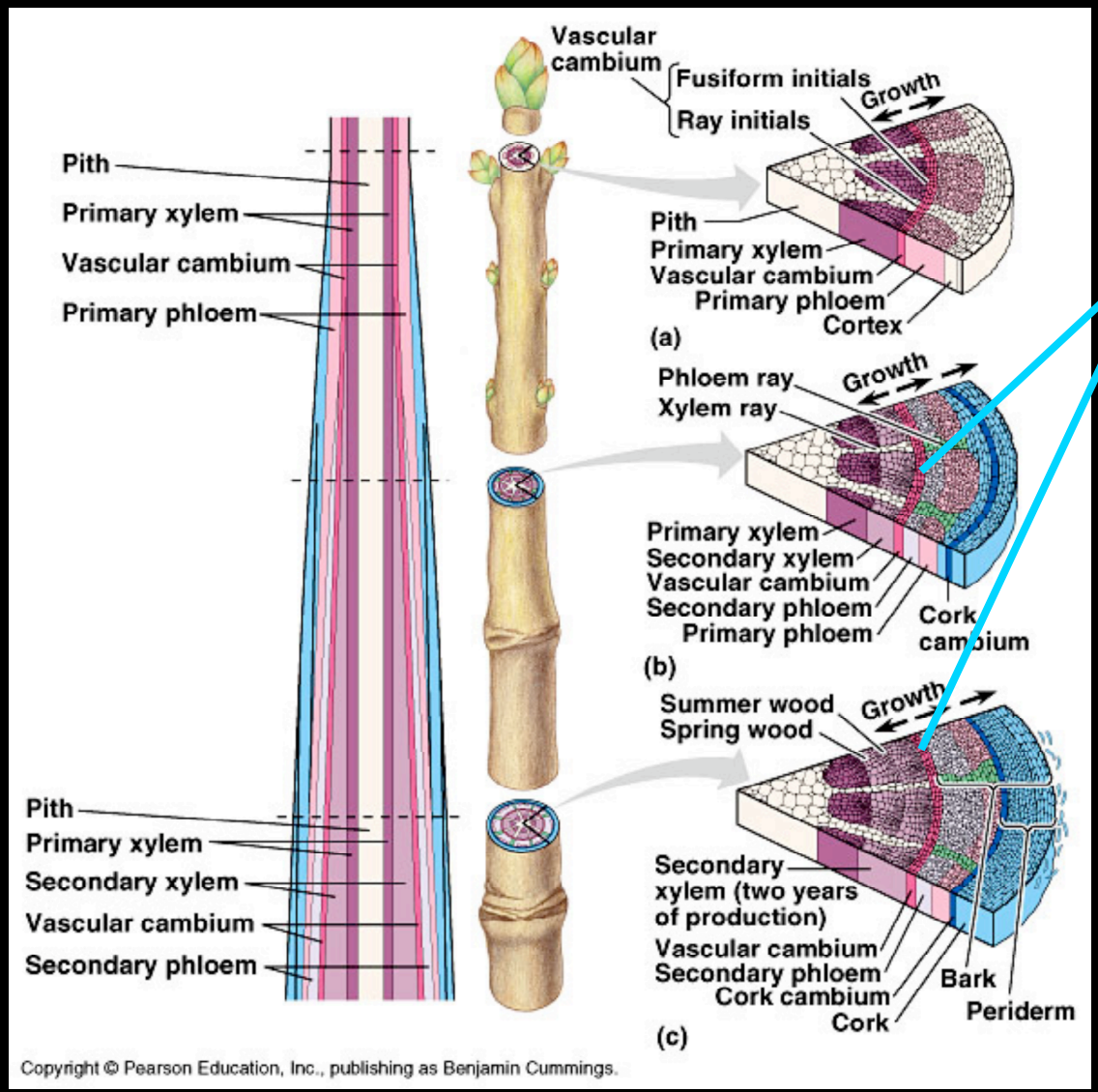
Apical growth

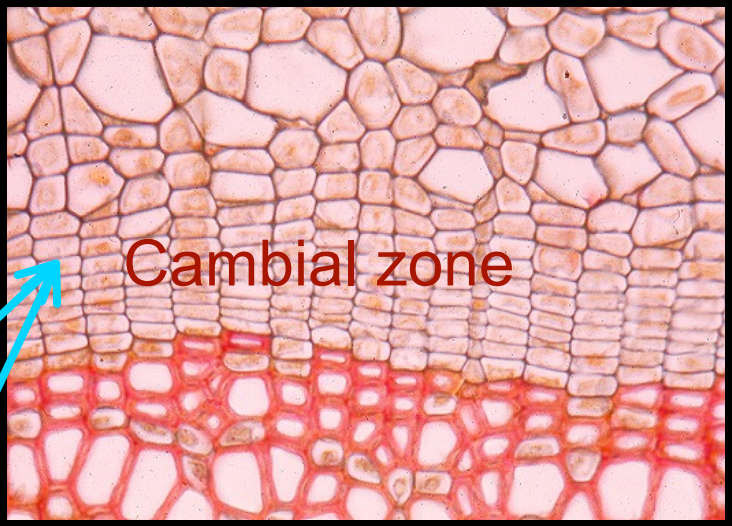
Cell division
Elongation
Differentiation



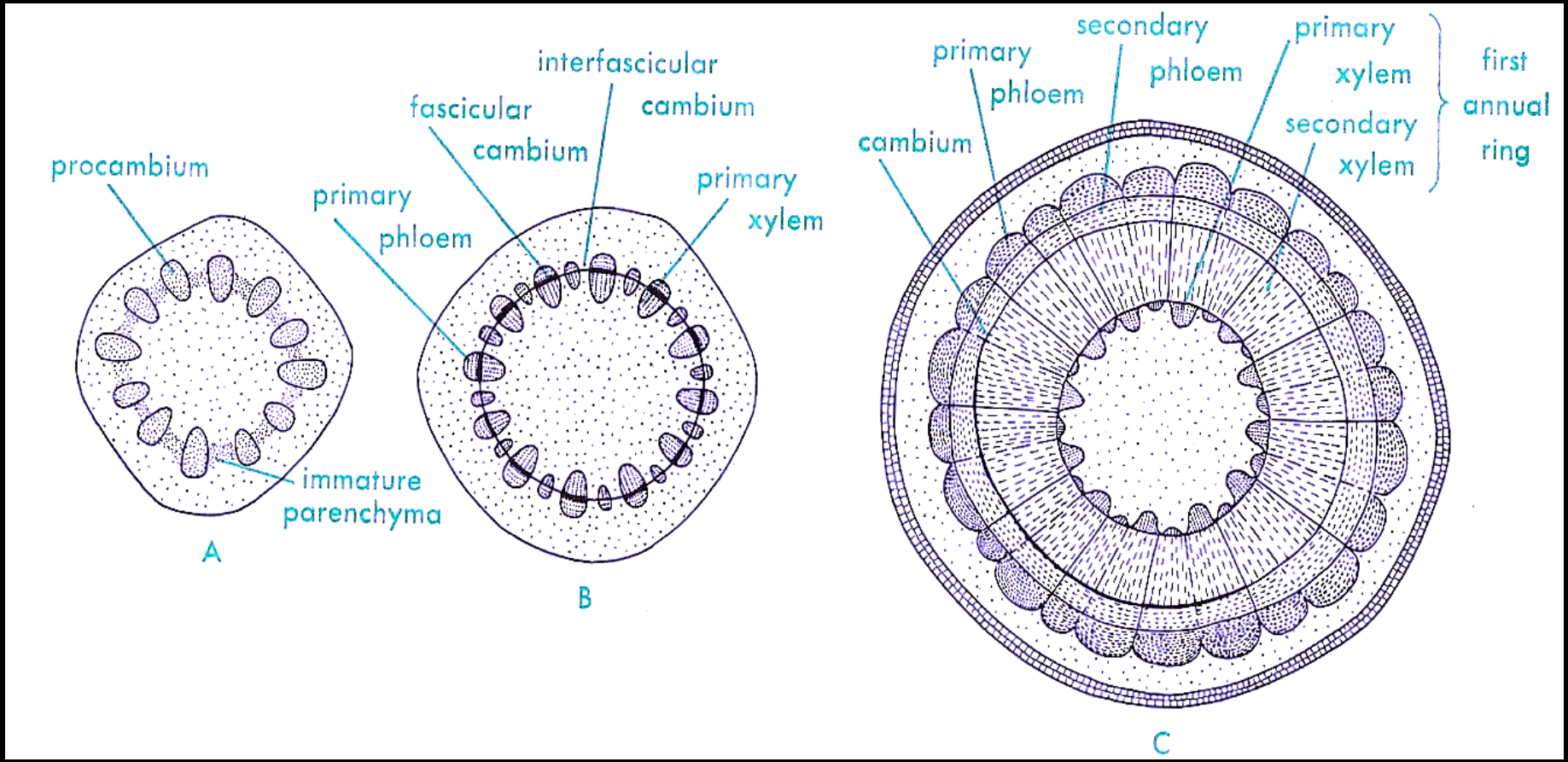


Cambium and its activity



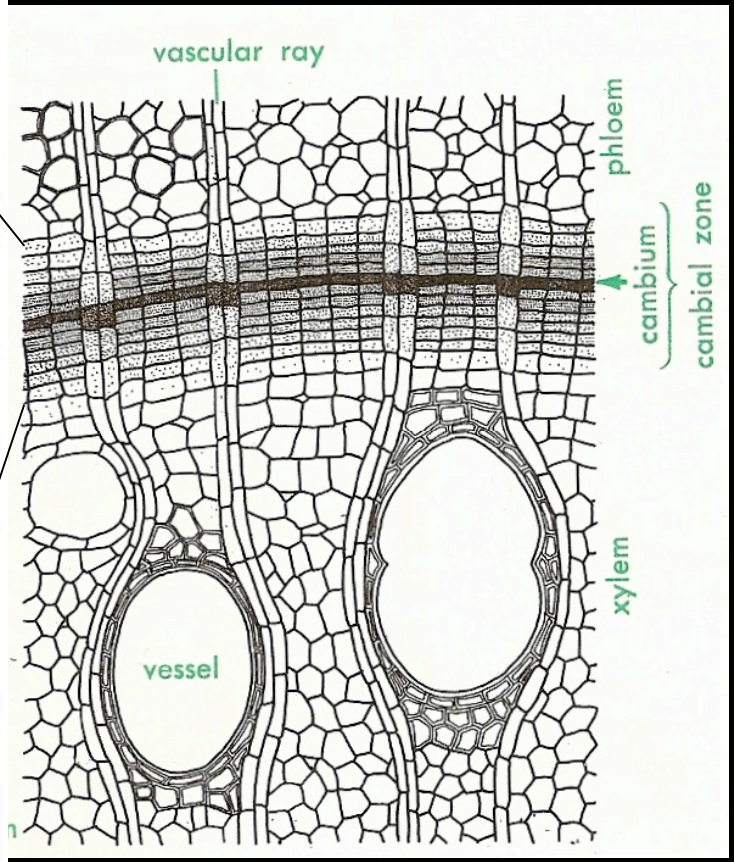


Cambium and its activity

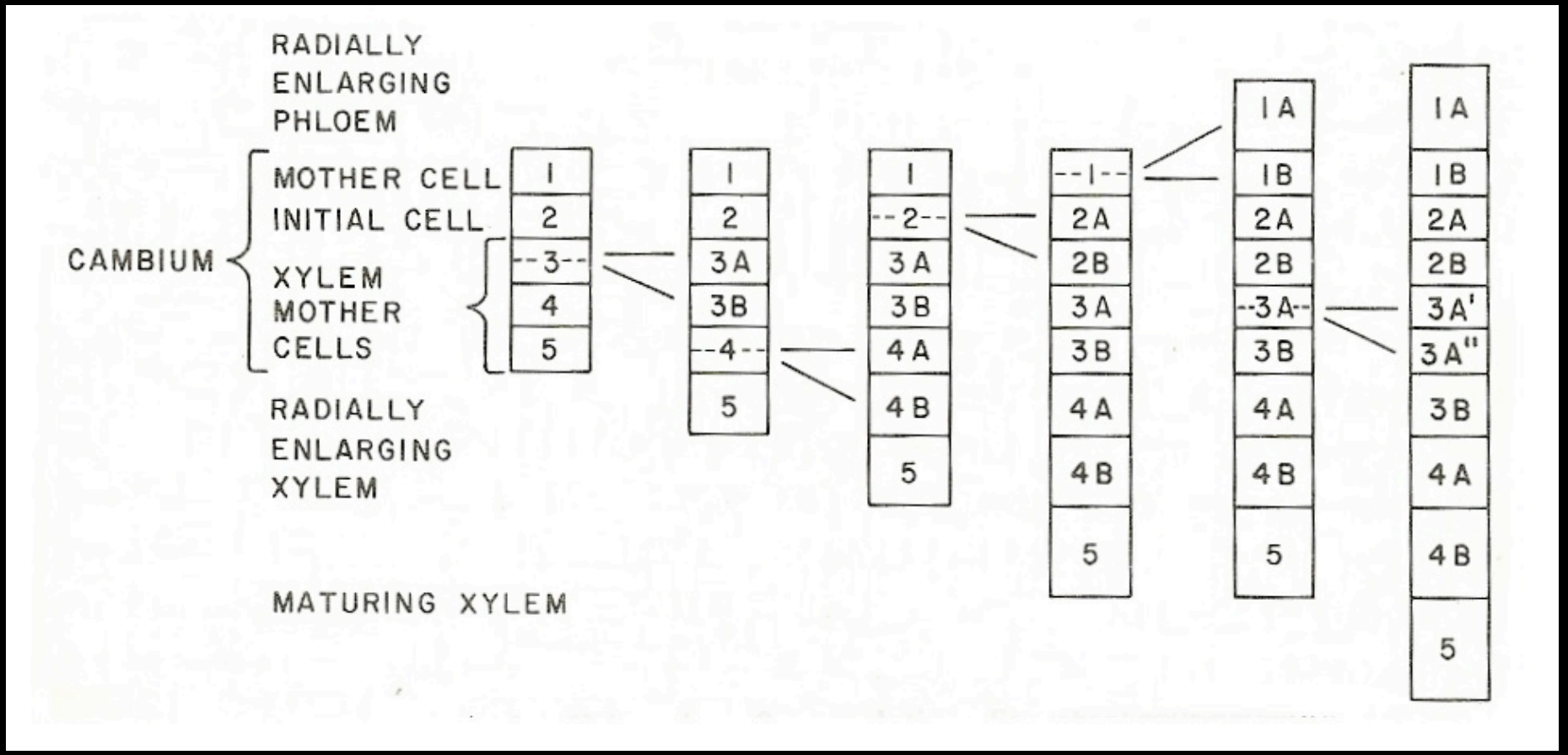


Cambium and its activity

MATURE PHLOEM		
DIFFERENTIATING PHLOEM	MATURING PHLOEM	
	RADIALLY ENLARGING PHLOEM	
	DIVIDING PHLOEM (Phloem mother cells)	CAMBIAL ZONE
CAMBIUM	CAMBIAL INITIAL (dividing)	
DIFFERENTIATING XYLEM	DIVIDING XYLEM (Xylem mother cells)	
	RADIALLY ENLARGING XYLEM	
	MATURING XYLEM	
MATURE XYLEM		

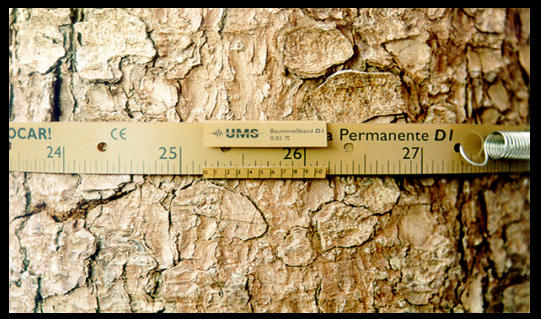


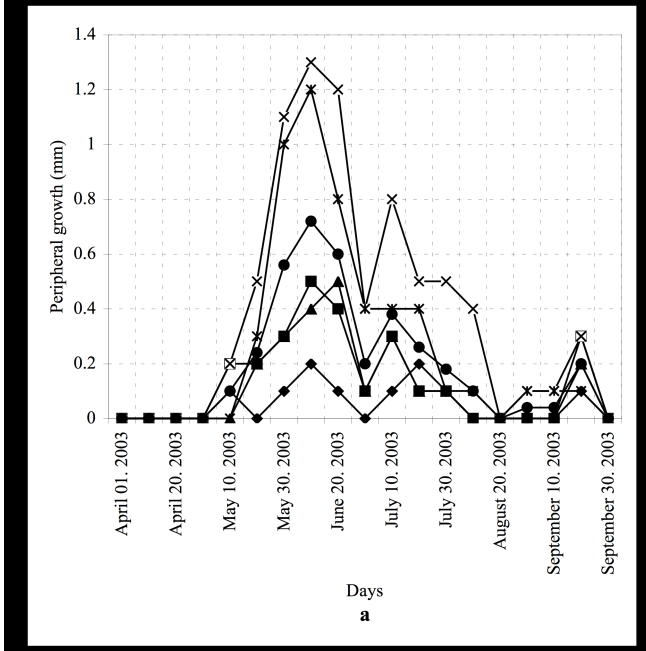
Cambium and its activity

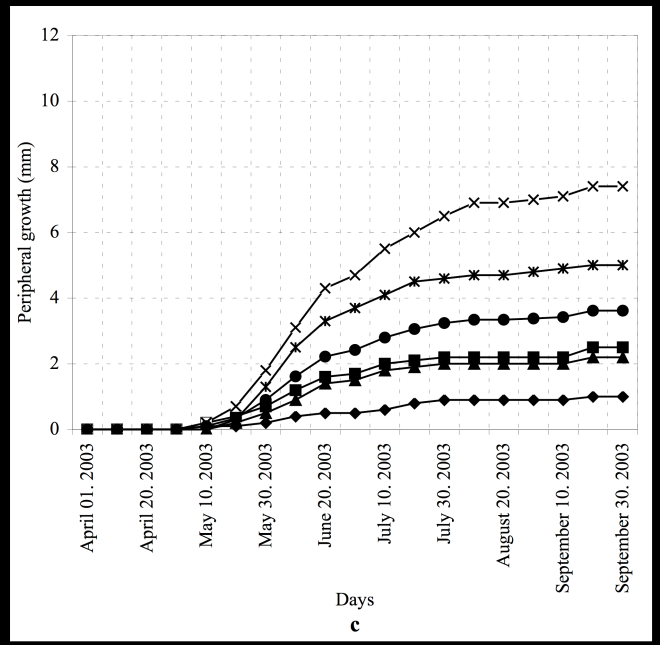


Cambium and its activity

Cambium activity can be measured by using dendrometers.



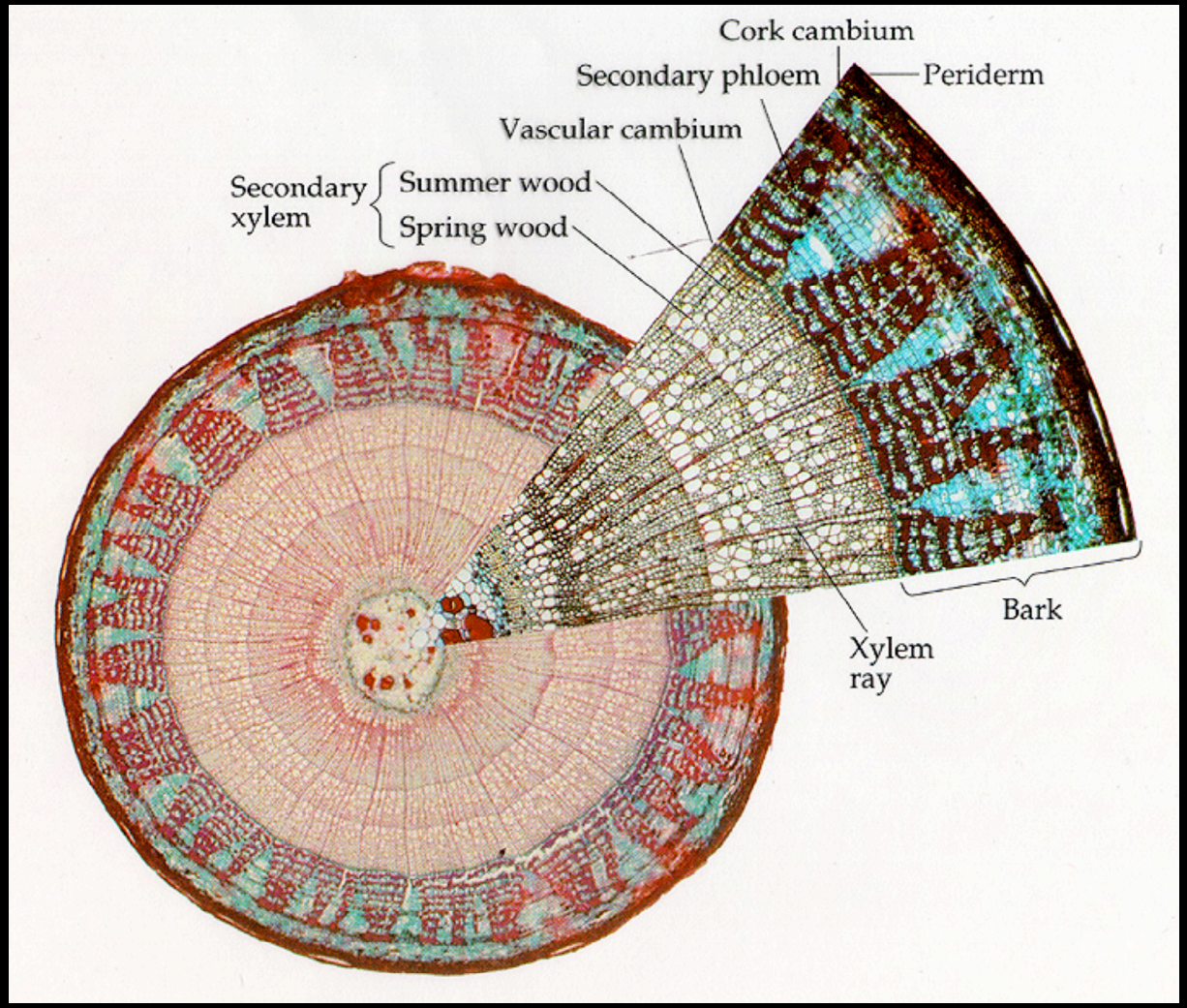


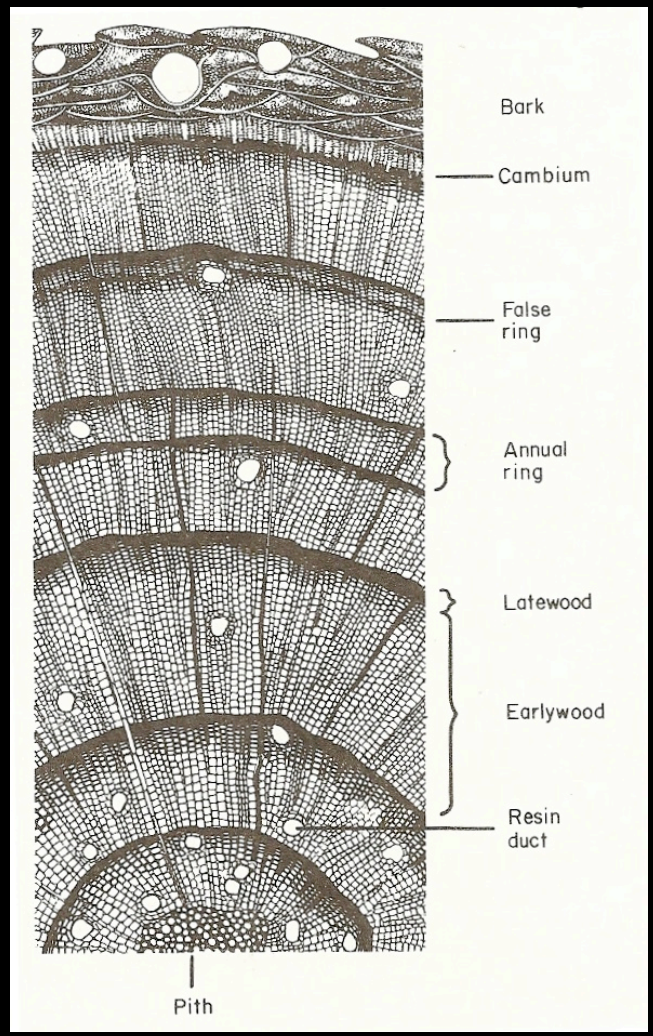


Cambium activity in Quercus petraea located in Belgrade Forest, İstanbul

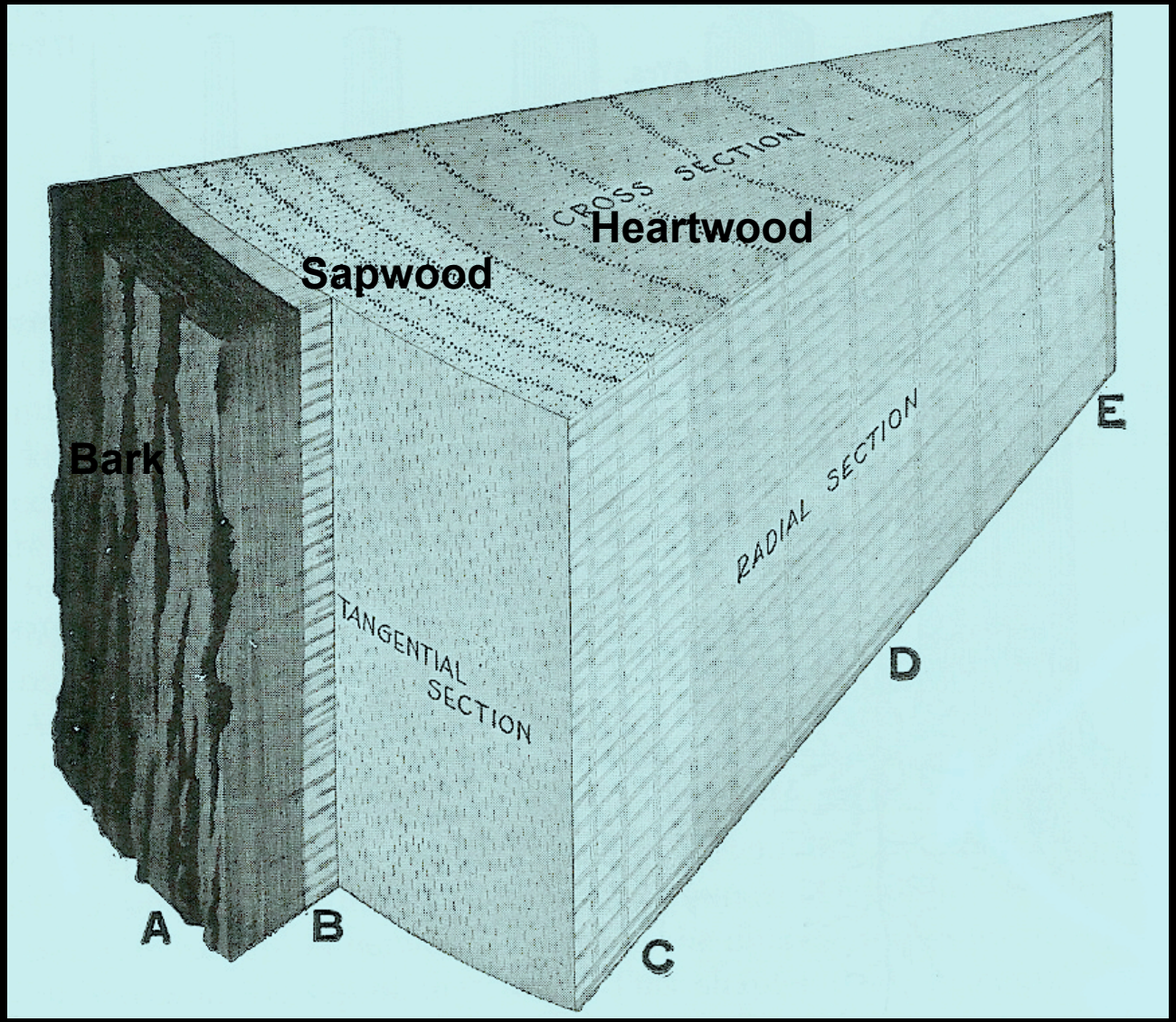
The results are from manual band dendrometers used in 2003 for per 10 days

Tree-ring formation





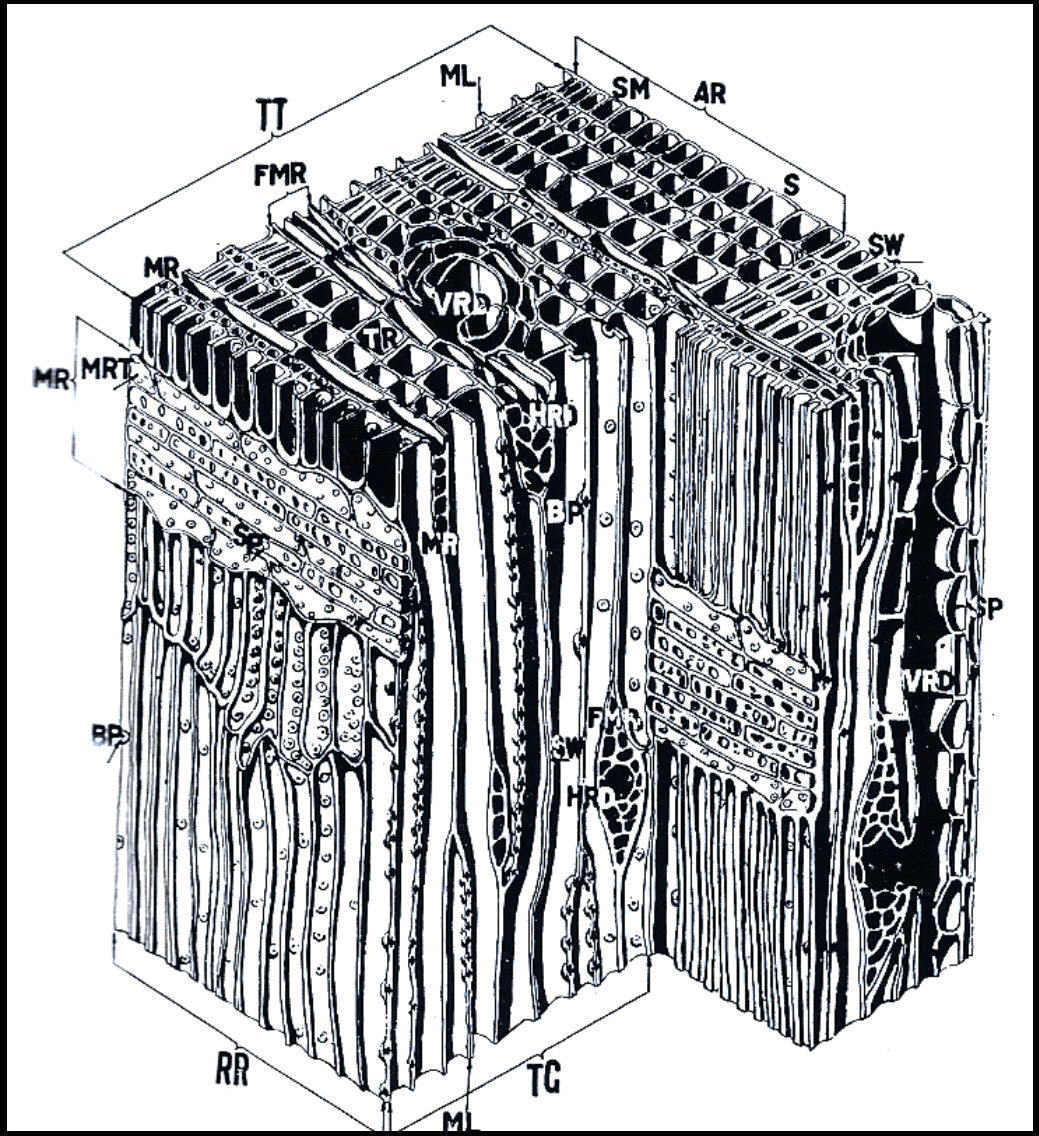
Wood (Macrosopic)



Conifer woods

Tracheids
Rays

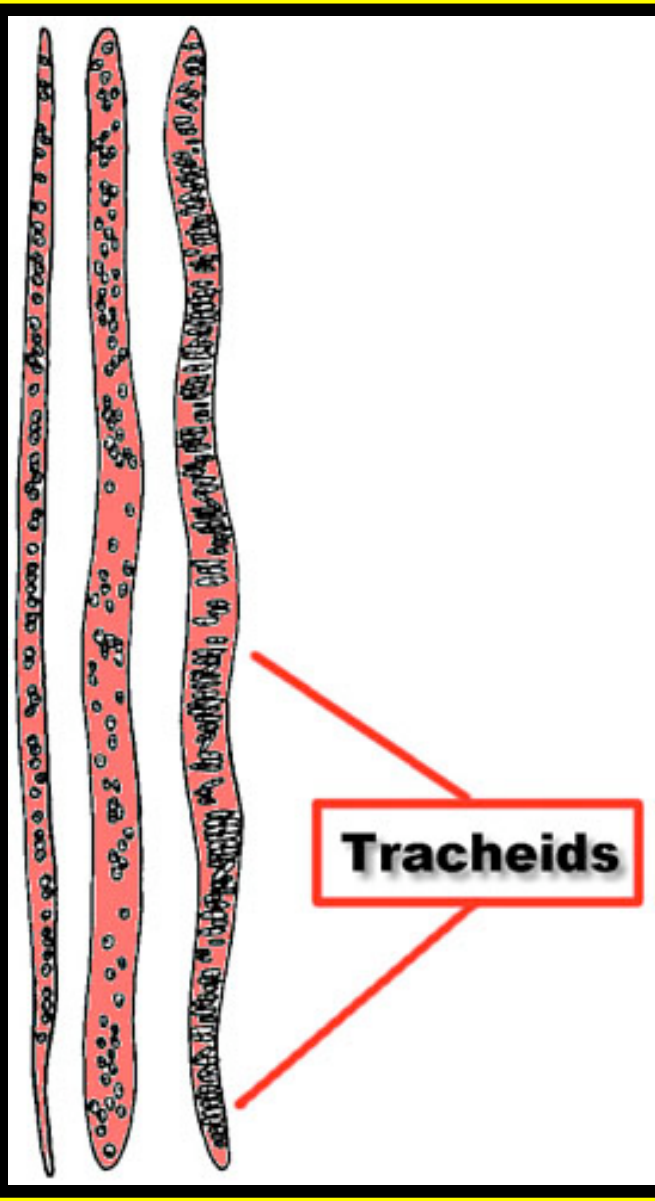
Transversal tracheids
Resin ducts
Wood parenchyma



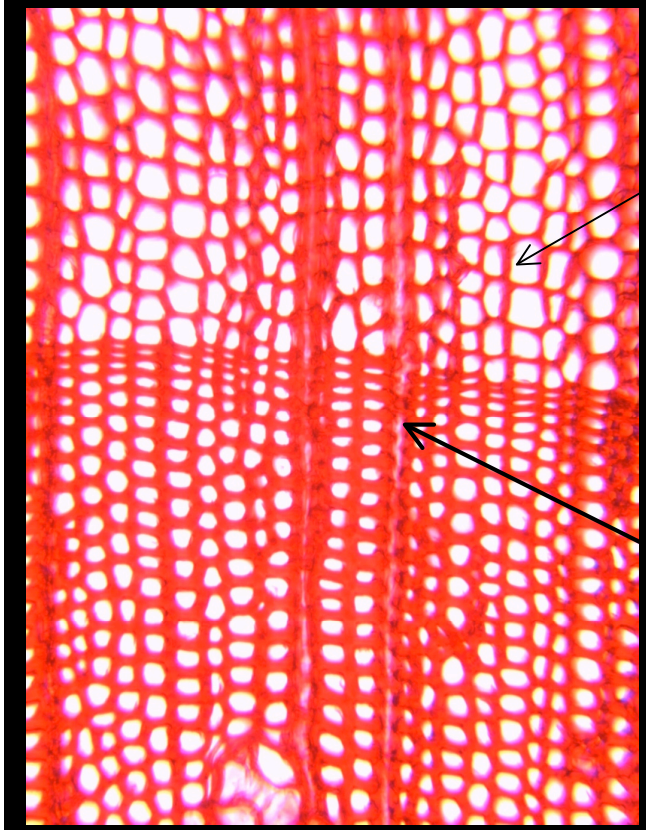
Conifer woods

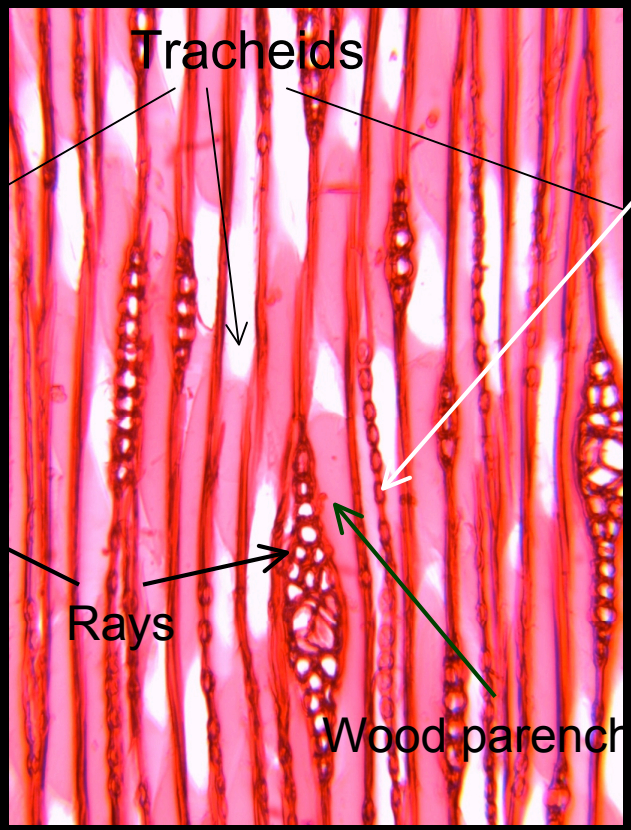
Tracheids

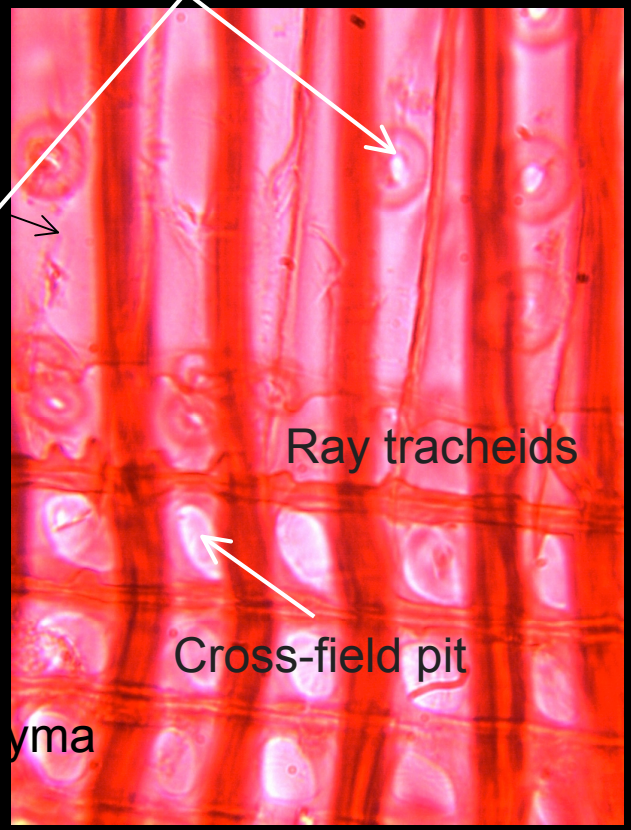
- Long (up to 9 mm) and dead cells
- have bordered pits on their radial surfaces to transport water and minerals
- their tips have not pores; because of this character, tracheids are primitive.



Conifer woods





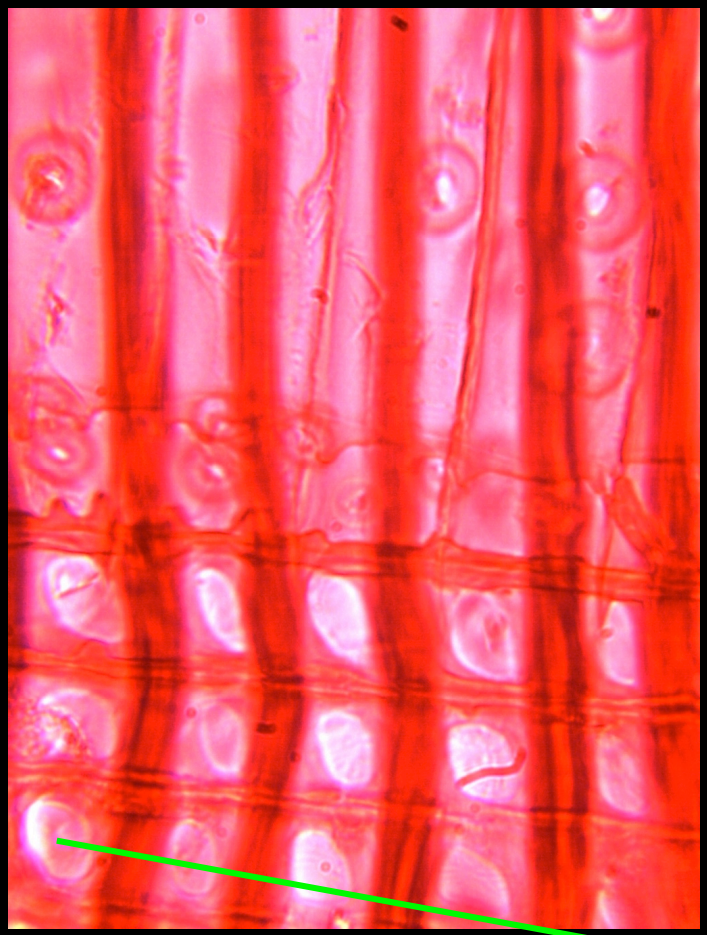


Cross section

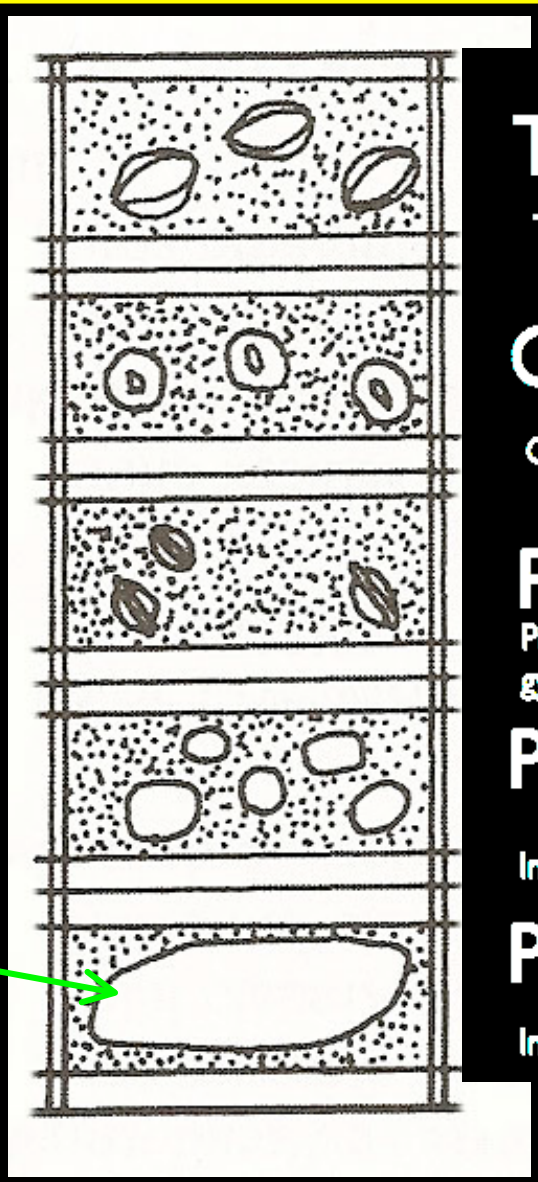
Tangential section

Radial section

Conifer woods



Cross-field pits on radial section



Taxodioid

Taxoidiaceae, Abies..

Cupreesoid

Cupressaceae, Abies..

Piceoid

Picea, and in summer woods of all gymnosperms

Pinoid

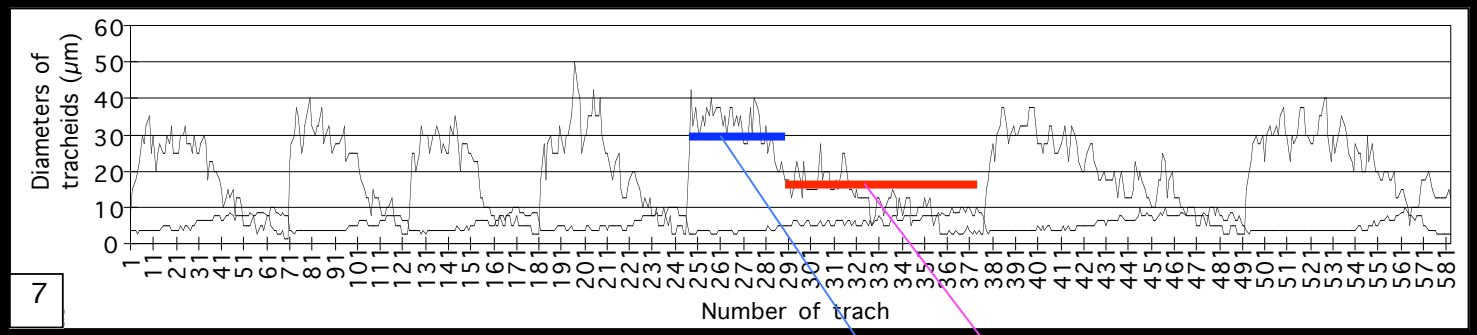
In Pinus species

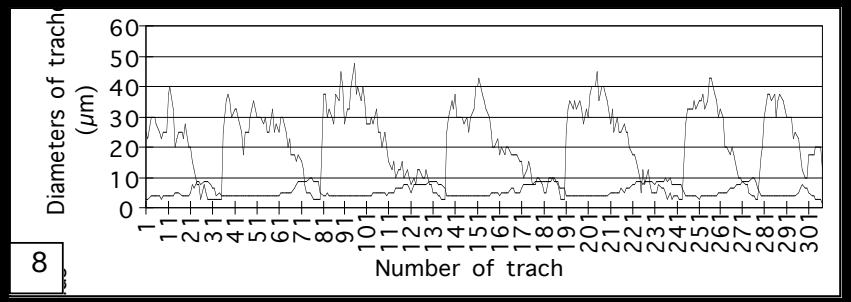
Pinoid-window like

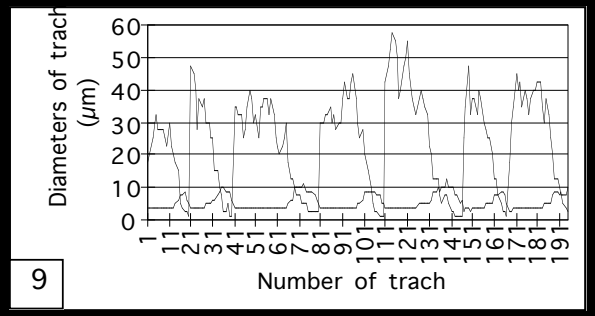
In Pinus species

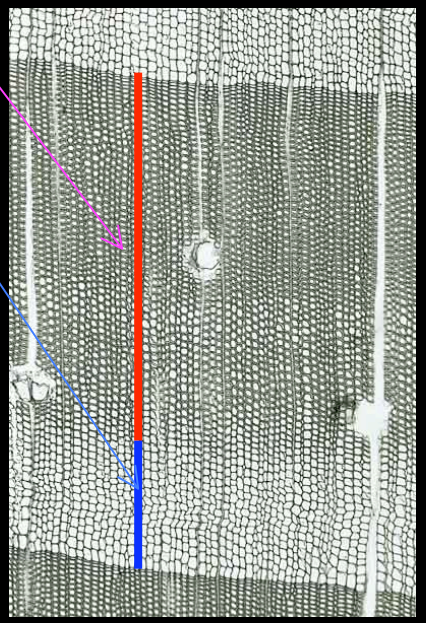
Conifer woods

Diameters of tracheids and cell walls, and their numbers in the last 7 tree rings during 1994-2000



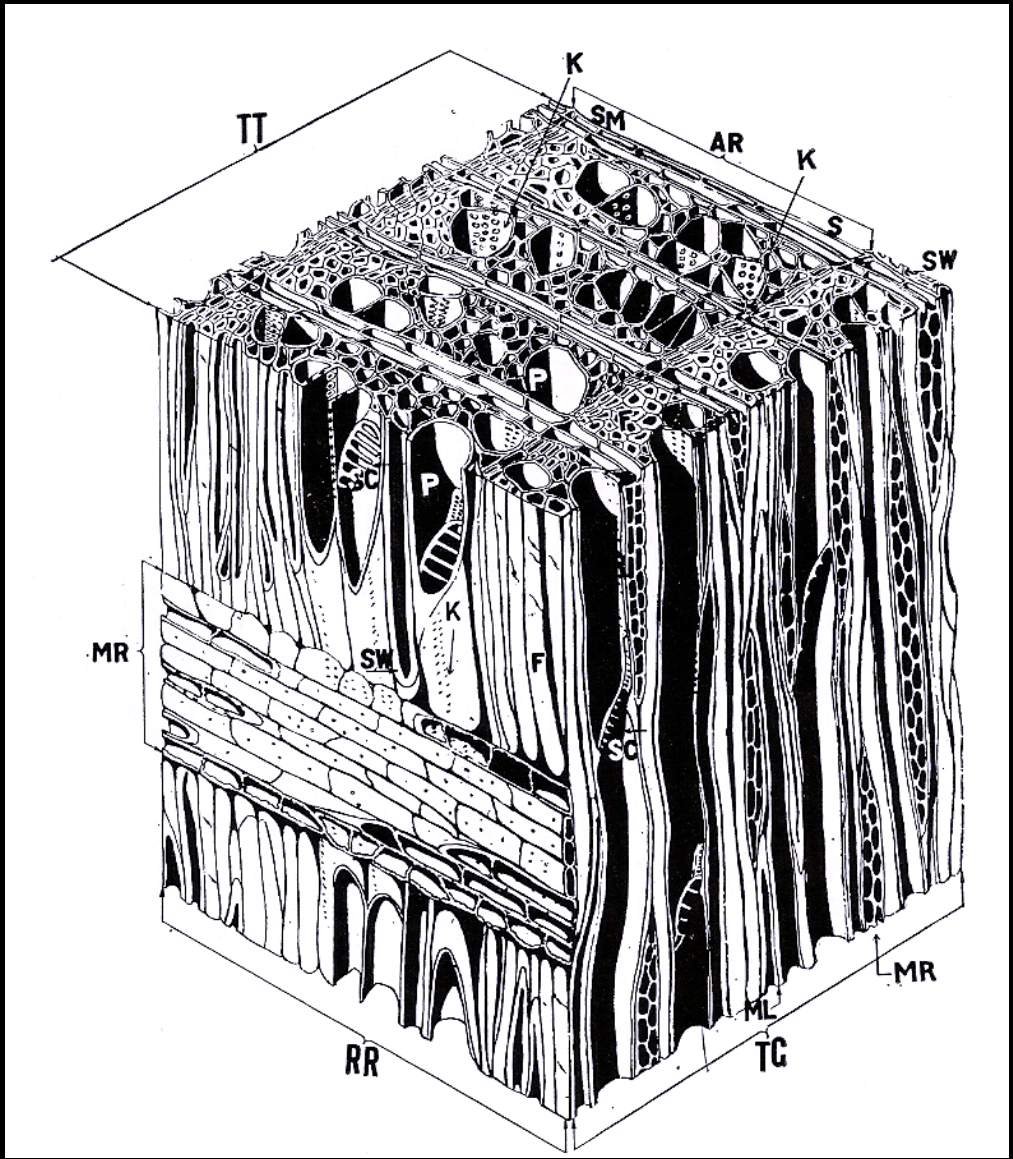






Hardwoods

- Vessels
- Fibre
- Rays
- Wood parenchyma



Hardwoods

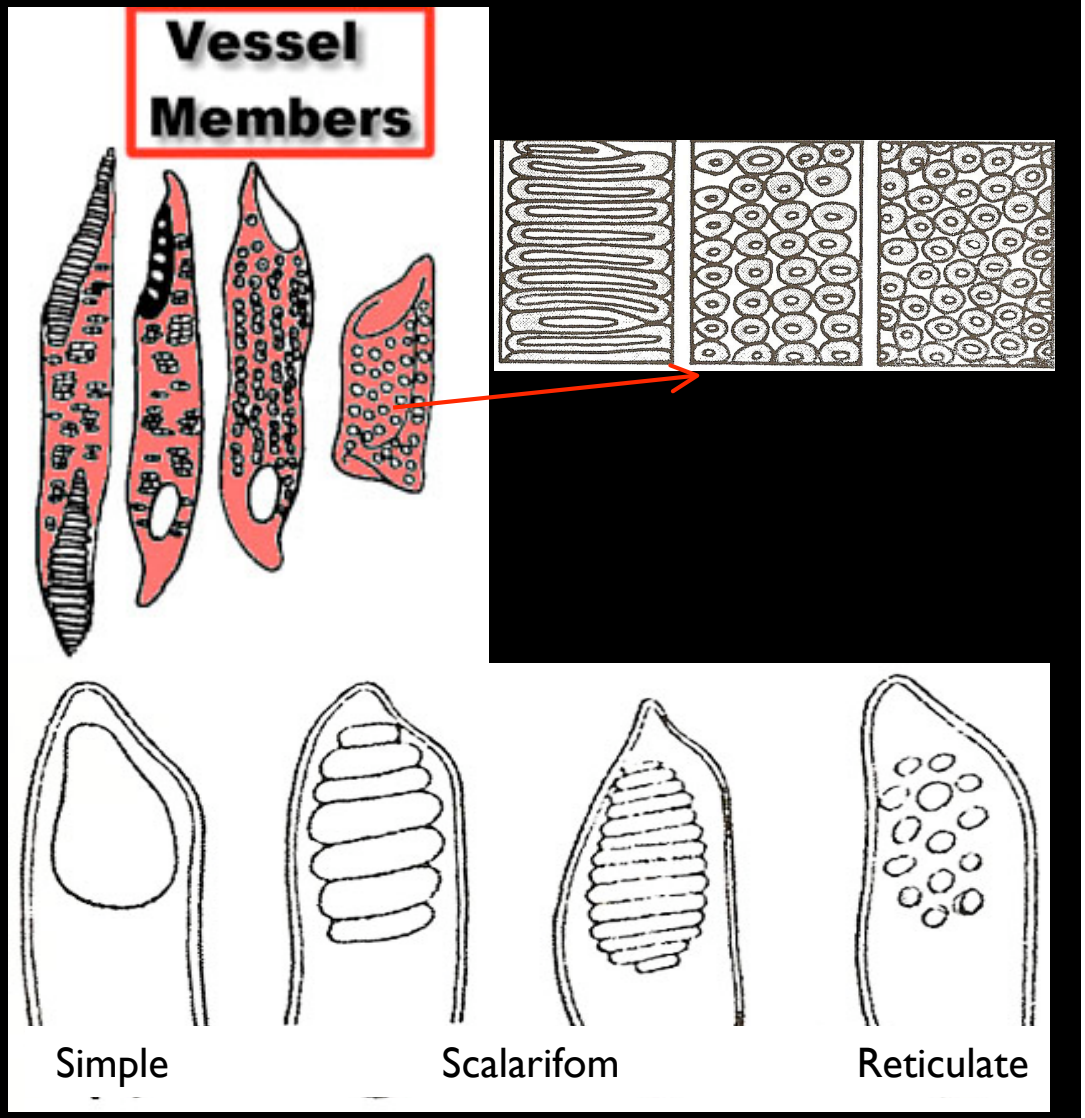
Vessels

Long (up to 1 mm) and dead cells

have perforation plates on their tips, and bordered pits on their surfaces to transport water and minerals

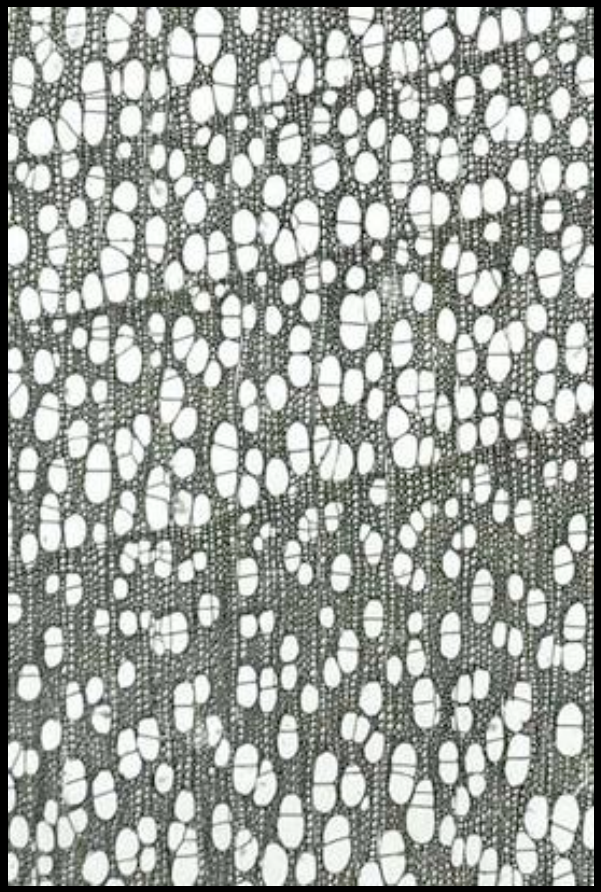
Because of having perforation plates in their tips, vessels are evolutive.

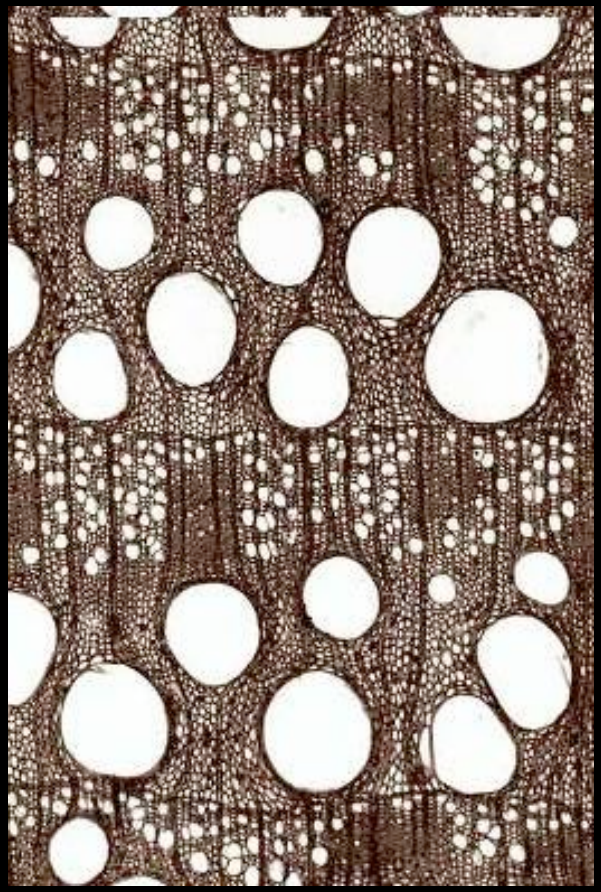
Reticulate perforation plate
Scalariform perforation plate
Simple perforation plate (the most evolutive one)

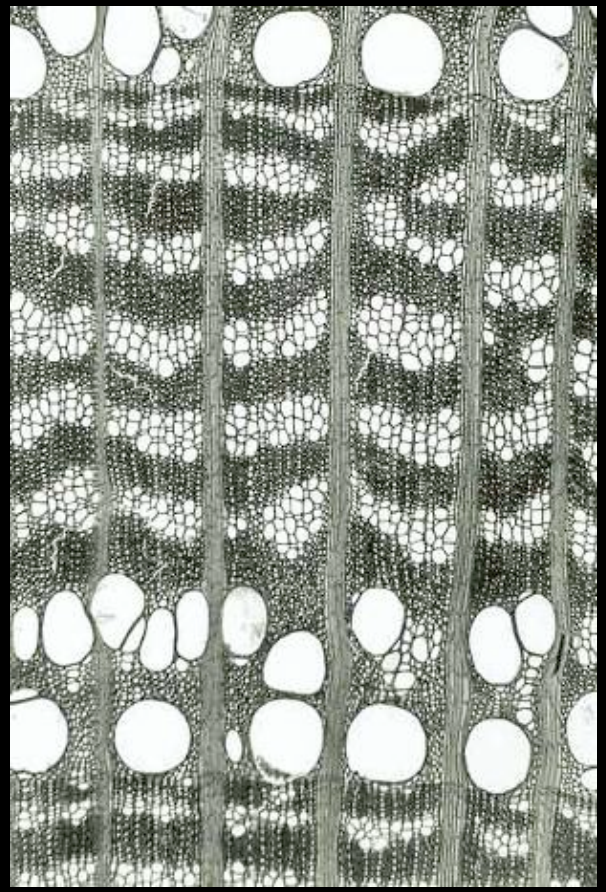


Hardwoods

Vessel arrangement





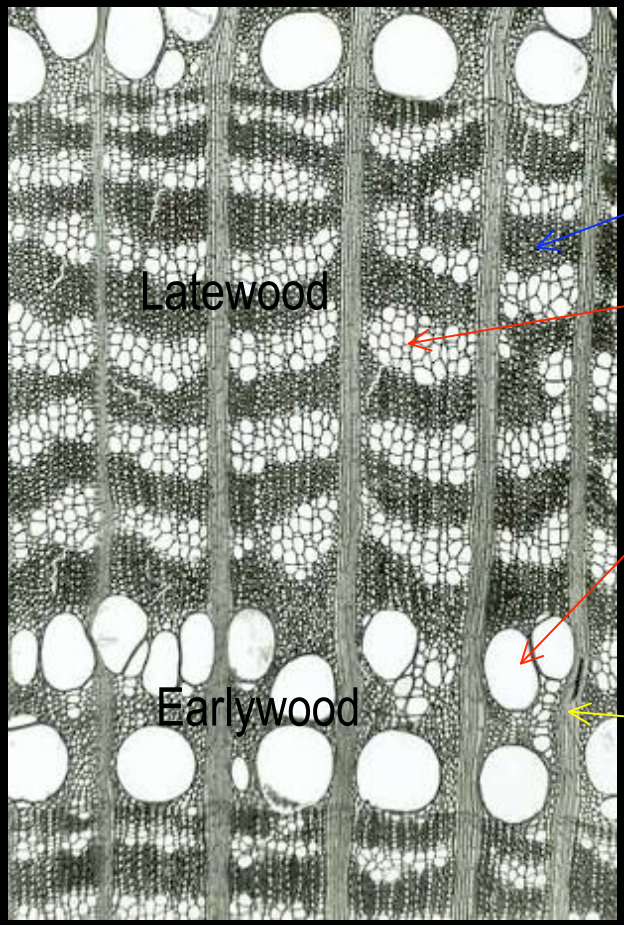


Diffuse porous

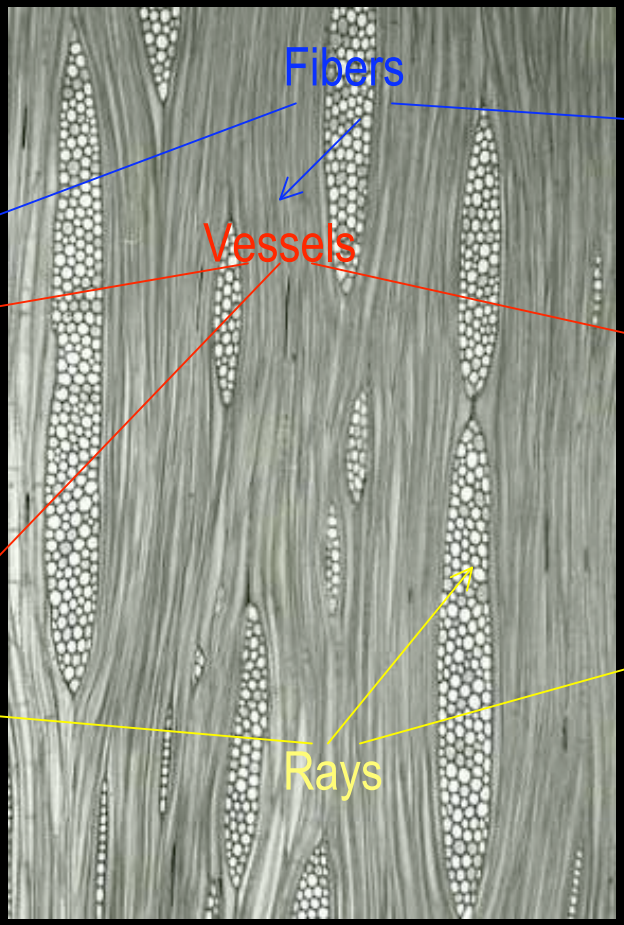
Ring porous

Hardwoods

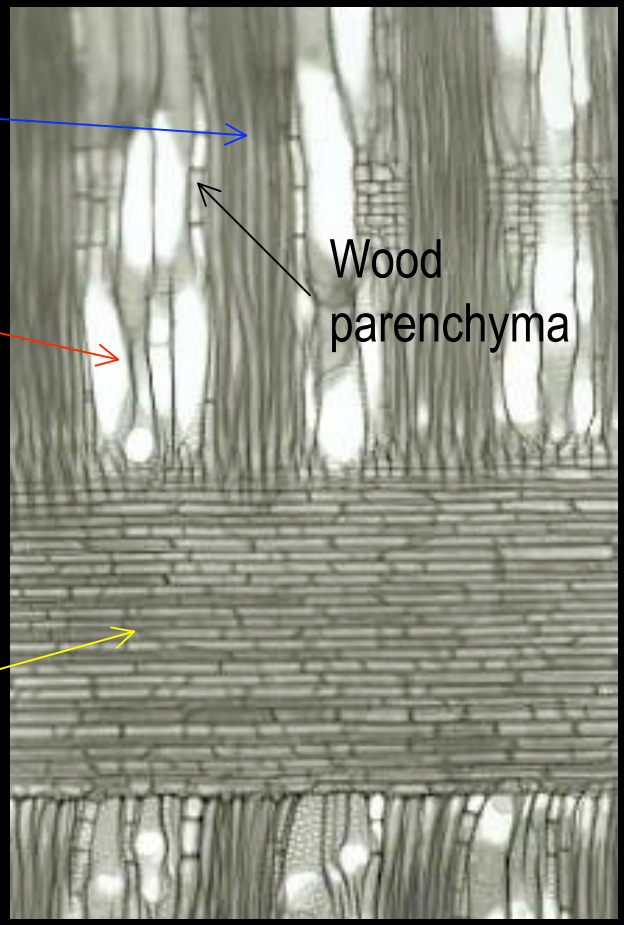
Ulmus laevis



Transversal section



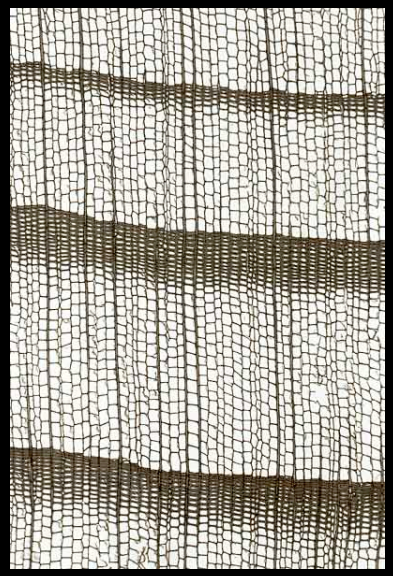
Tangential section

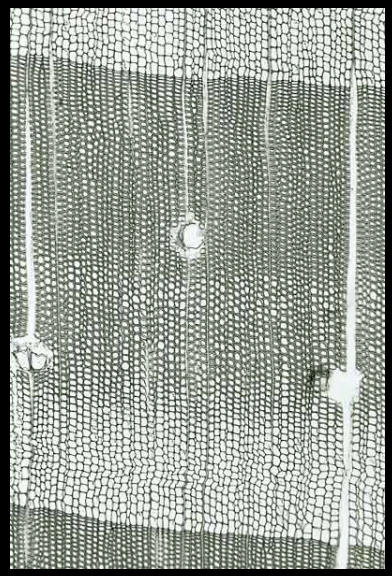


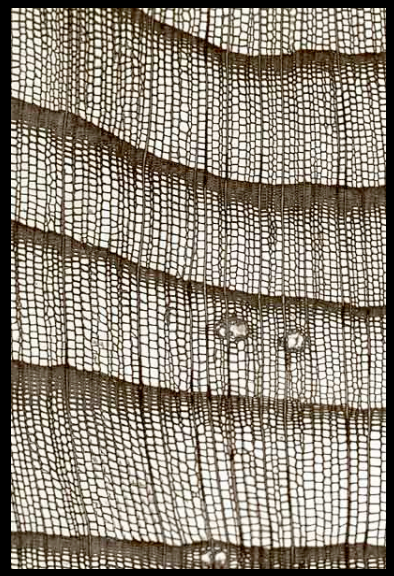
Radial section

Tree rings

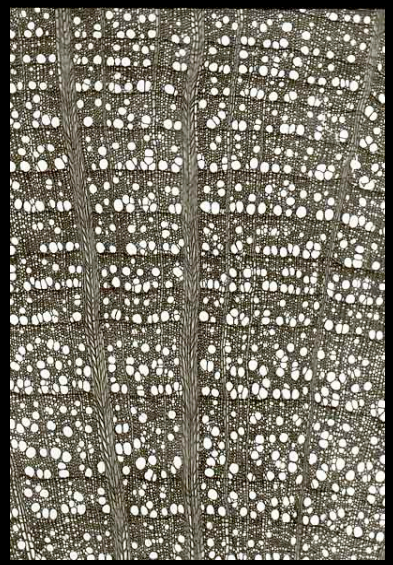
Gymnosperms

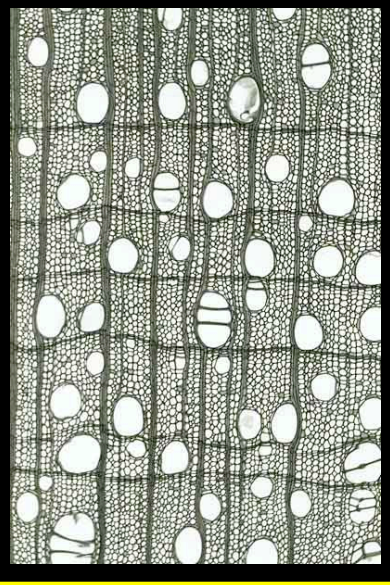


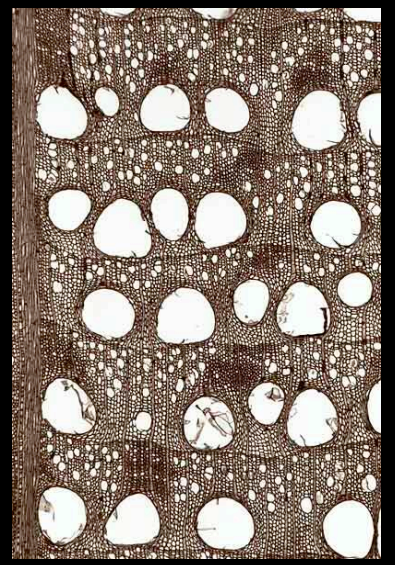




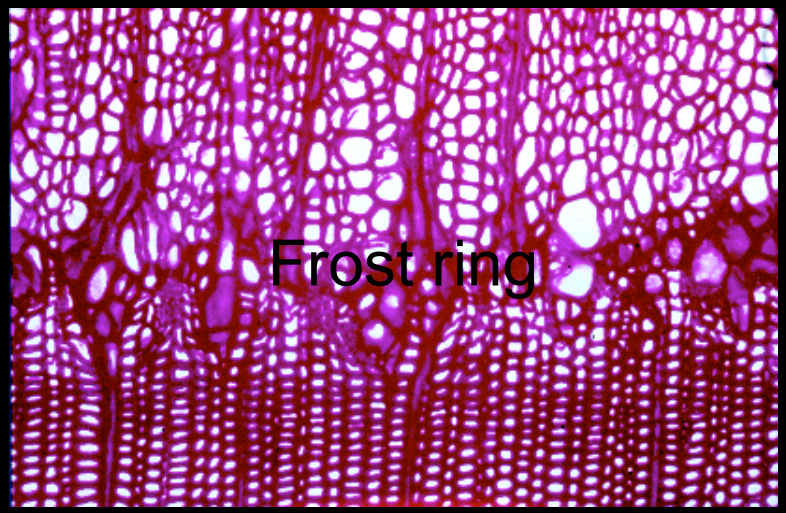
Angiosperms



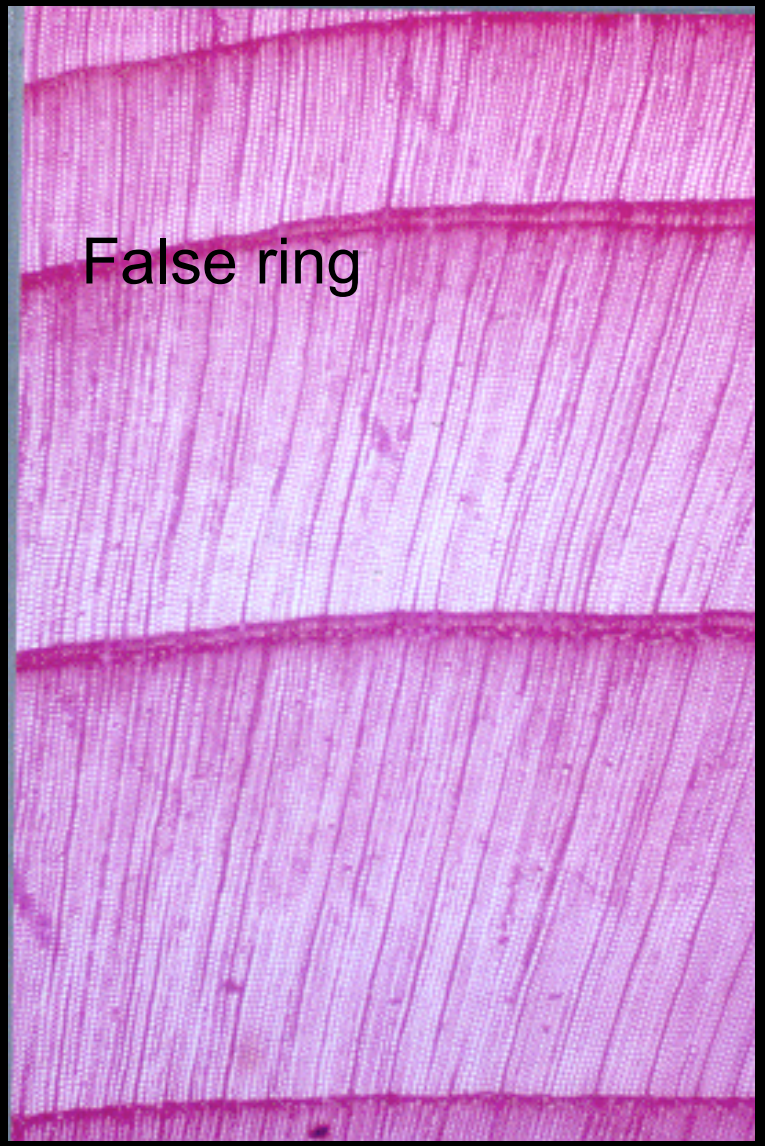




Tree rings


Frost ring


0
63
57
1730
Fire scars
1696
1705
48
1715
1708


False ring

Changes in wood features

- Aging
- Reaction wood
  - Tension wood
  - Compression wood
- Sapwood - Heartwood
- Ecological factors

Changes in wood features

Aging effects

The length of tracheids and fibers are

- shorter in the first years,
- depending on the aging, they begin being longer during maturation,
- in old woods no clear increase in length.

The width of vessels is

- narrower in the first years,
- depending on the aging, they begin being wider during maturation,
- in old woods no clear increase in width

Changes in wood features

Aging effects

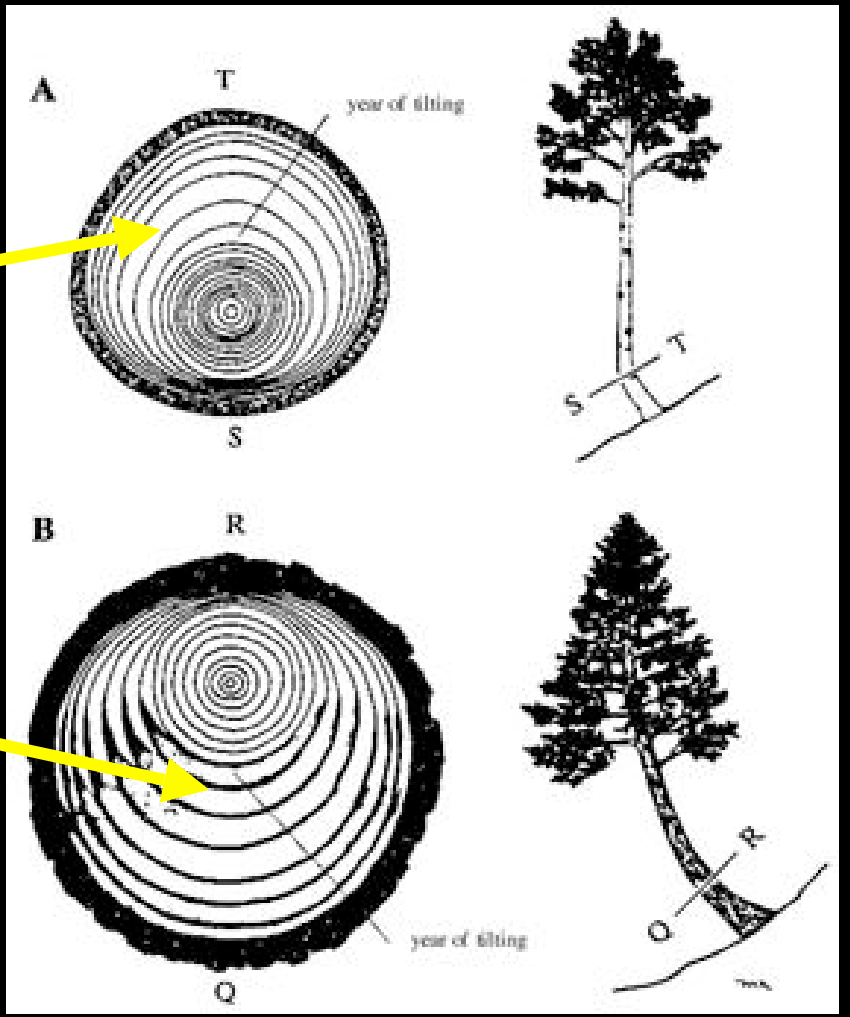
Reaction wood

-Tension wood

forms in angiosperms; it occurs upper side or side of the effect

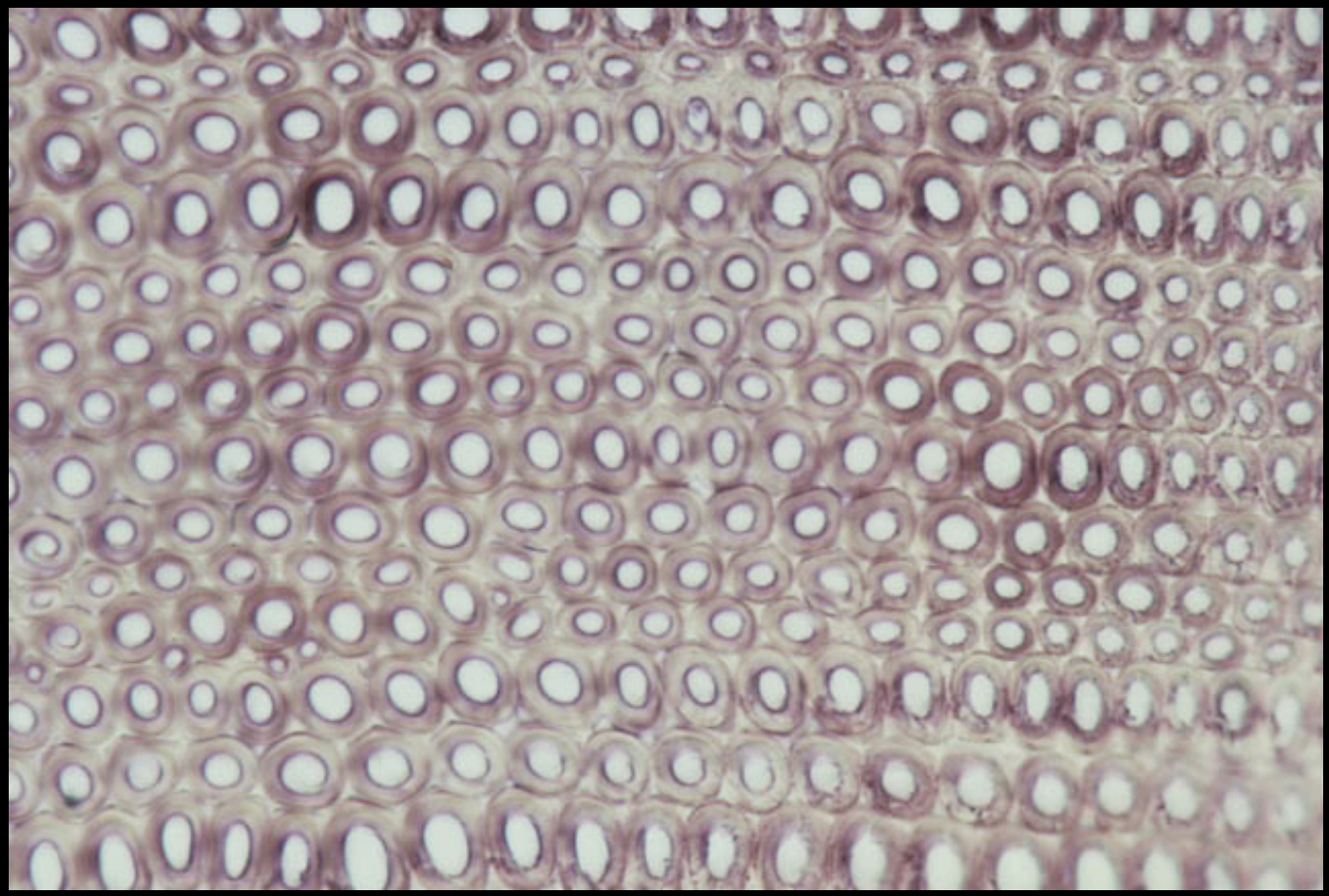
-Compression wood

forms in gmnosperms; it occurs down side or in the opposite side of the effect.
It is also called as red wood formaton



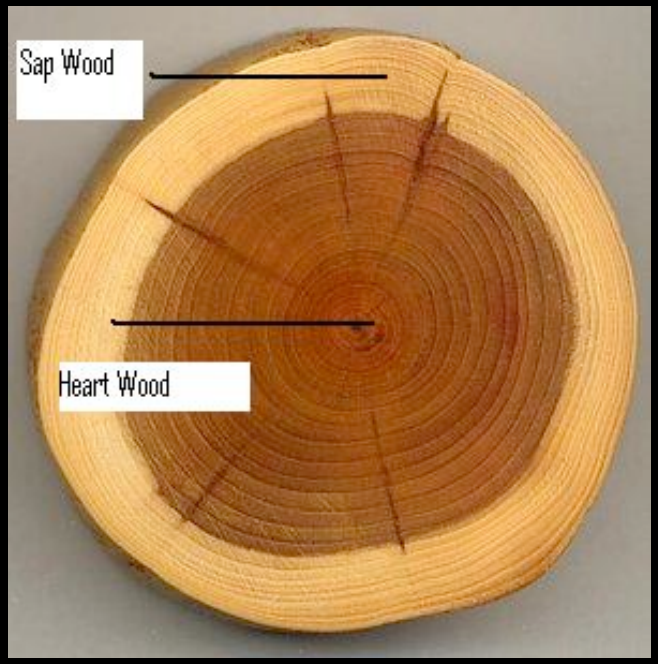
Changes in wood features

Compression wood



Changes in wood features

Aging effects
Reaction wood
-Tension wood
-Compression wood
Sapwood - Heartwood

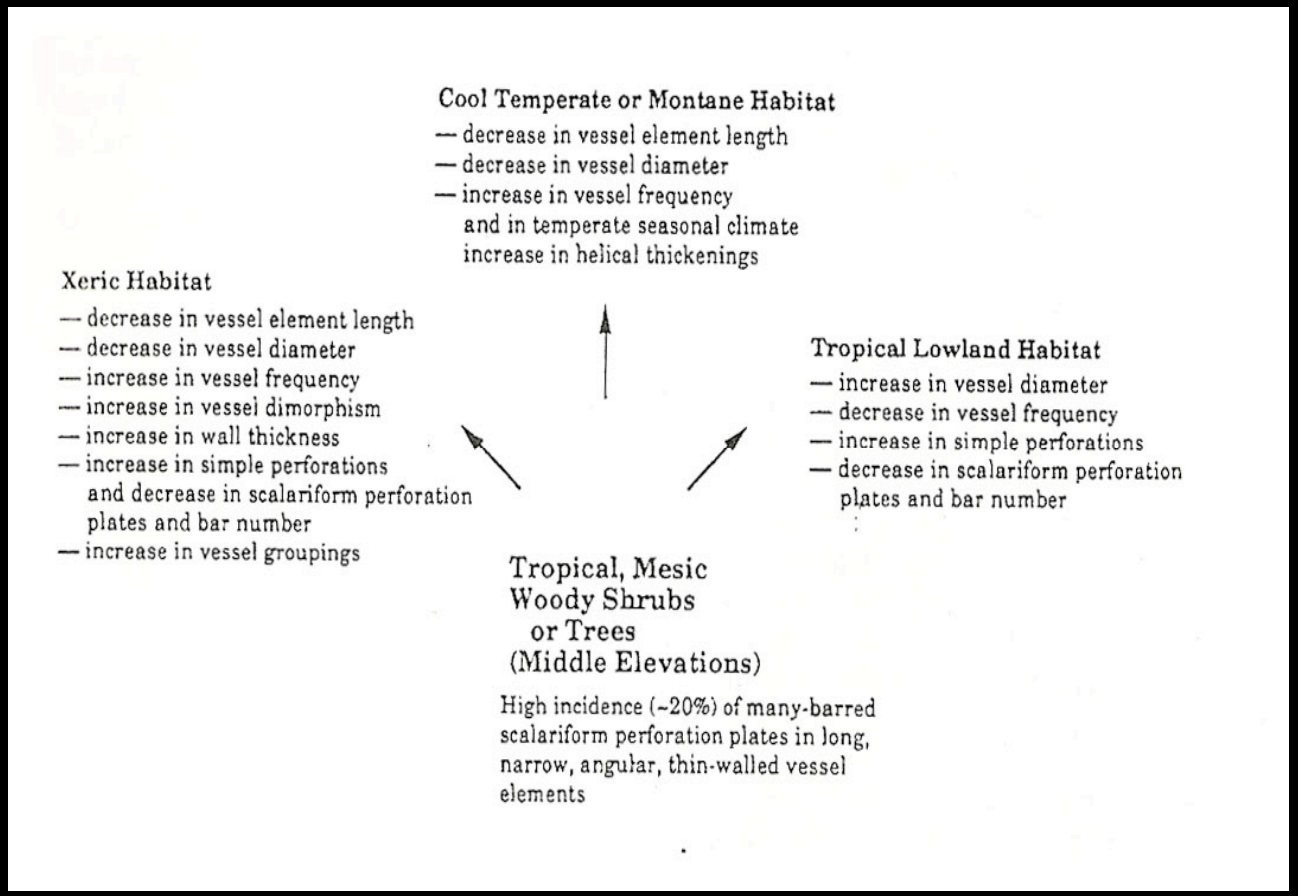


Sapwood ring numbers

Castanea sativa	3-4
Quercus sp	20-30
Pinus nigra	120-130

Changes in wood features

Aging effects
Reaction wood
-Tension wood
-Compression wood
Sapwood - Heartwood
Ecological factors



Importance of wood anatomy

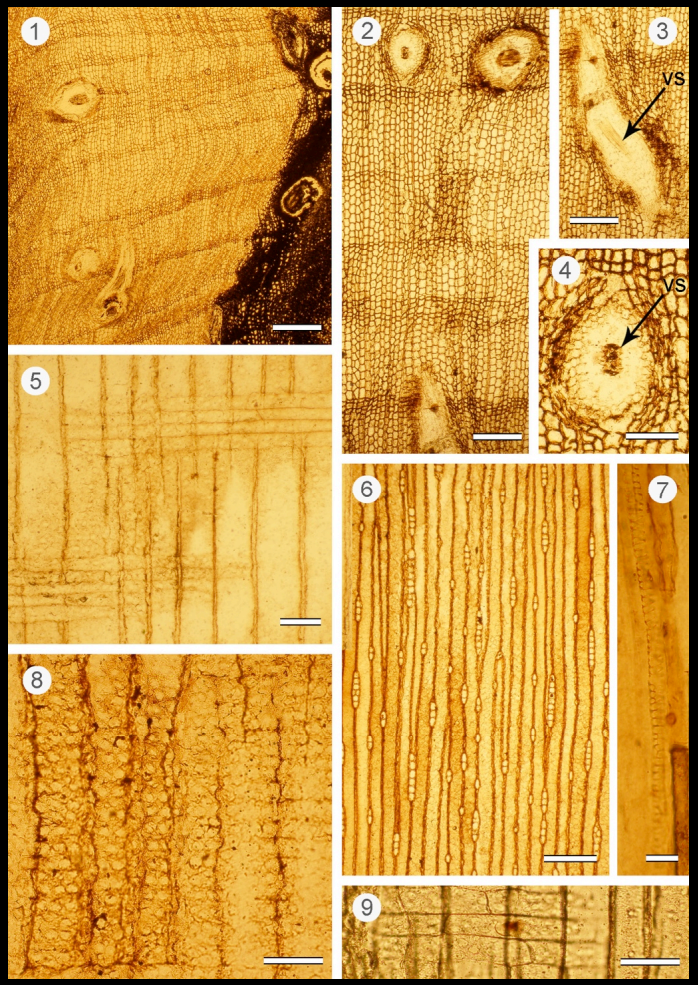
Woods of a ship from Byzantine Period (Marmaray 6)

Oak	: Quercus petraea (Mattuschka) Liebl.
	Quercus robur L.
	Quercus frainetto Ten.
Ashwood	: Fraxinus angustifolia Vahl.
Hornbeam	: Carpinus betulus L. (1 piece-repair piece)
Plane	: Platanus orientalis L. (1 piece-repair piece)
Chesnut	: Castanea sativa Miller
Walnut	: Juglans regia L.

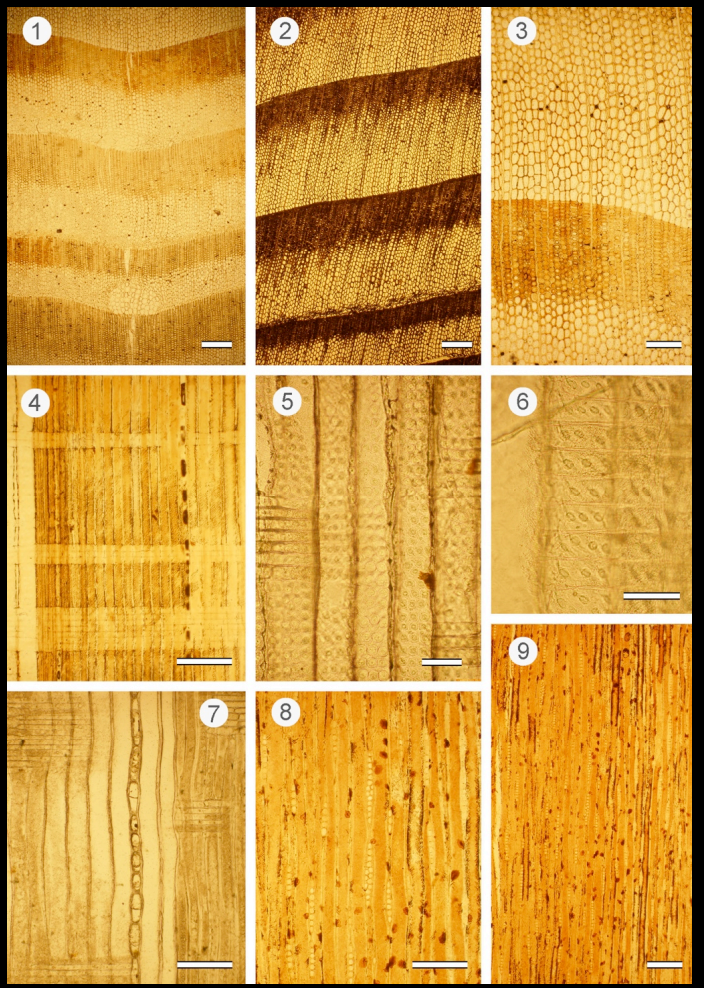
Trees, except Juglans, grow naturally in Belgrade Forest located just north of İstanbul
These woods were probably cut from this forest.

Importance of wood anatomy

Woods from Miocene of Ankara



Taxodium



Sequoia

Importance of wood anatomy

In dendrochronology, wood anatomy is also important.

A wood taken from an old building should be identified before dating.

Why?

Because in dating the better way is to use the master chronology from the same genus.

For example, if you find an oak sample from the old building, the best way is to use an oak chronology to date the sample.