VASCULAR CAMBIUM

THE 3D VIEW

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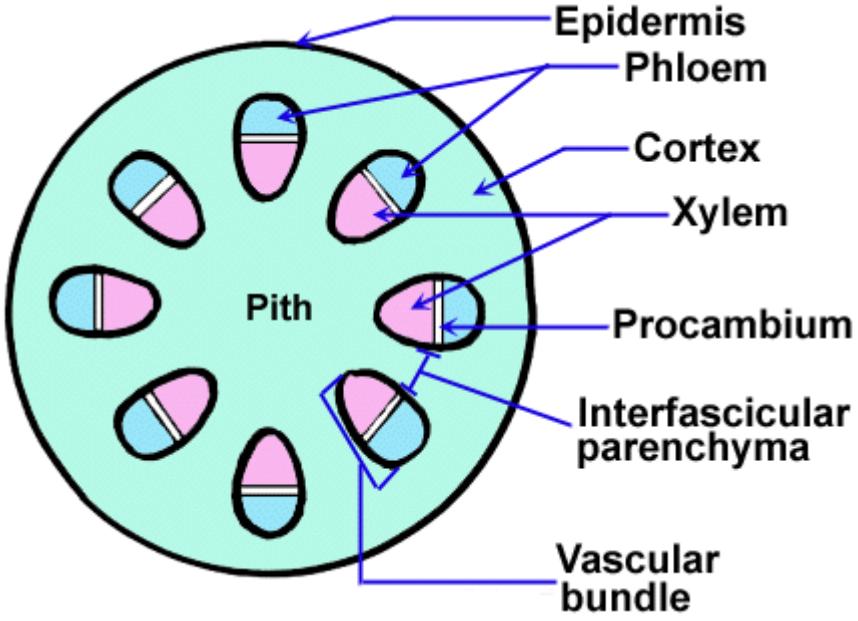
SECONDARY GROWTH

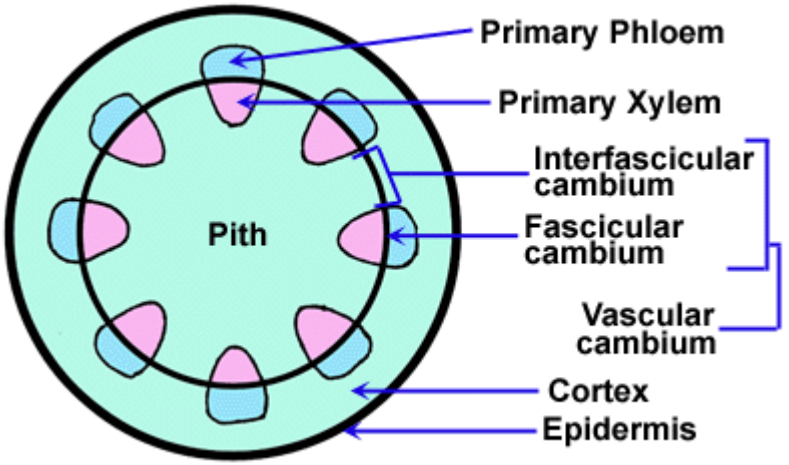
Secondary growth begins with the initiation of the vascular cambium,

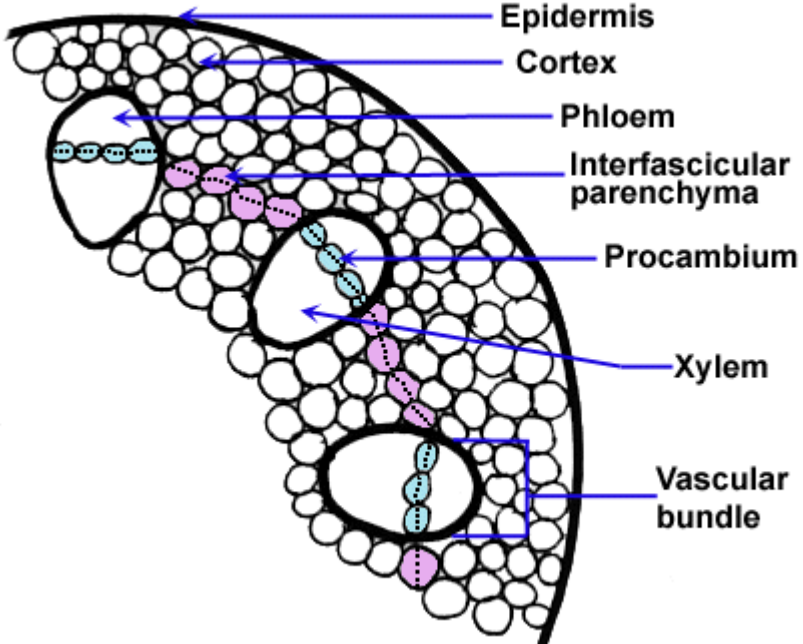
a cylinder of meristematic tissue that produces additional xylic and phloic tissues.

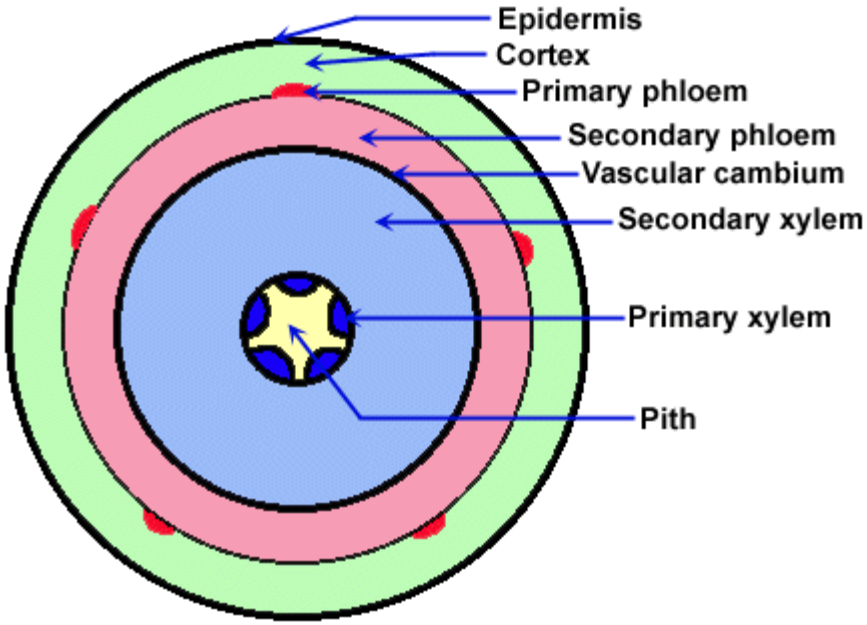
The cells that eventually form the vascular cambium come from two sources, the procambium in the vascular bundles and the interfascicular parenchyma cells between vascular bundles.

STEPS IN FORMATION OF VASCULAR CAMBIUM

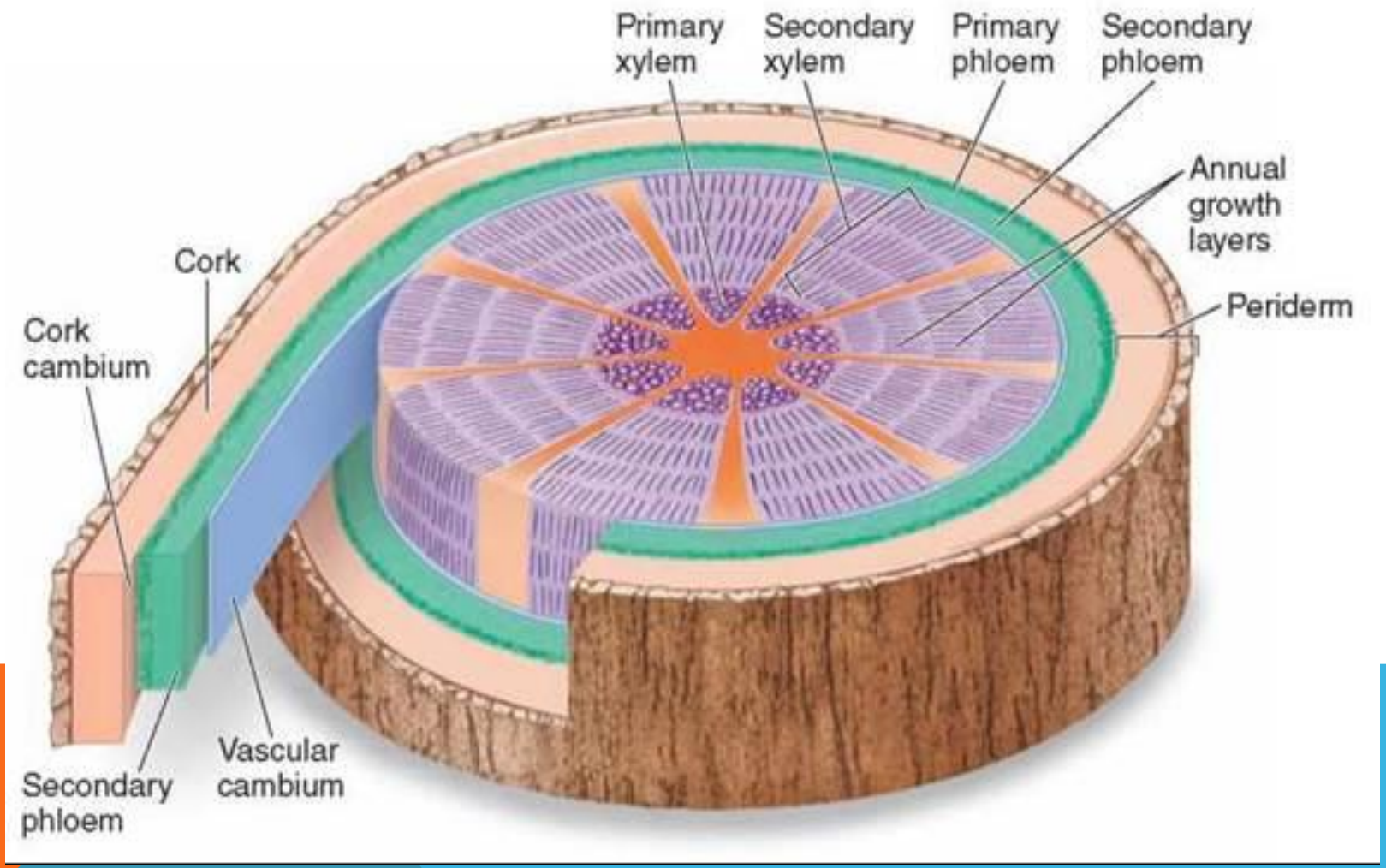






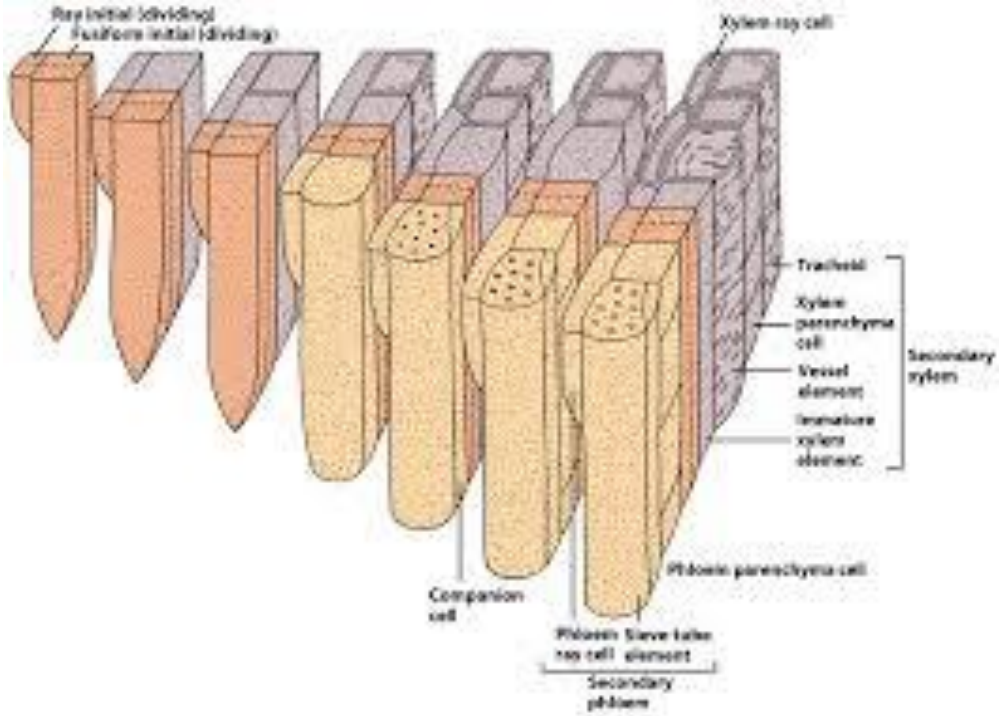


POSITION OF VASCULAR CAMBIUM



Two types of cells in Vascular Cambium

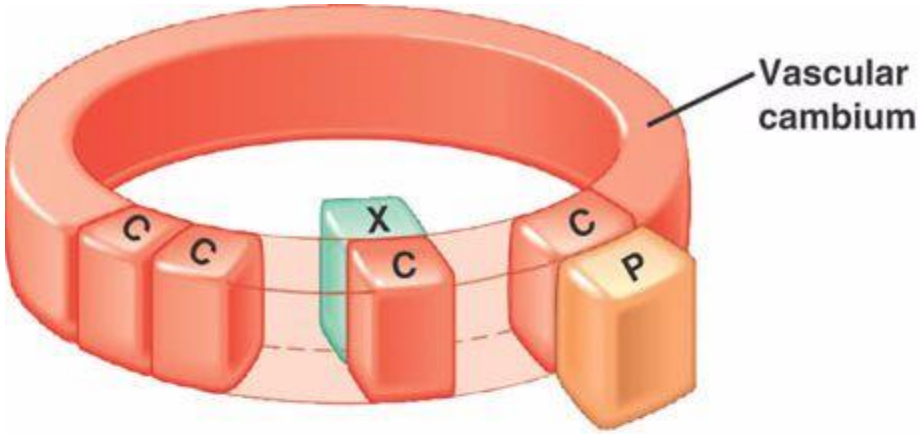
1. Fusiform initial
2. Ray initial



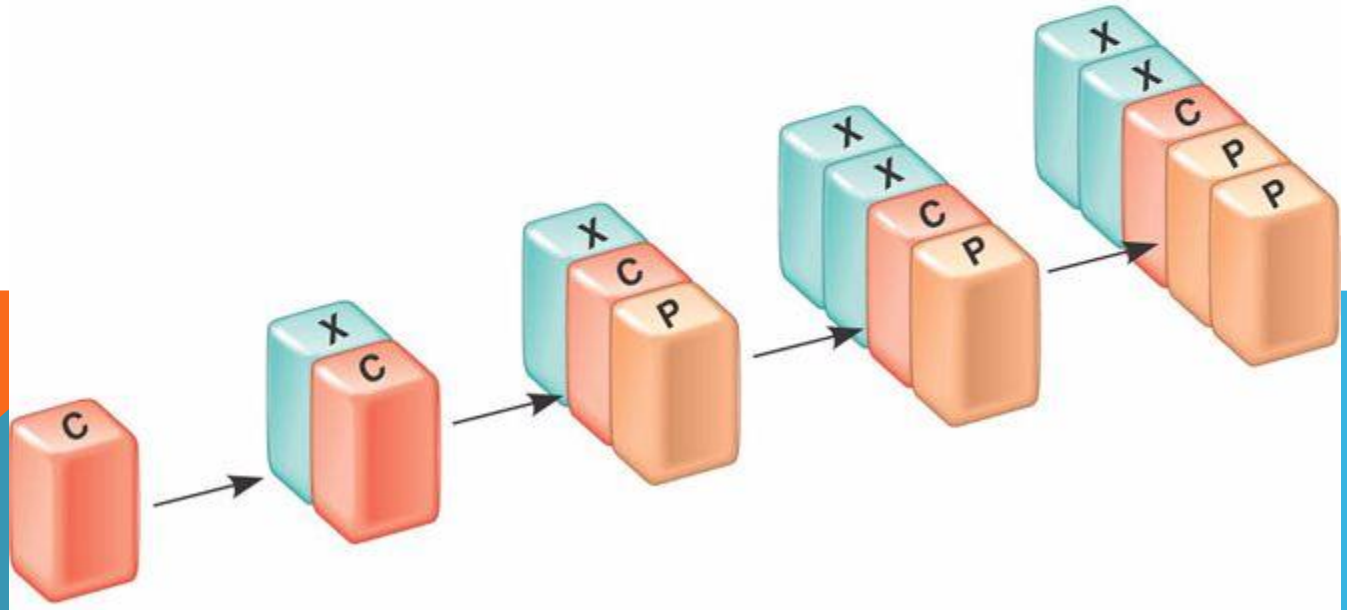
VASCULAR CAMBIUM

1. Fusiform initials
   -- elongated and tapered
   -- tracheary elements, fibers, xylem and phloem parenchyma, sieve elements
2. Ray initials
   -- smaller; isodiametric
   -- vascular rays

TYPES OF CELLS DIVISION IN VASCULAR CAMBIUM

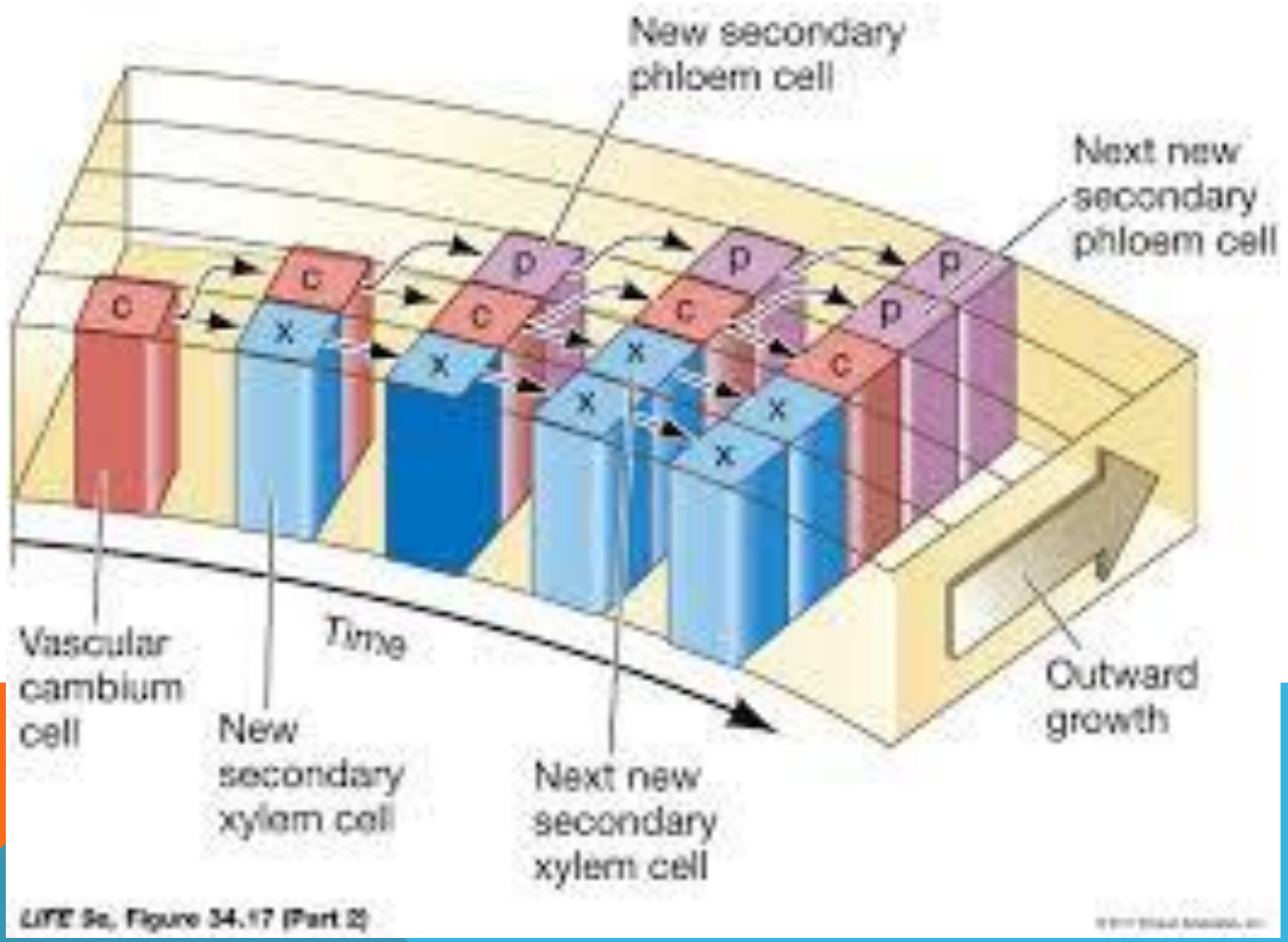


(a) Types of cell division

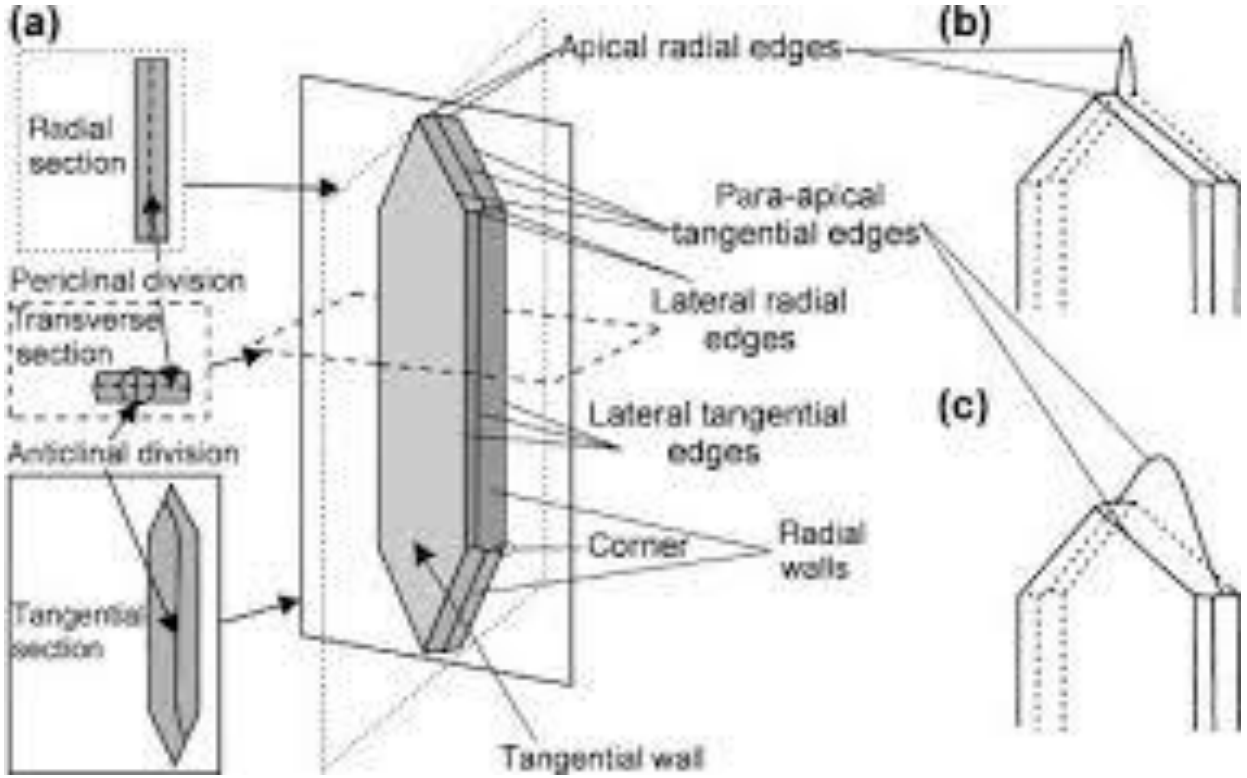


(b) Accumulation of secondary growth

DIVISION OF VASCULAR CAMBIUM

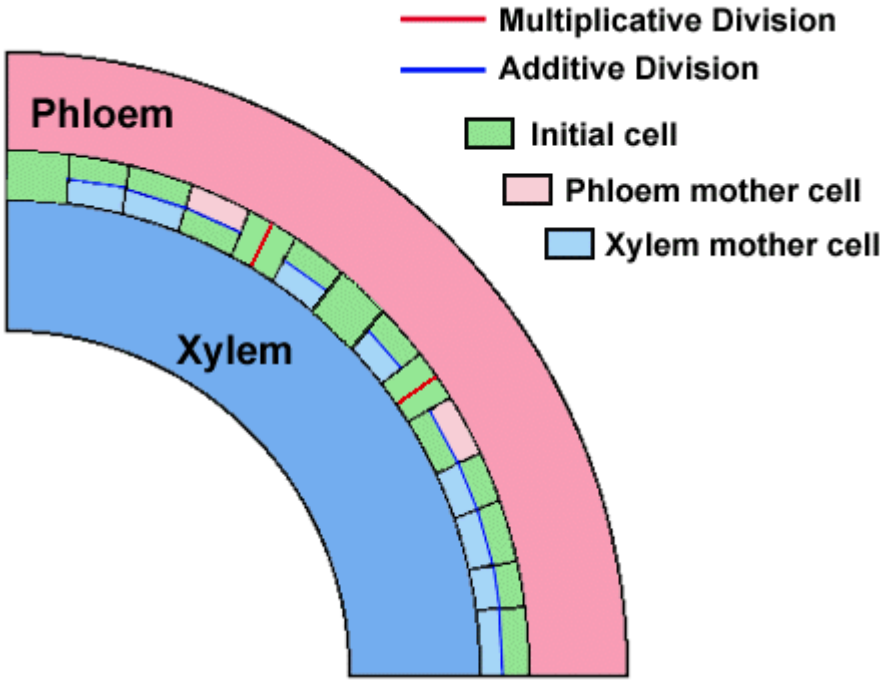


LIFE 9e, Figure 34.17 (Part 2)

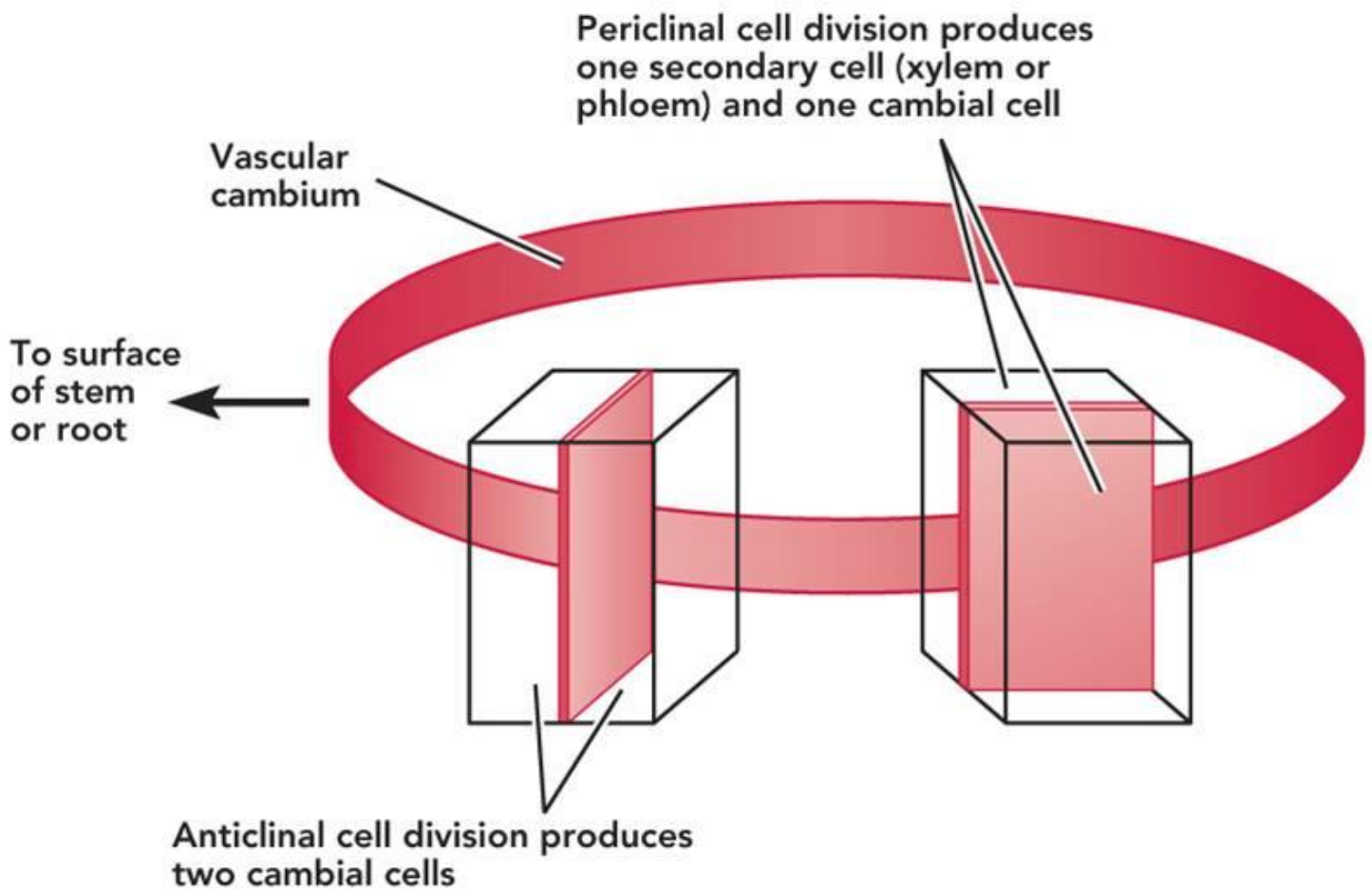

(a)
Radial section
Periclinal division
Transverse section
Anticlinal division
Tangential section
Apical radial edges
Para-apical tangential edges
Lateral radial edges
Lateral tangential edges
Corner
Radial walls
Tangential wall
(b)
(c)

TYPES OF CELL DIVISION IN VASCULAR CAMBIUM

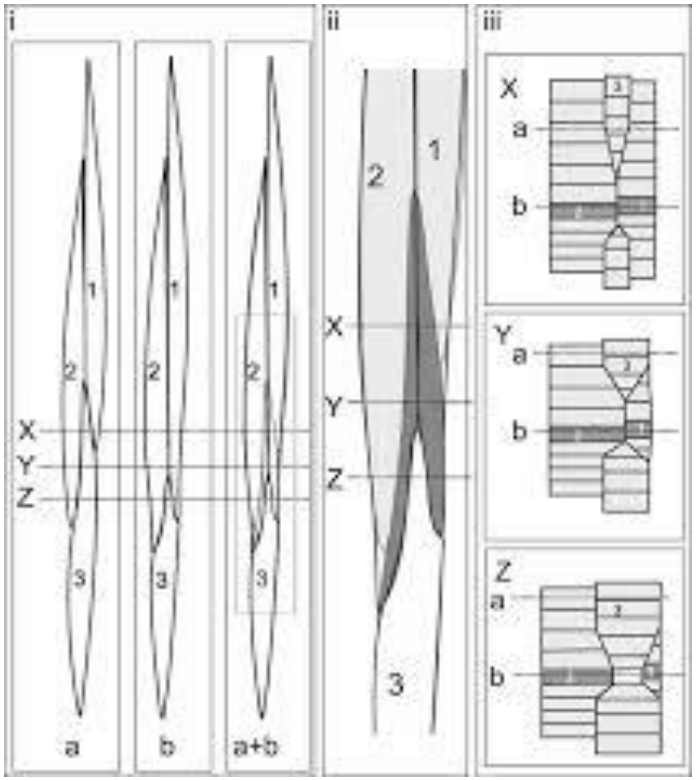
1. Additive division : it is periclinal division in which there is addition of xylem and phloem cells
2. Multiplicative division: this is anticlinal division in which multiplication of cambium initials take place to combat with the increasing girth
3. Intrusive division or oblique division: increases length of the cambial cells with the increase in the length of the tree



PERICLINAL AND ANTICLINAL DIVISION



OBLIQUE DIVISION



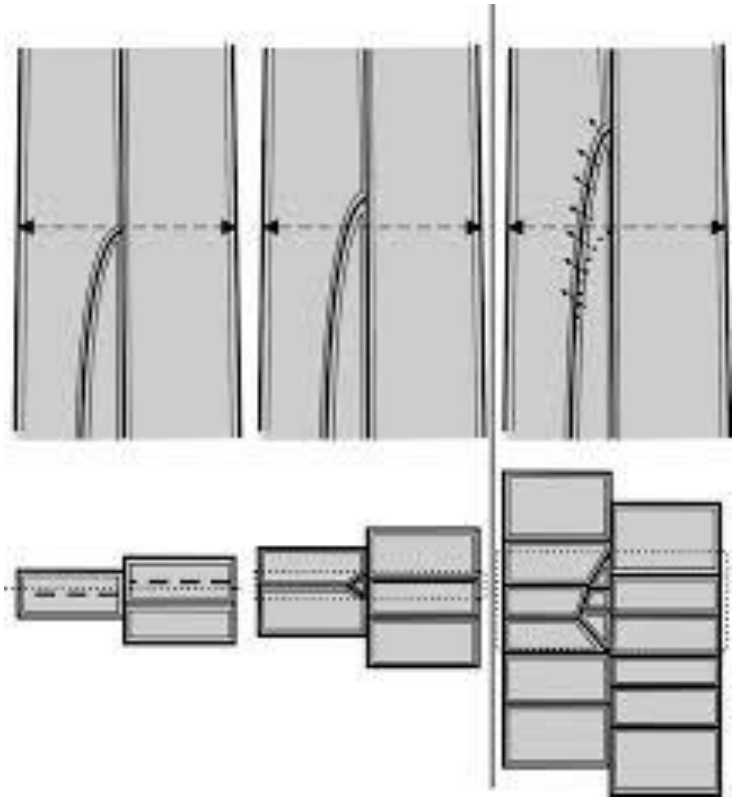
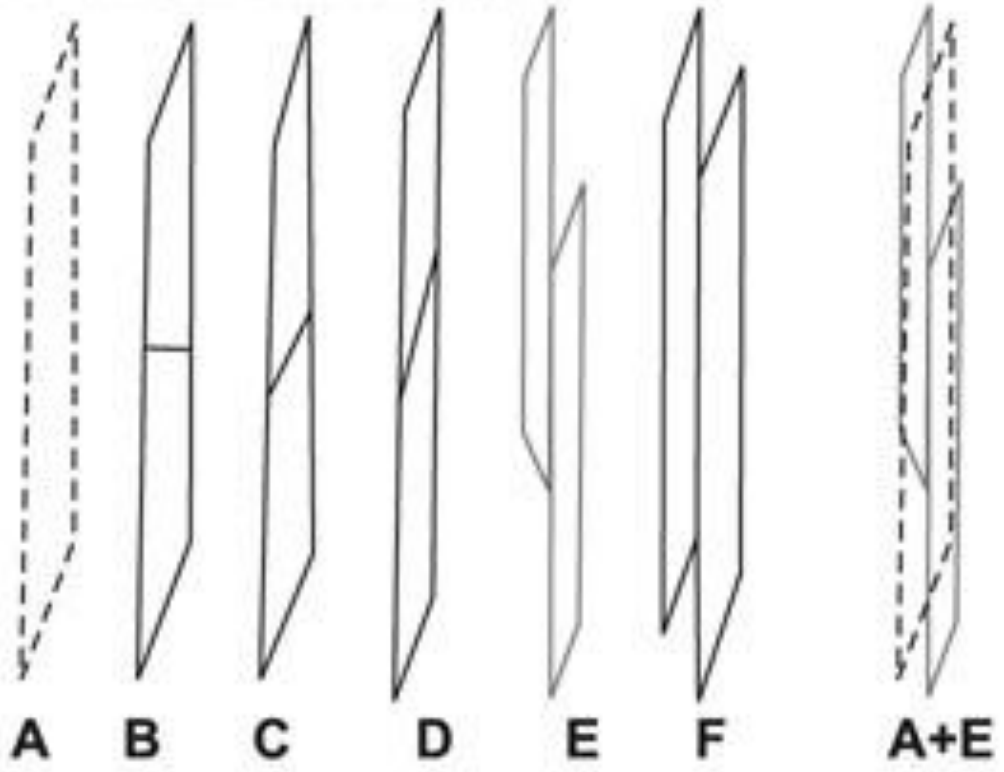


Fig. 9. Root cambium of *Tilia tomentosa*. Diagrams of fusiform initials (A–F) in tangential view showing the transverse anticlinal division of an initial (B), subsequent shift to oblique orientation (C and D) and growth of young derivatives (E and F) (from Neeff, 1920). Our superimposing of drawings A and E shows that the sum of the tangential widths of the young derivatives is almost equal to the width of the mother initial (A).



INTRUSIVE DIVISION OF VASCULAR CAMBIUM

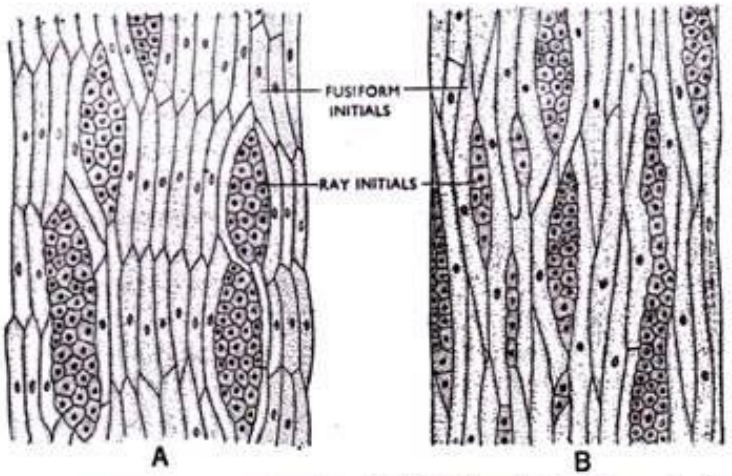
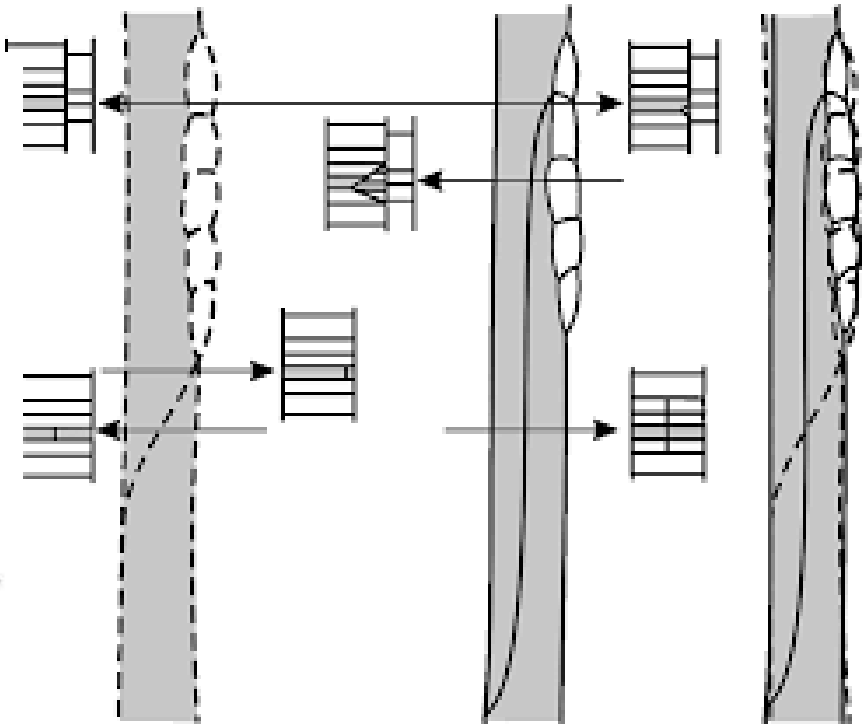


Fig. 628. Cambium. Fusiform initials and ray initials in longitudinal views. A. Storied cambium. B. Non-storied cambium.



FORMATION OF STORIED AND NON STORIED CAMBIA

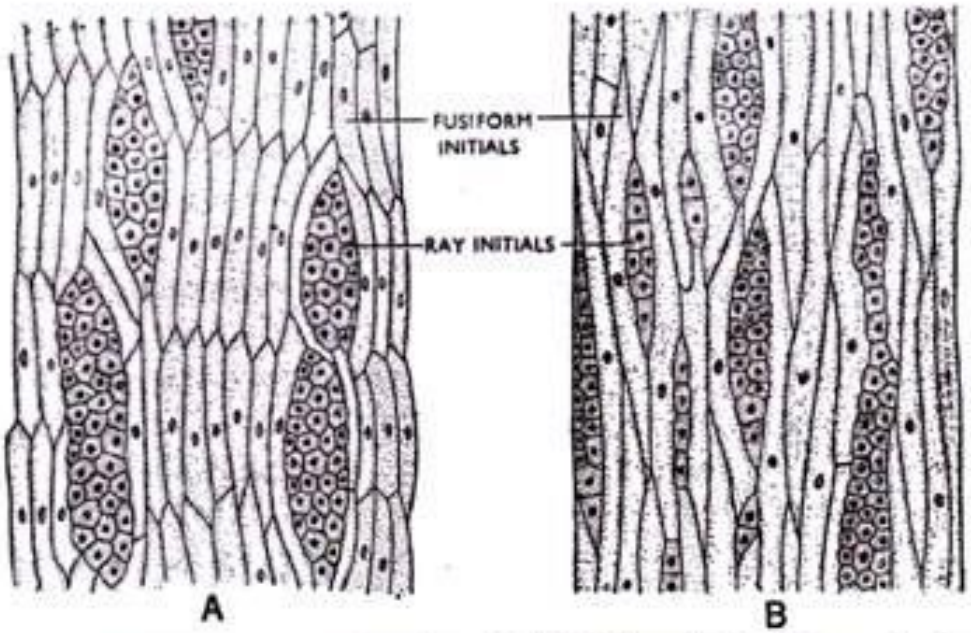
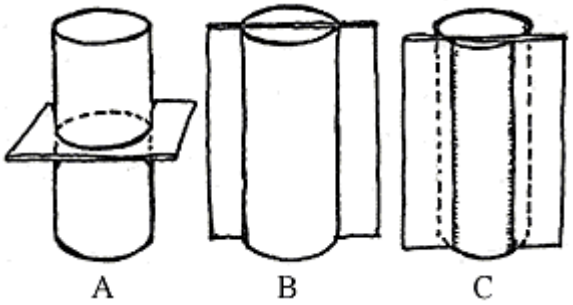
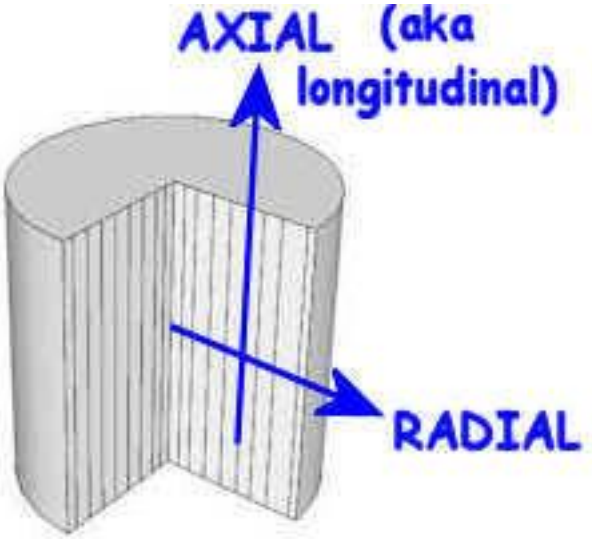
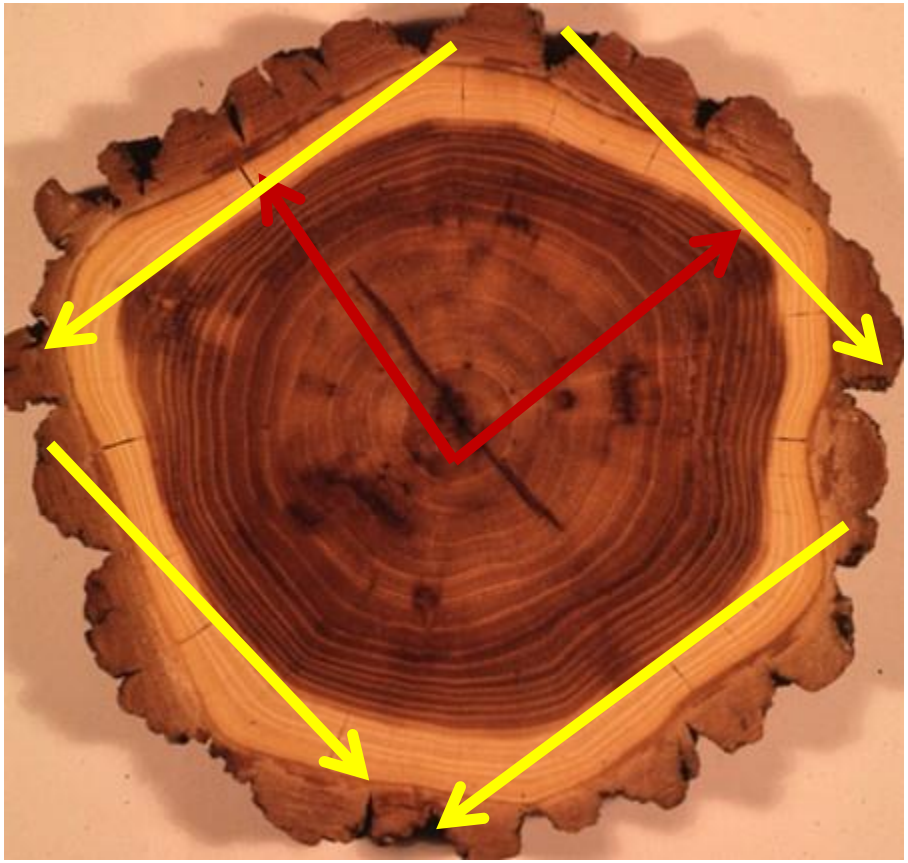
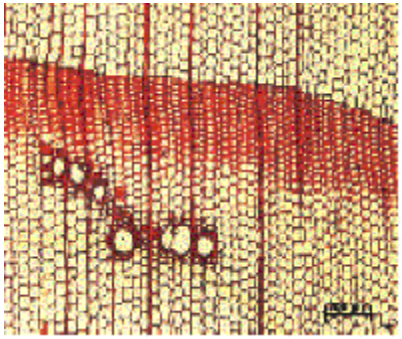


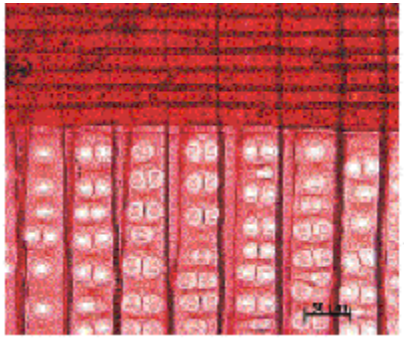
FIG. 628. Cambium. Fusiform initials and ray initials in longitudinal views. A. Storied cambium. B. Non-storied cambium.

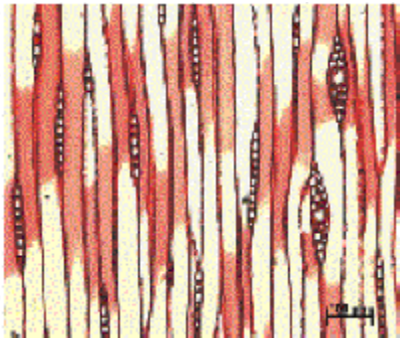

A
B
C

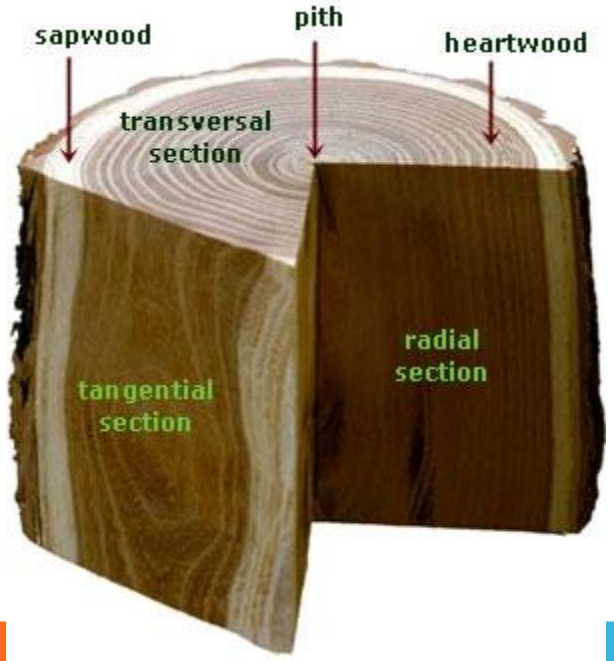

AXIAL (aka
longitudinal)
RADIAL

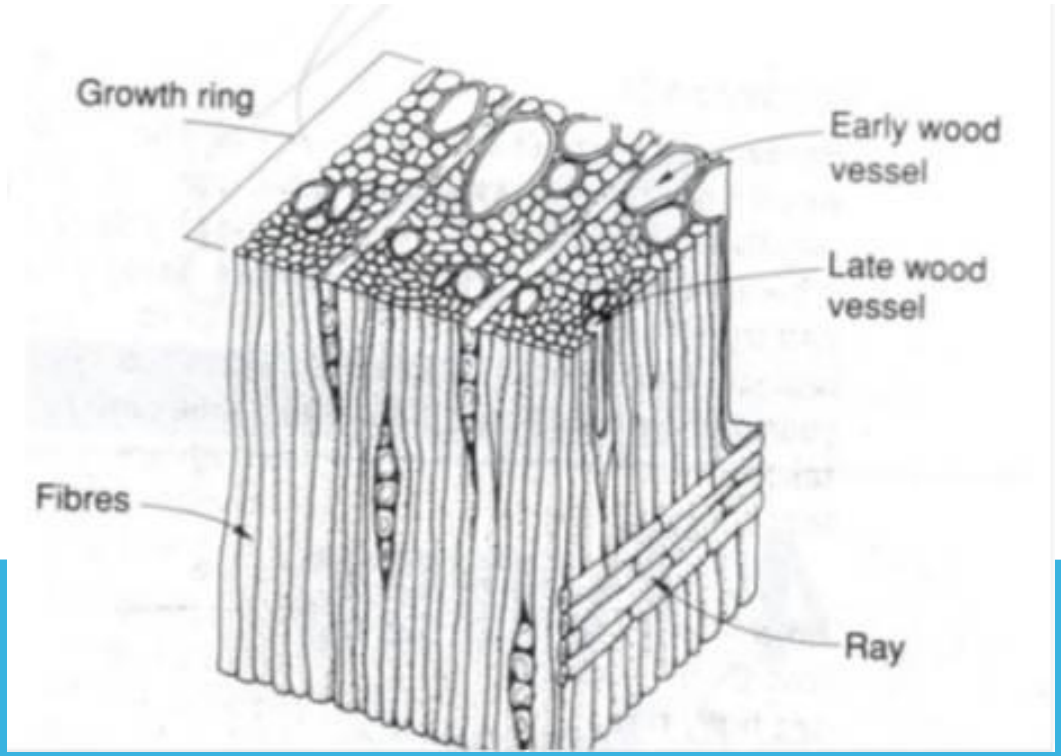









sapwood
pith
heartwood
transversal section
radial section
tangential section


Growth ring
Early wood vessel
Late wood vessel
Fibres
Ray

ANNUAL RINGS

Cell types in secondary xylem

Cell types		Principal function
A.	Axial system	
	1) Tracheary elements a. Tracheids b. Vessels	Conduction of water
	1) Xylem Fibres a. Fiber tracheids b. Libriform fibres	Mechanical support and rarely storage
	1) Axial Parenchyma cells a. Apotracheal b. Paratracheal:	Storage and translocation
B	Ray system	
	1) Ray parenchyma cells 2) Ray tracheids (in some Conifers)	Storage and translocation Storage and translocation