

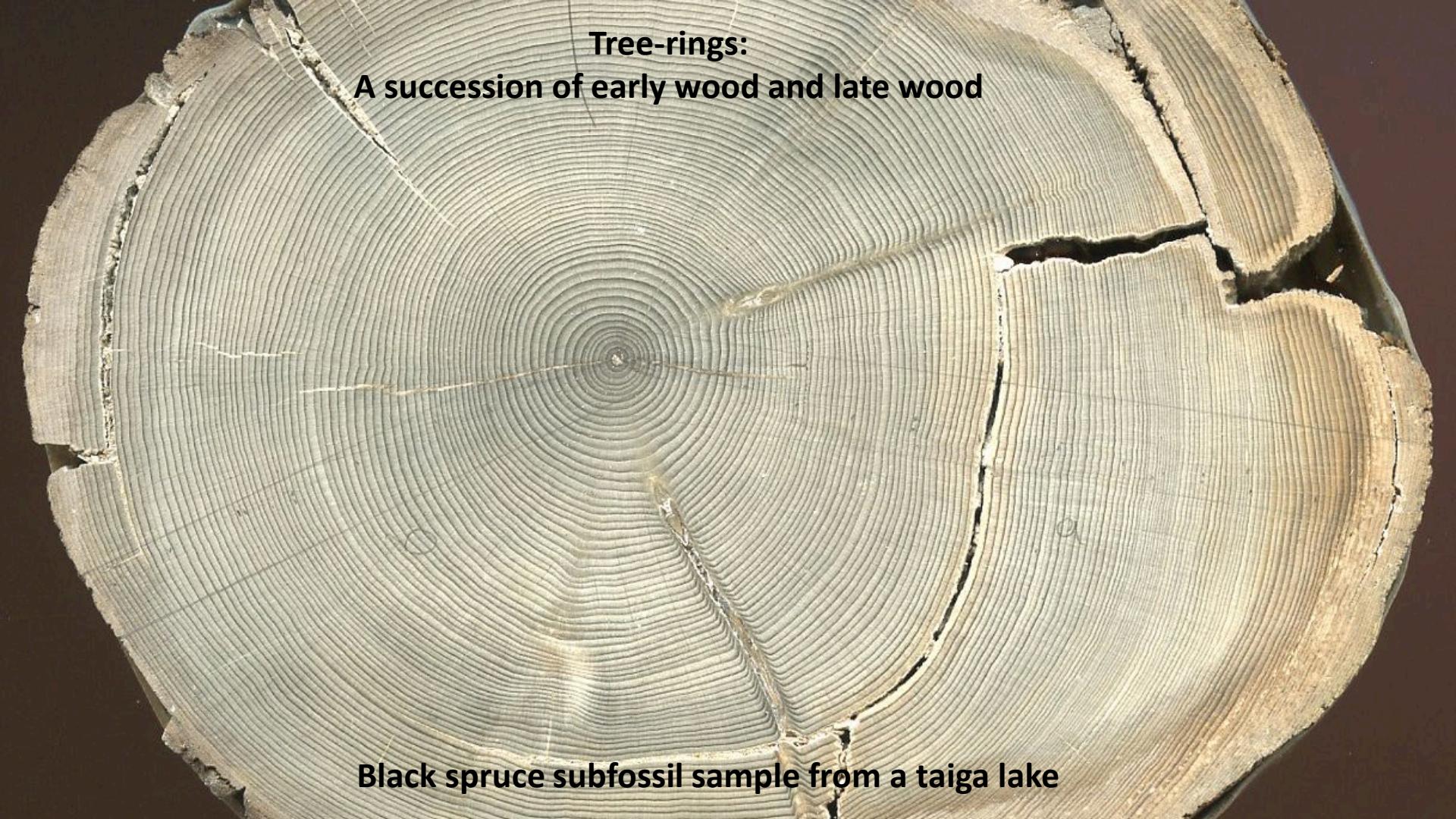


ECL7202 –
DENDROECOLOGY

1.1 - Anatomy and
morphology of
growth rings

Anatomy and morphology of growth rings

1. Basic concepts
2. Wood and tree-ring structure
3. Wood traits of gymnosperms and angiosperms
4. Species identification according to wood traits
5. Tree-ring formation : Secondary growth and cambium
6. Xylogenesis



**Tree-rings:
A succession of early wood and late wood**

Black spruce subfossil sample from a taiga lake

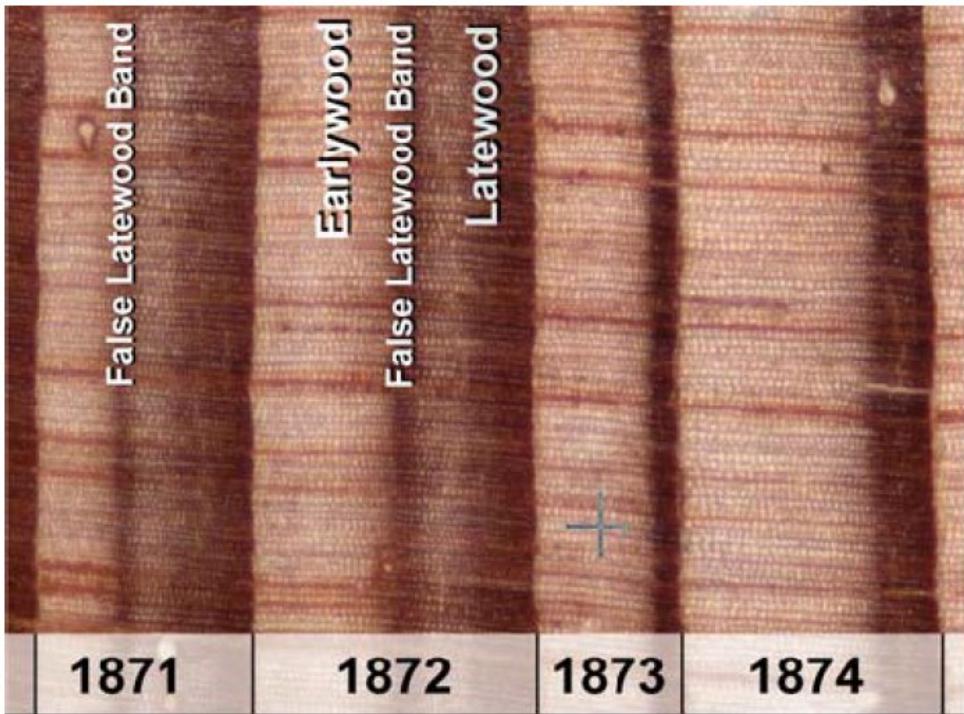
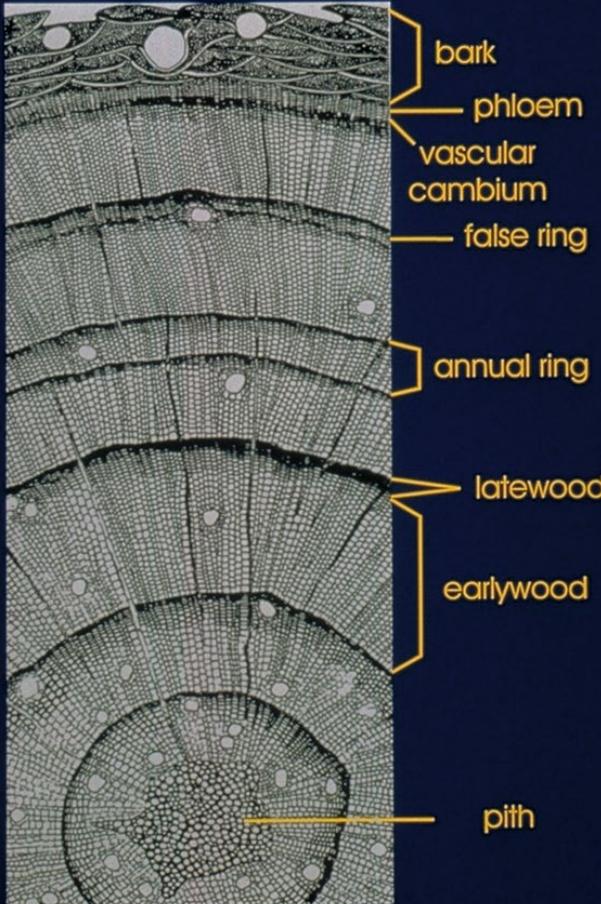


Figure 5. Douglas fir tree rings from southwestern New Mexico showing variability in the widths of early (light) and late (dark) rings, and the presence of 'false rings', produced in the dry pre-monsoon season. The relative widths of early and late wood can be used as a proxy to reconstruct winter versus summer moisture. From Leavitt et al. 2010.

CROSS SECTION of a CONIFER

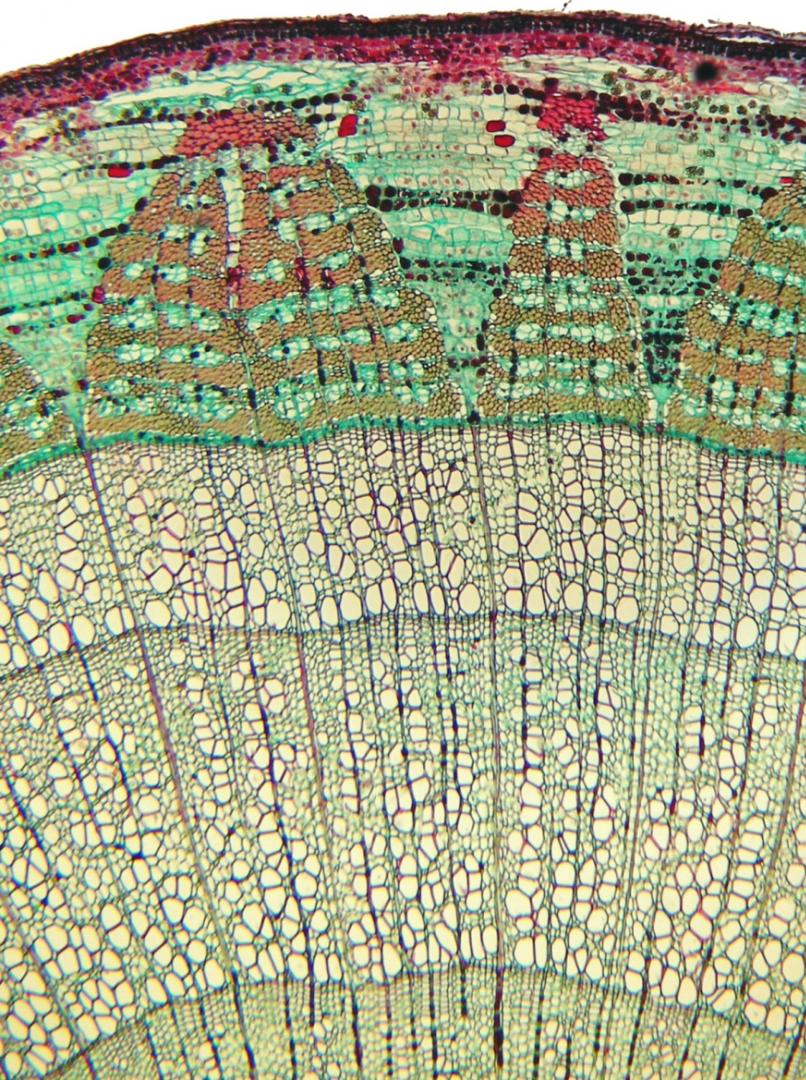


(Fritts, 1976)

Tree-rings

Unique data source:

- Annually formed
- They record past human and natural disturbances
- Tree-ring of dead wood can be dated with precision with the development of long tree-ring chronologies



Anatomy (anatomical section of Linden tree)

Epidermis

Periderm (cork + phellogen + phelloderm)

Cortex (collenchyma + parenchyma)

Parenchyma rays in the phloem (dilated or not)

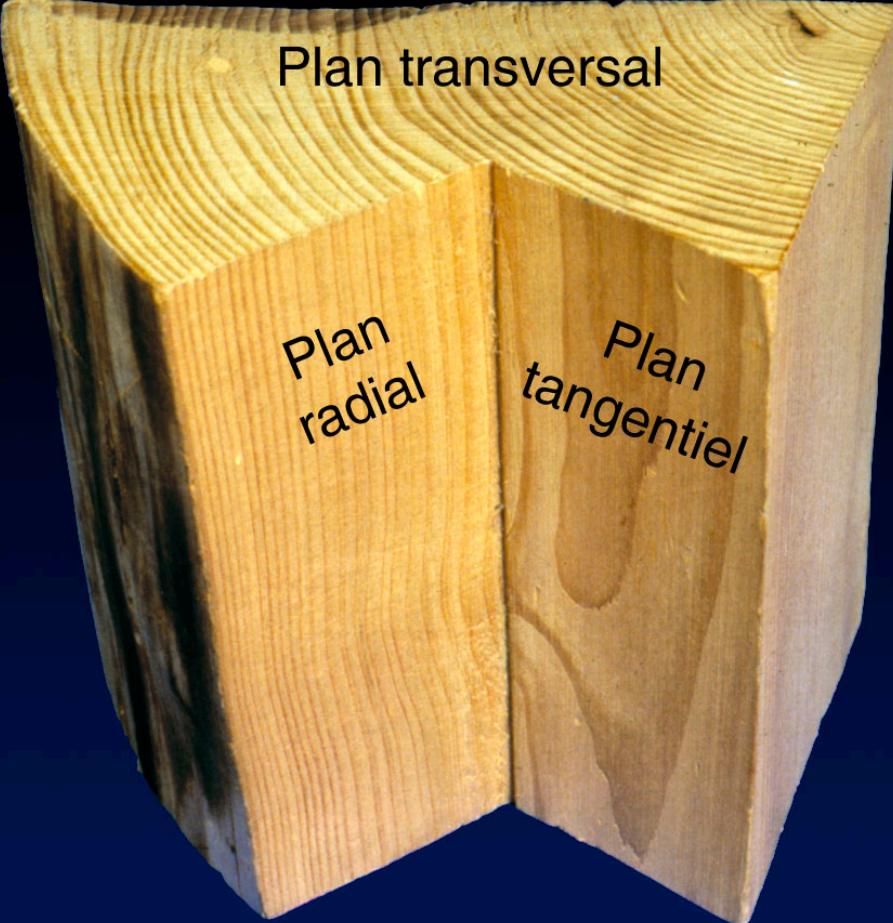
Phloem (fibers + sieve vessels + parenchyma)

Cambium

Secondary xylem (early wood + late wood = ring)

Parenchyma rays in the xylem

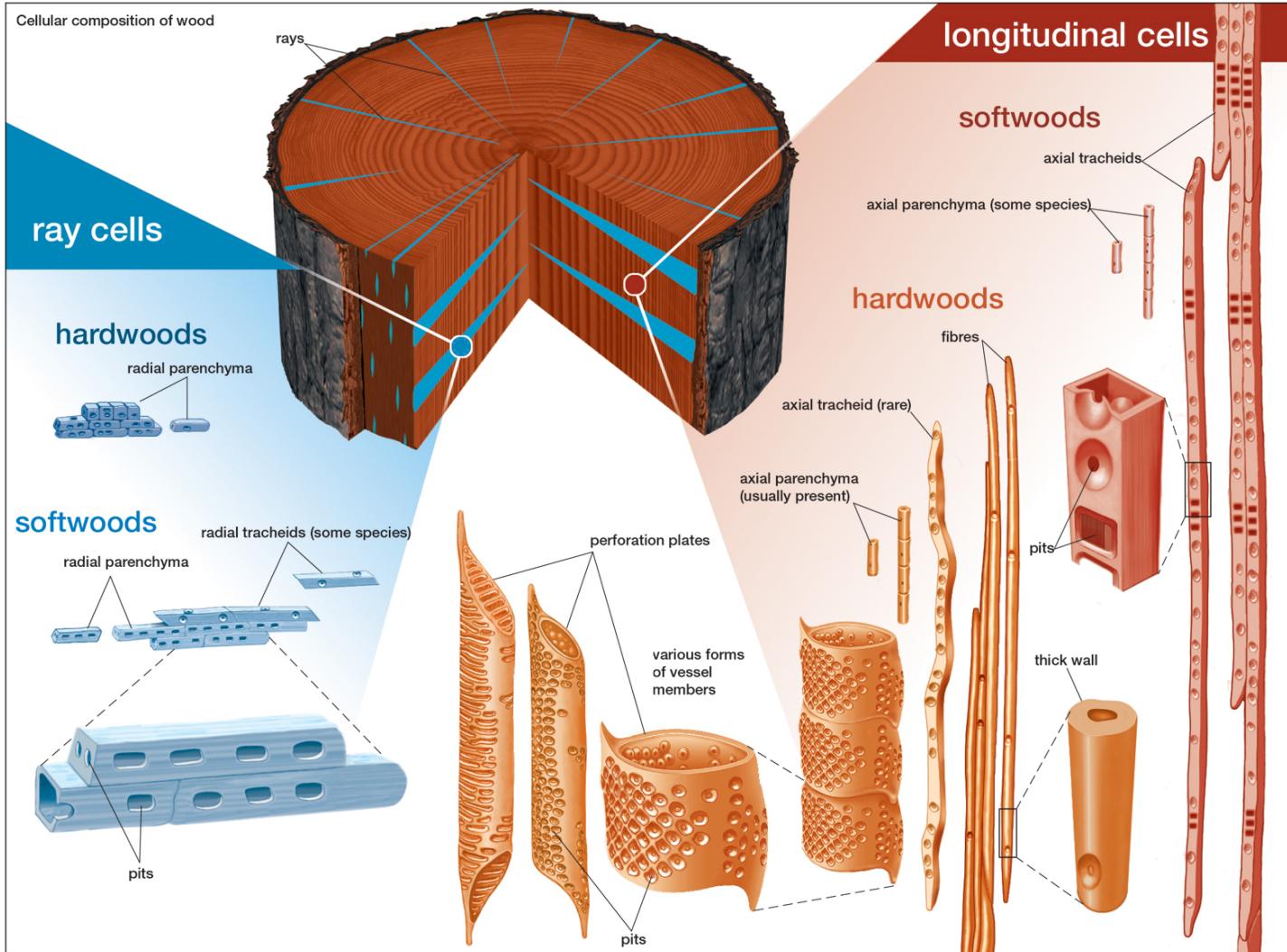
Pith (parenchyma + mucilage ducts)



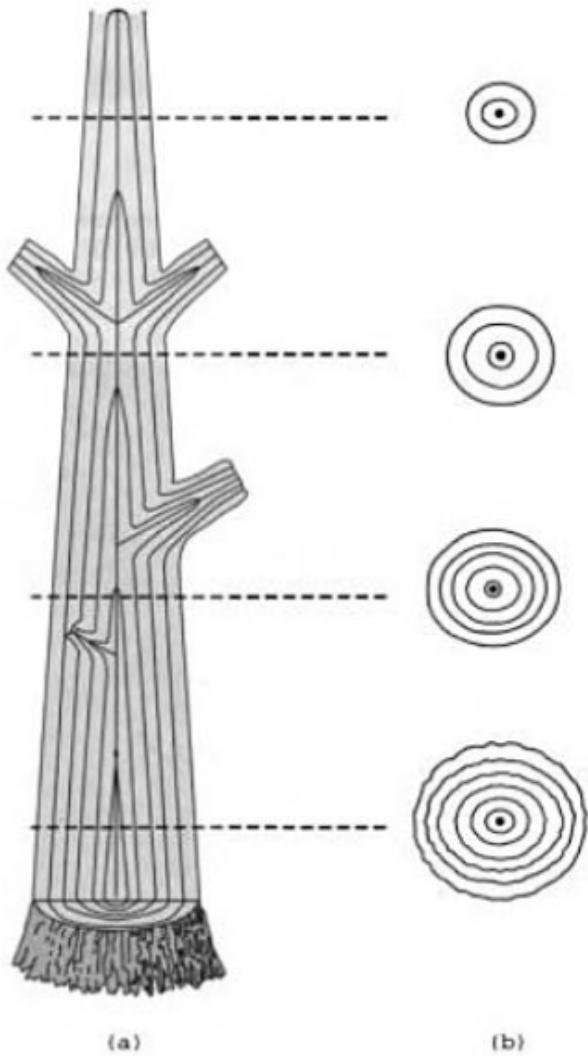
Plan transversal

Plan
radial

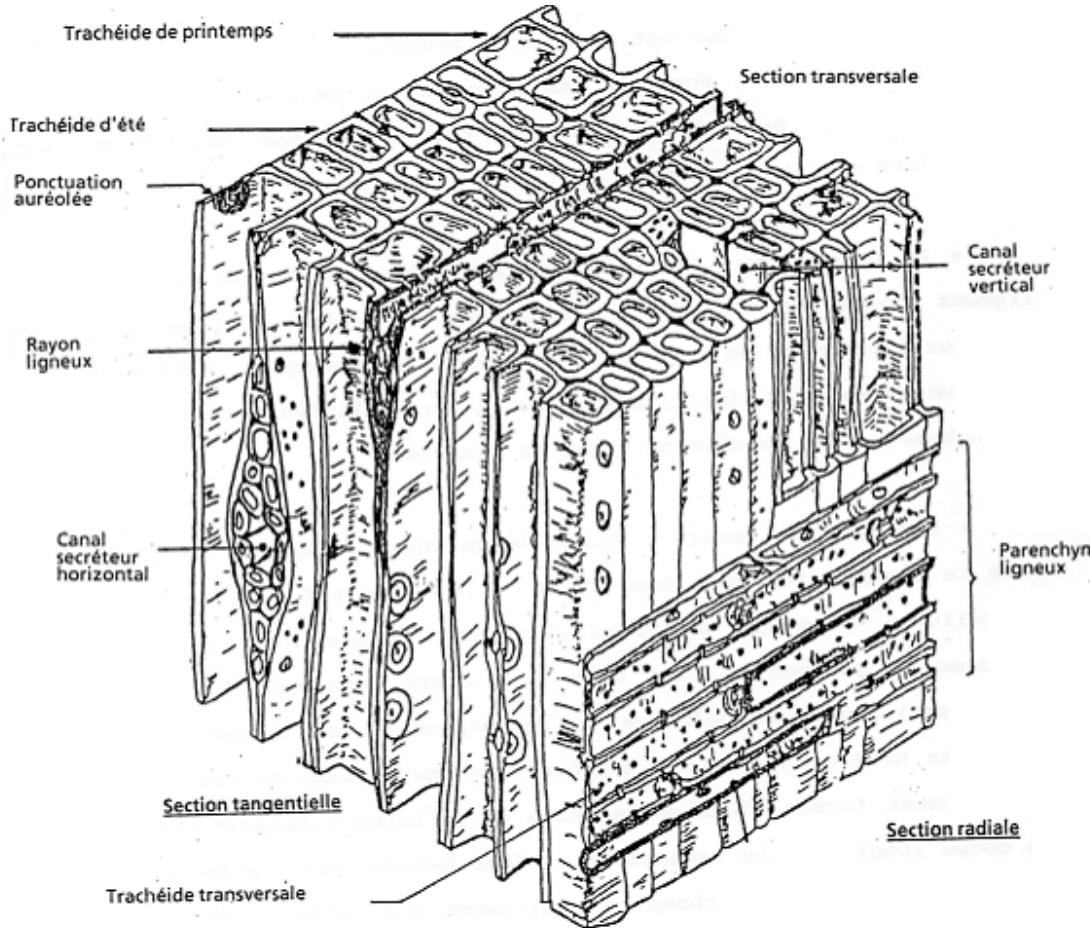
Plan
tangentiel



Tree-ring structure in a tree



Gymnosperms' wood (e.g. spruce)



Transversal section

- Tracheids (90%)
- Axial parenchyma
- Resin canals

Longitudinal sections

- Tracheids
- Parenchyma ray
(Parenchyma + transverse tracheids)

Gymnosperms' wood

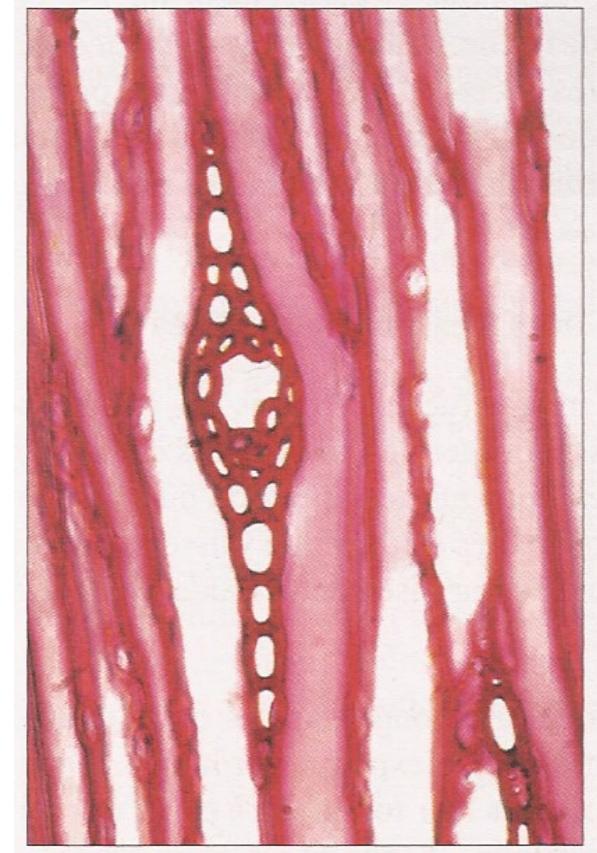
Spruce
Transversal section



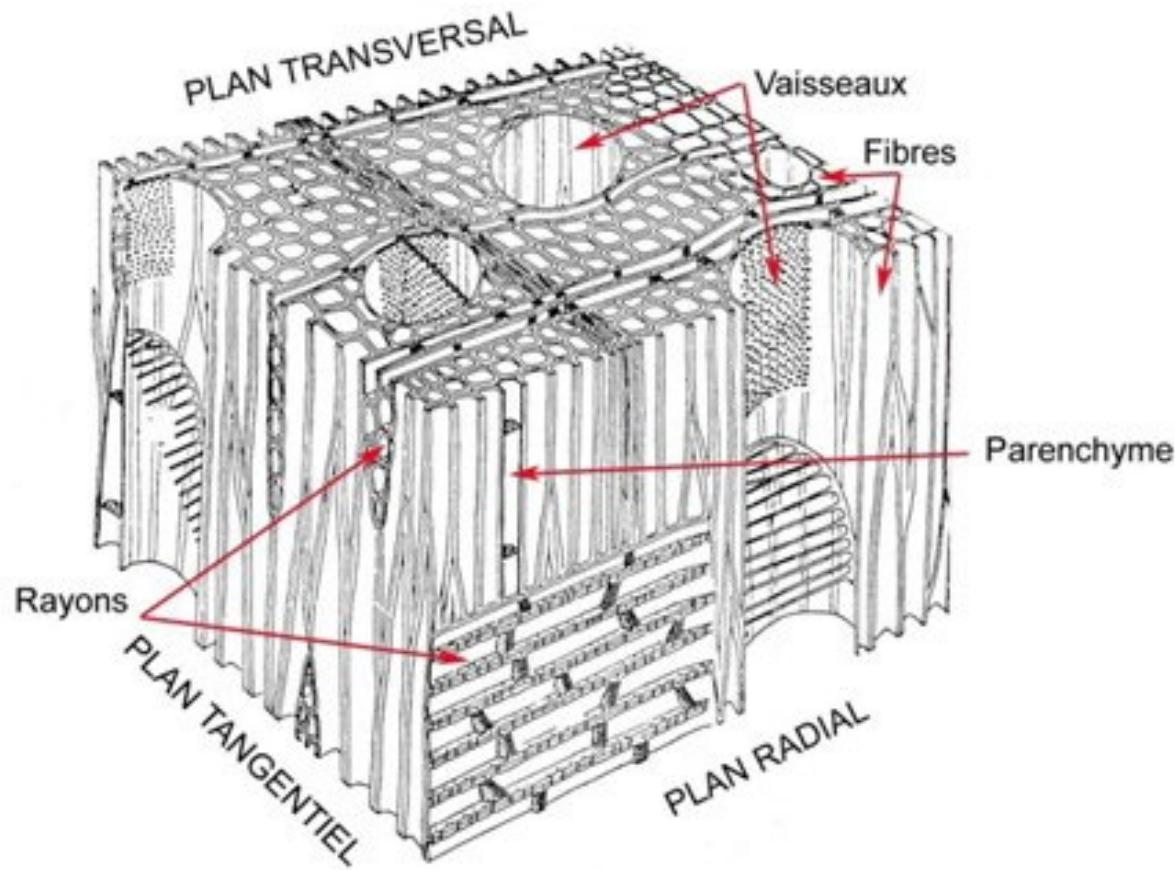
Larch
Radial section



Spruce
Tangential section



Angiosperms' wood (e.g. oak)



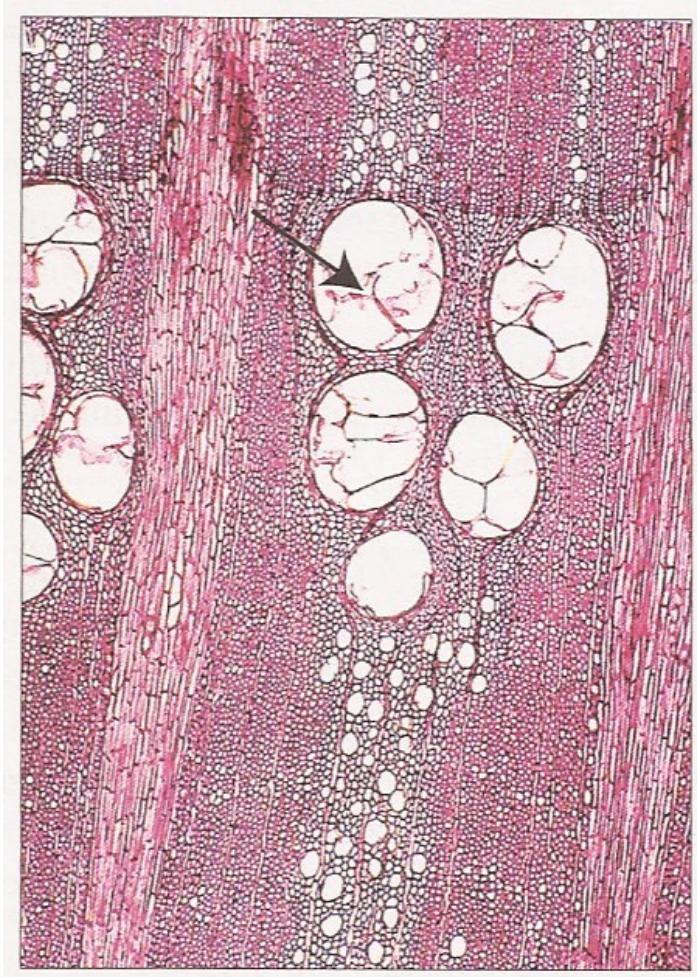
Transversal section

- Vessels
- Tracheids
- Fibers
- Axial parenchyma

Longitudinal sections

- Vessels, tracheids, fibers
- Parenchyma ray

Angiosperms' wood

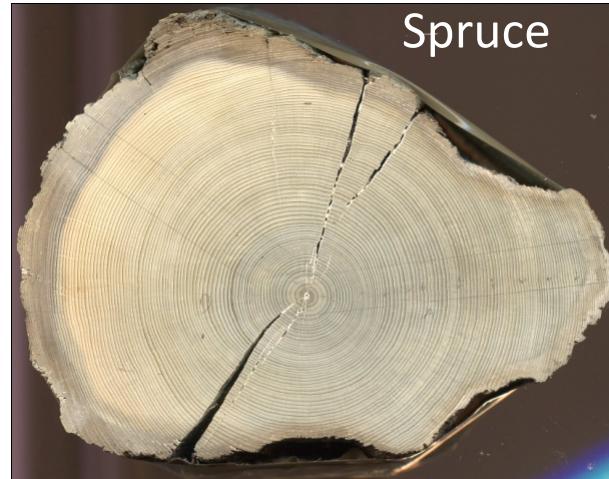
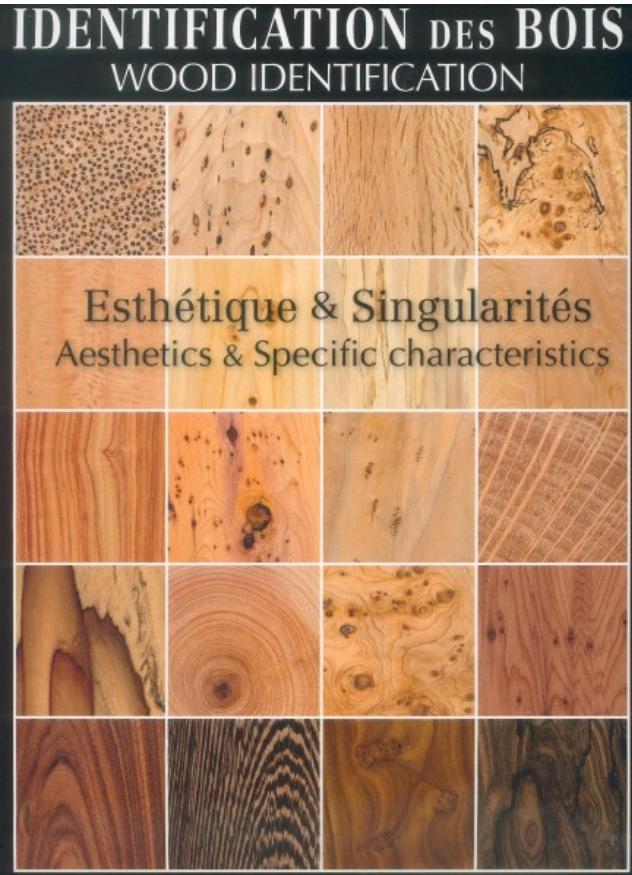


White oak
Transversal section

To note: Tylose

Species identification according to wood traits -

Macroscopic traits



Species identification according to wood traits - Microscopic traits

Criterion 1 – Elements in the cross sections

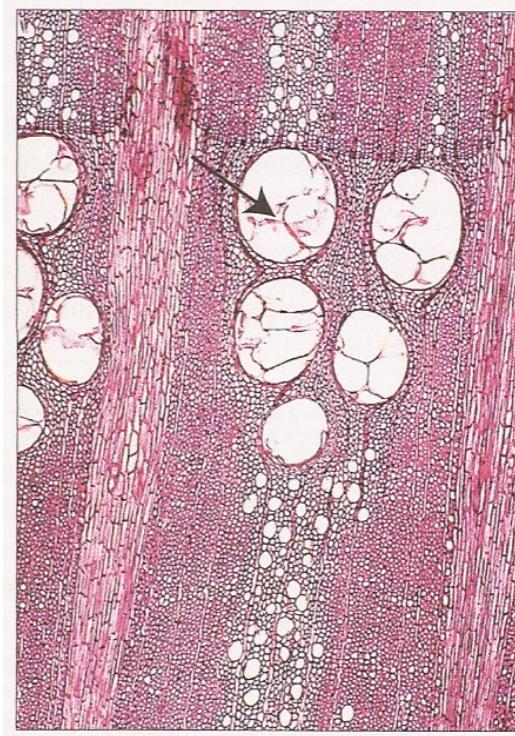
Gymnosperms' wood

Spruce



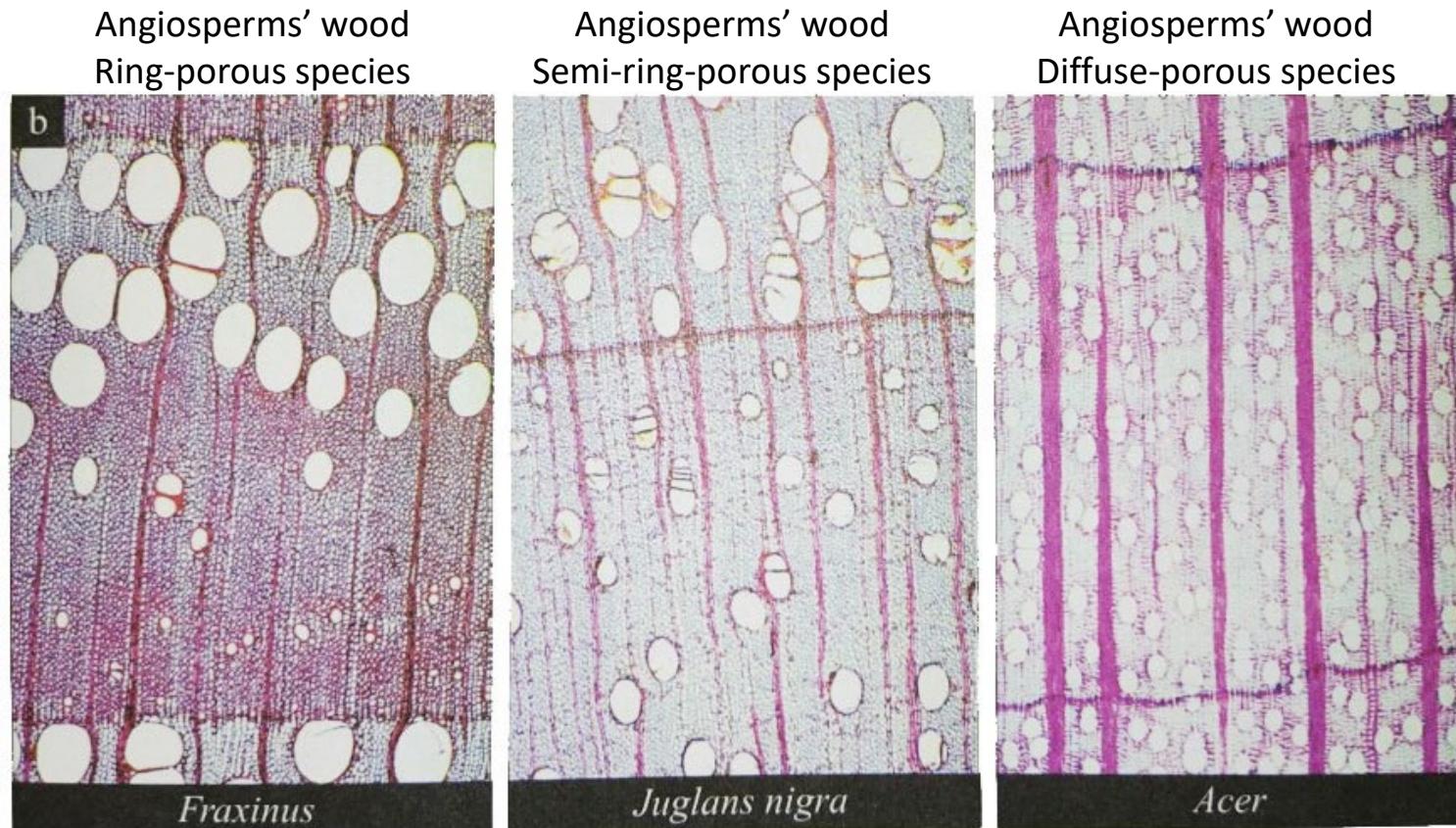
Angiosperms' wood

White oak



Species identification according to wood traits - Microscopic traits

Criterion 1 – Elements in the cross sections



Species identification according to wood traits - Microscopic traits

Criterion 2 - presence of resin canals

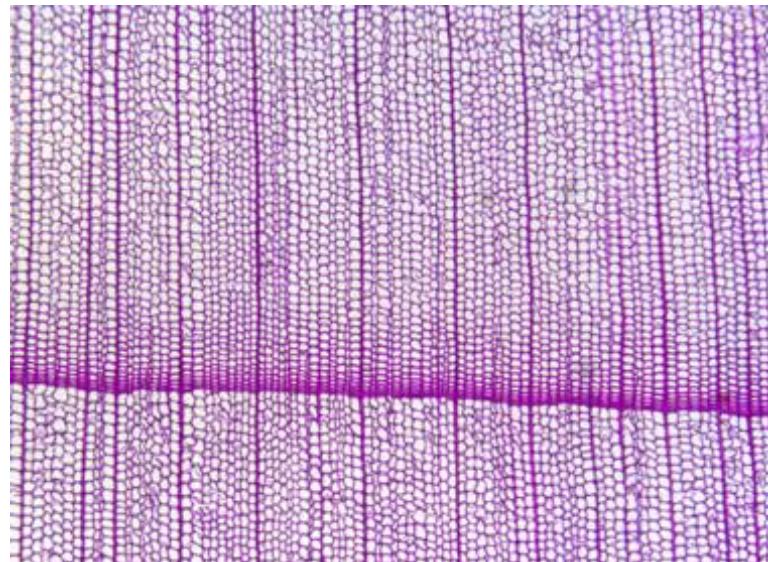
With resin canals

Spruce



Without resins canals

Balsam fir



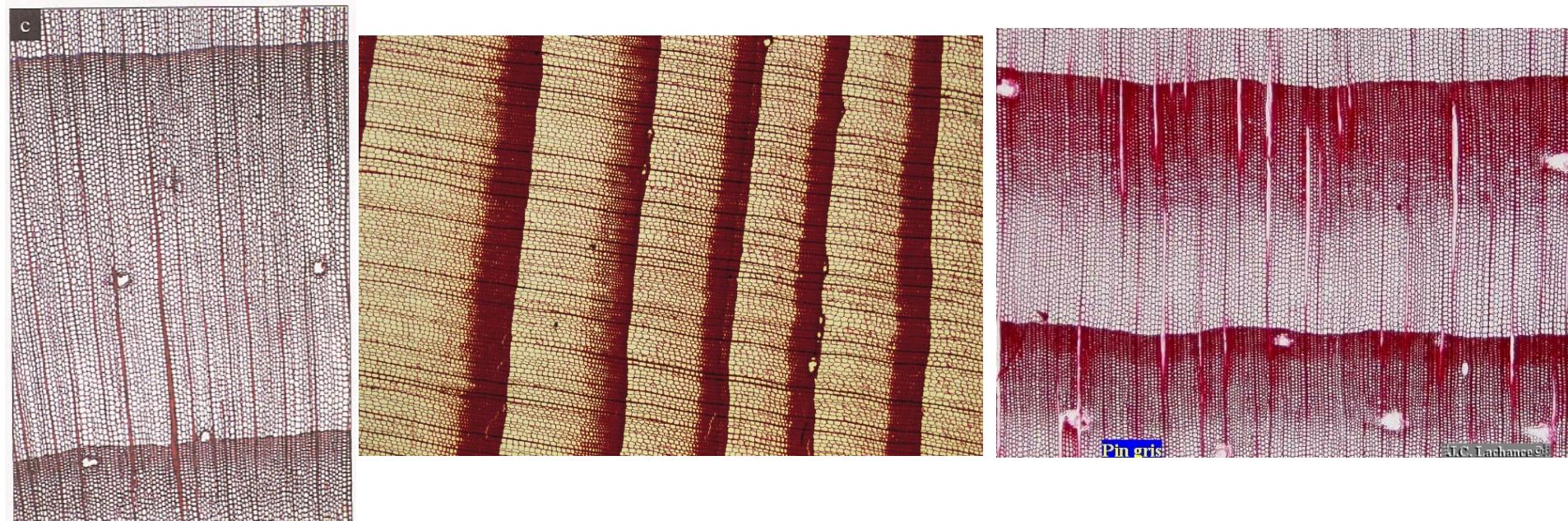
Species identification according to wood traits

Other criteria in the cross sections - transition between early and late wood, heartwood, abundance of resin canals

Soft transition from early to
late wood
+ indistinct heartwood
Spruce

Abrupt transition from early to late wood
+ distinct heartwood
Larch

numerous resin canals
+ distinct heartwood
Jack pine



Taxus baccata



Species identification according to wood traits -

Microscopic traits

Criteria in the radial section - pits and tracheids

Jack pine

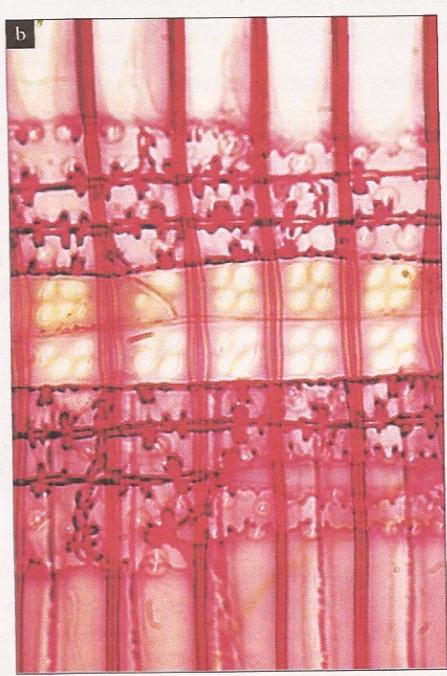
Pinoid pits

Dentate ray tracheids

Larch

Piceoid pits

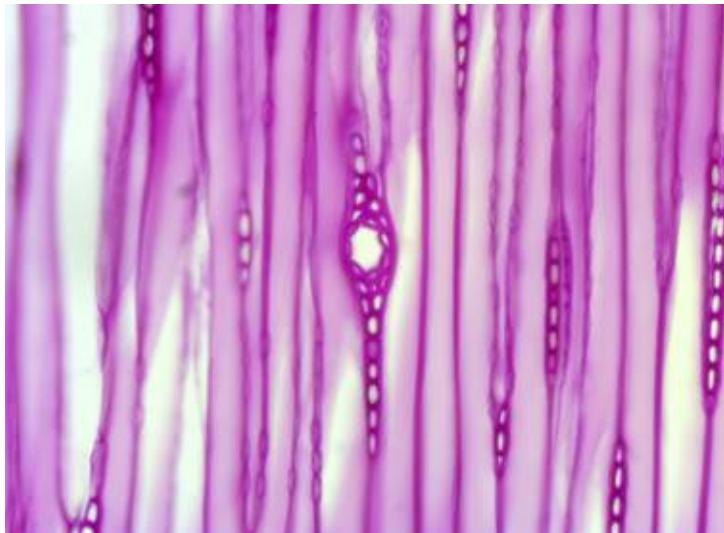
Non-dentate ray tracheids



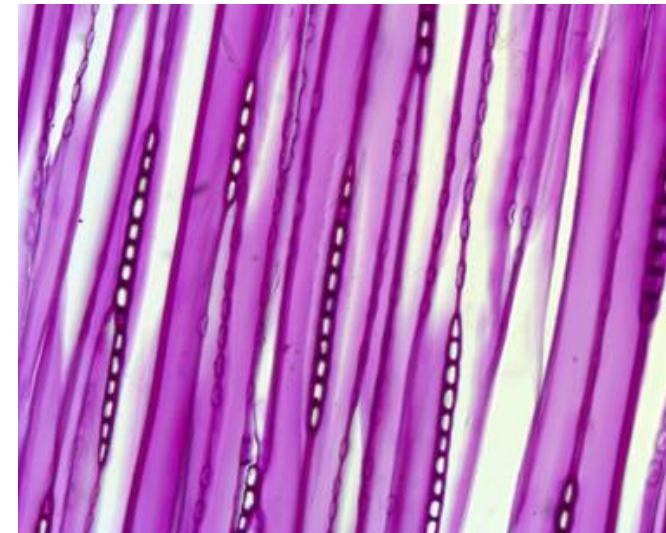
Species identification according to wood traits - Microscopic traits

Criteria in the tangential section - the parenchyma rays

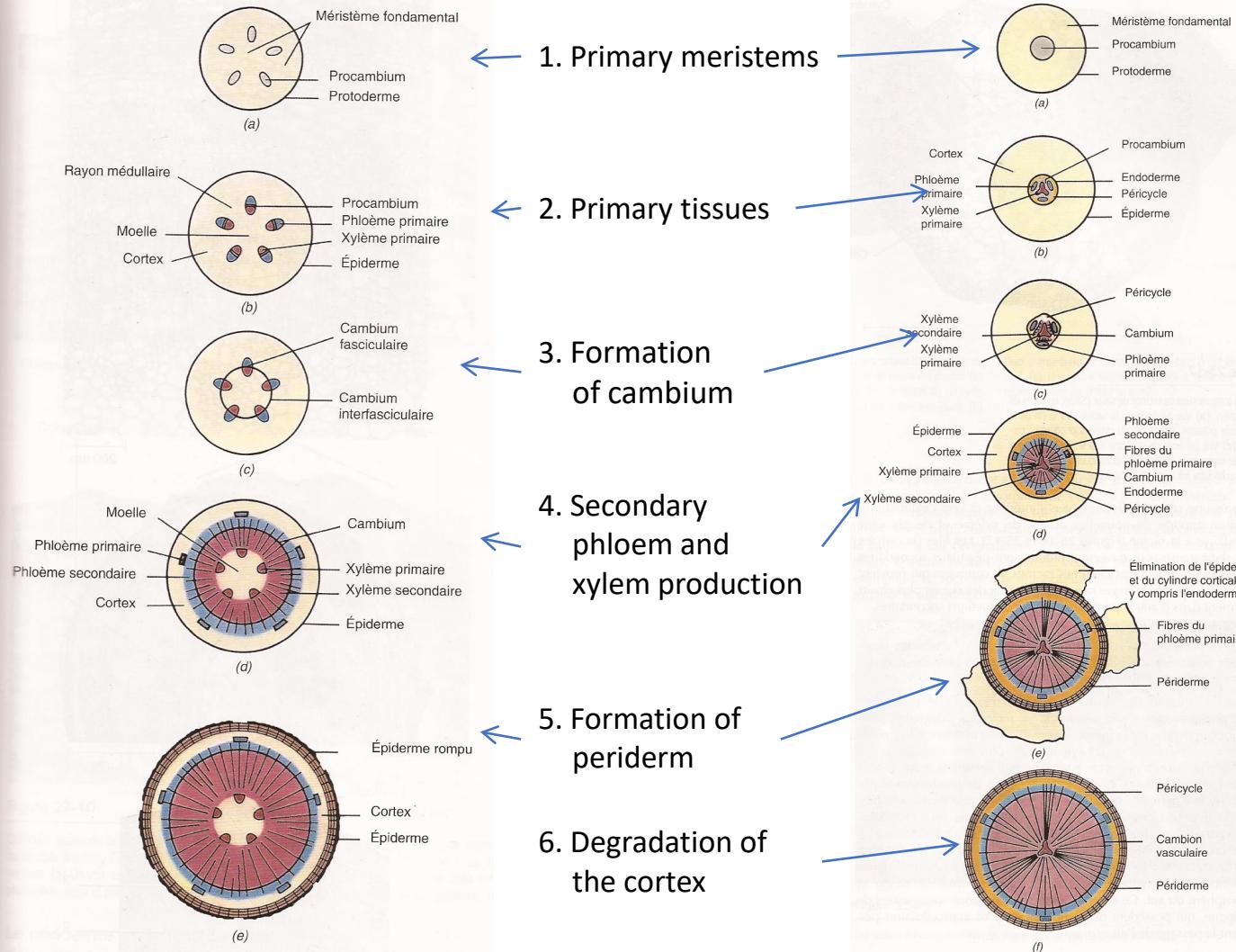
Spruce - Tangential section
Fusiform ray



Balsam fir - Tangential section
Uniseriate rays



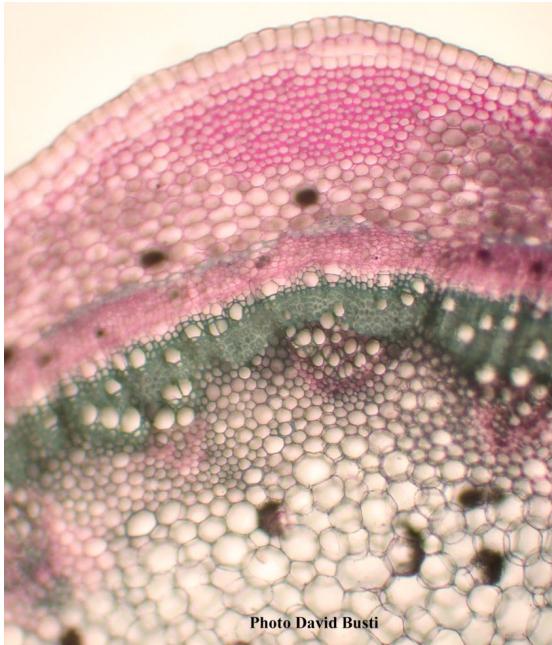
Summary of the growth of a stem and a root



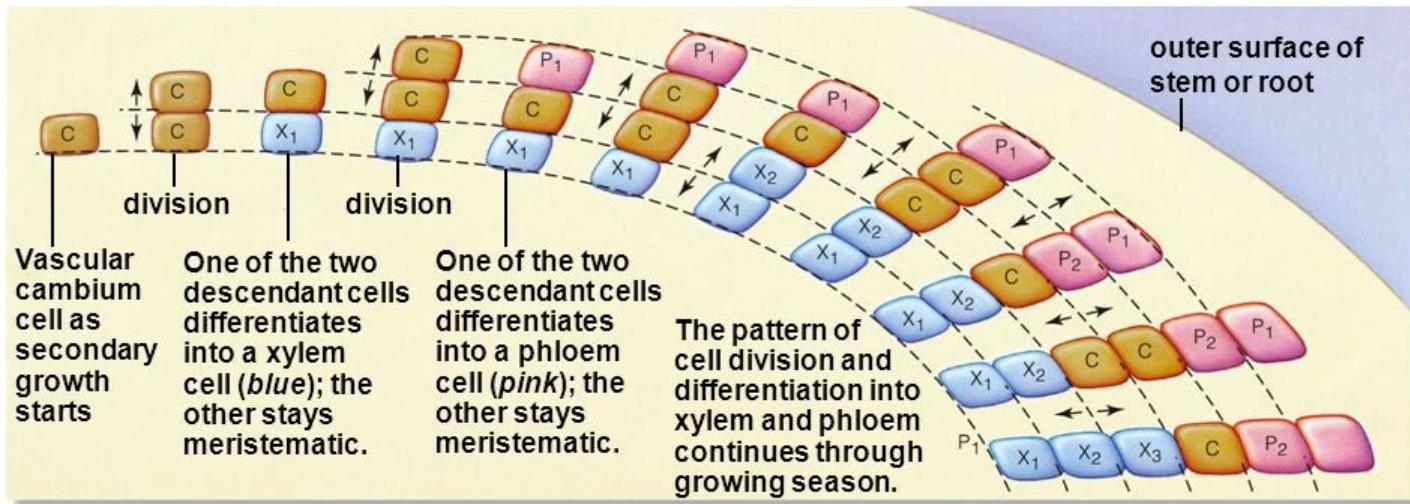
Anatomy of Elderberry Stem (Cross Section)

Sections showing stages 3 and 4 from the previous slide

To see → Epidermis, Peridermis (cork + phellogen + phelloderm),
Cortex (collenchyma + parenchyma), Phloem (fibers + sieve
vessels), Cambium, Xylem (secondary and primary),
Parenchima rays, Pith

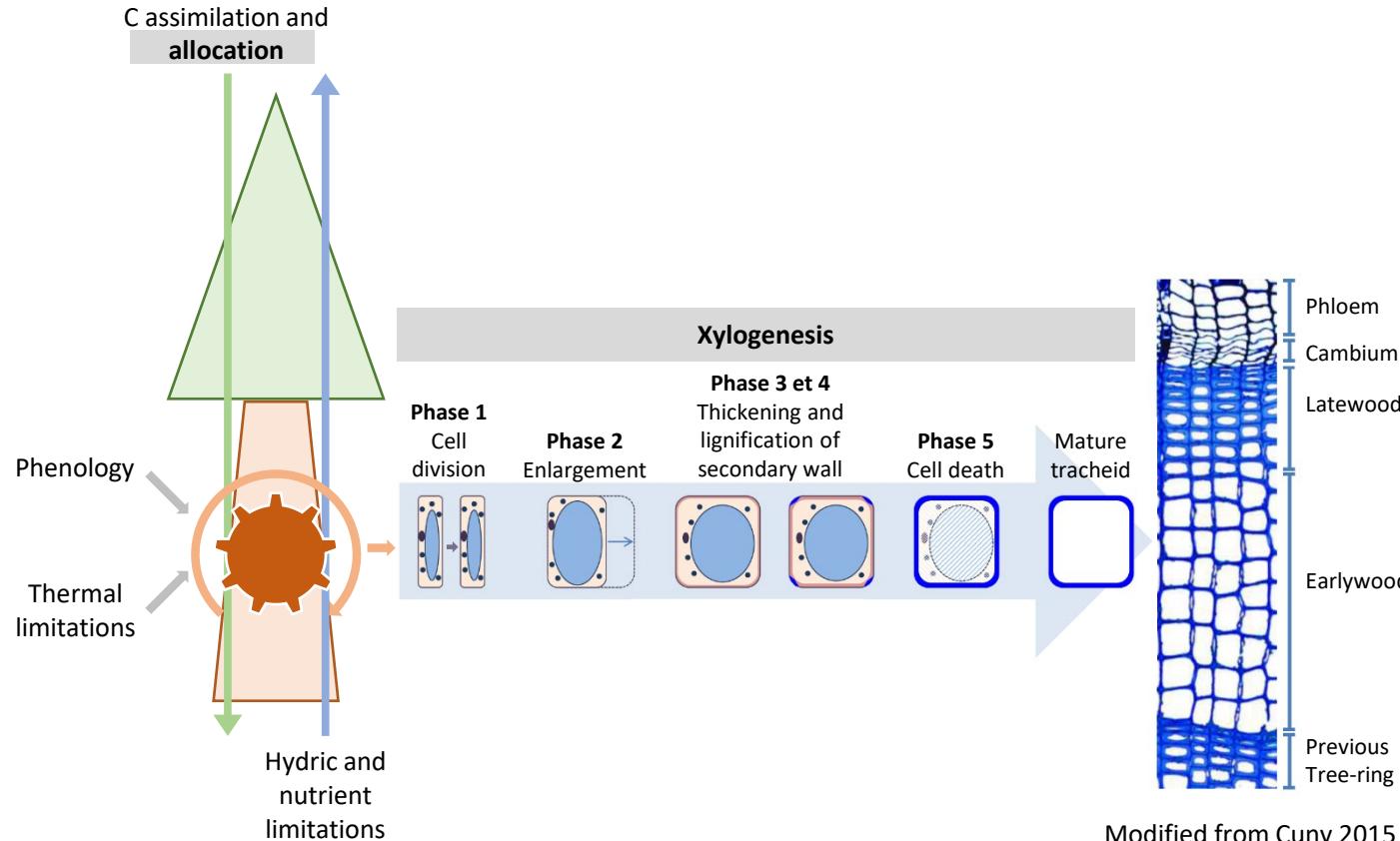


Growth at a Vascular Cambium

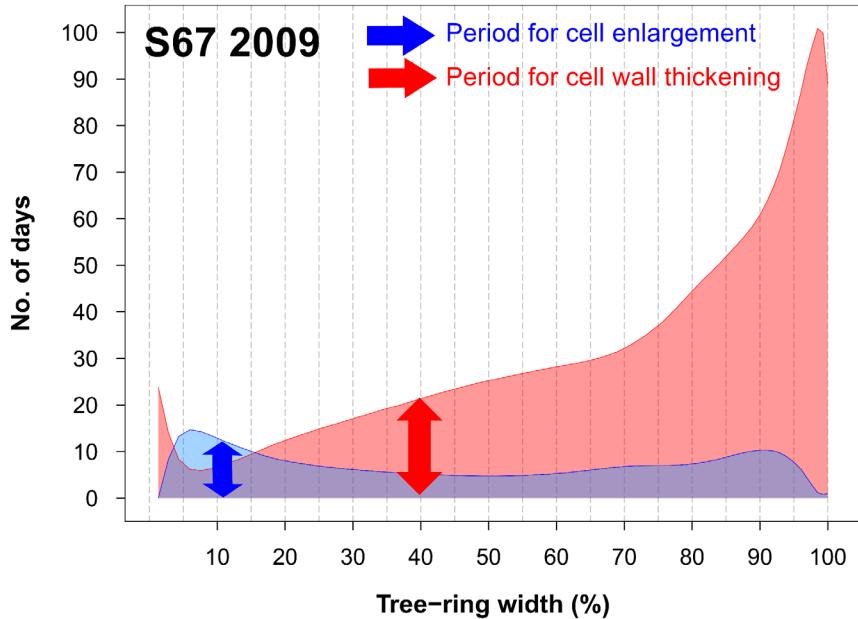


C Overall pattern of growth at vascular cambium.

Xylogenesis



The temporal intervals of xylogenesis



cE, cessation of the enlargement period
cW, cessation of the wall thickening and lignification period

