

Introduction to Botany. Lecture 33

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Outline

1 Questions and answers

2 Secondary stem

- Wood
- Life forms



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2 Secondary stem

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- Life forms



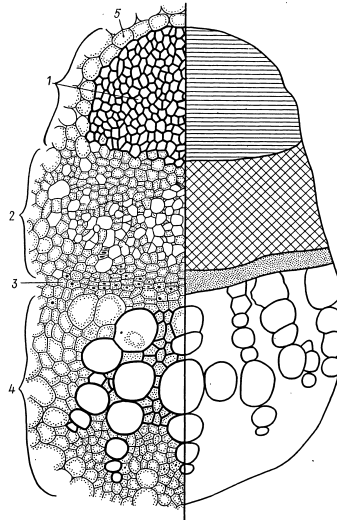
Previous final question: the answer

Where is a cambium?



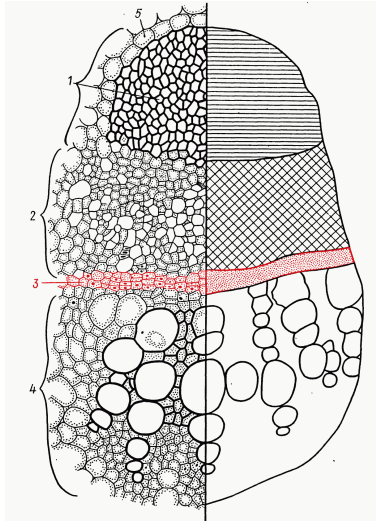
Previous final question: the answer

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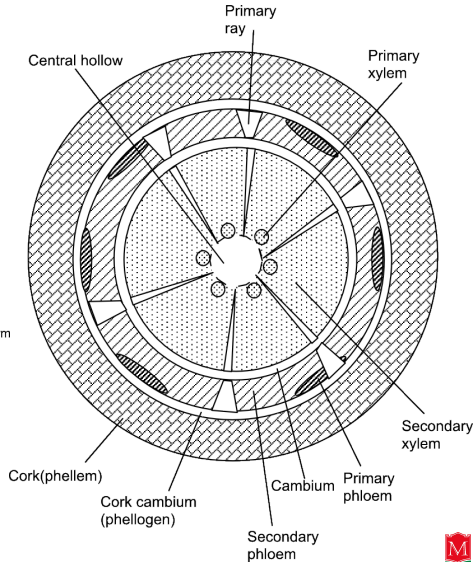
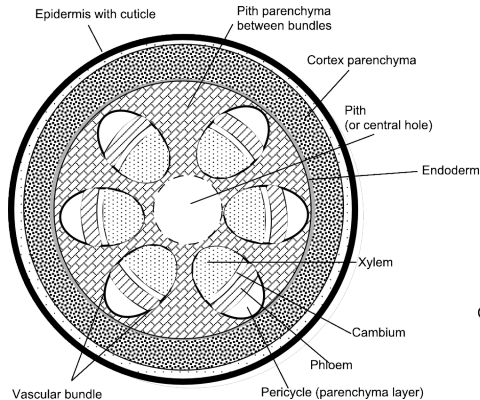


Secondary stem

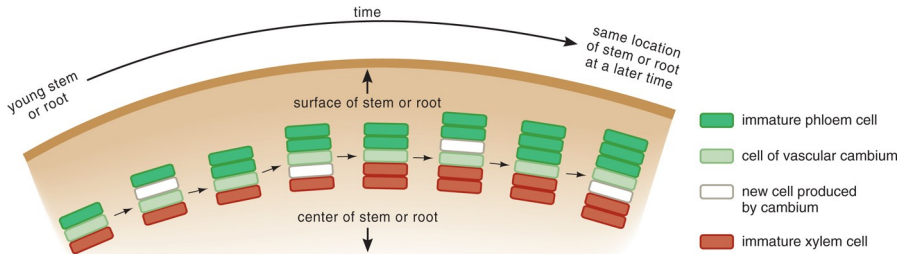
Wood



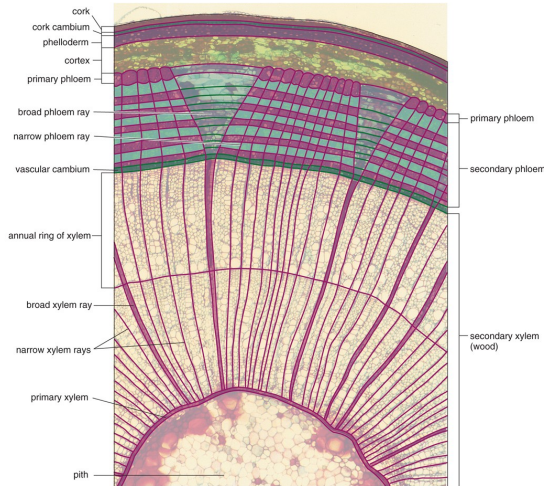
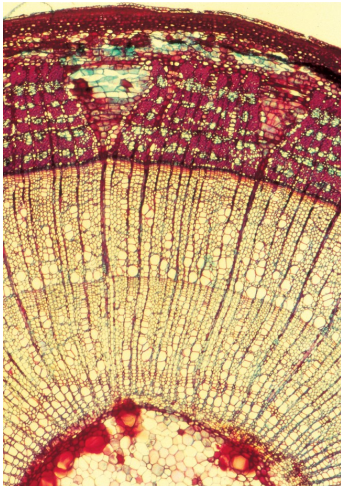
Primary and secondary stems (scheme)



How cambium works



Secondary structure of stem (photo and explanations)

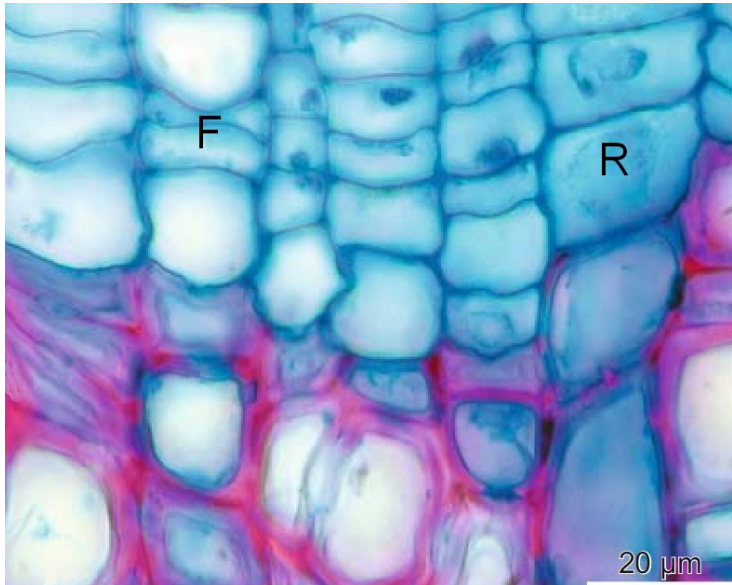


Secondary xylem and rays

- Secondary xylem, or wood, is the product of vascular cambium
- Some cambium cells are **fusiform initials**; they form axial vessel elements
- Other cambium cells are **ray initials**; they form rays (parenchyma + tracheids)
- **Rays** provide horizontal transport of water; **axial system** provide vertical transport



Fusiform and ray initials

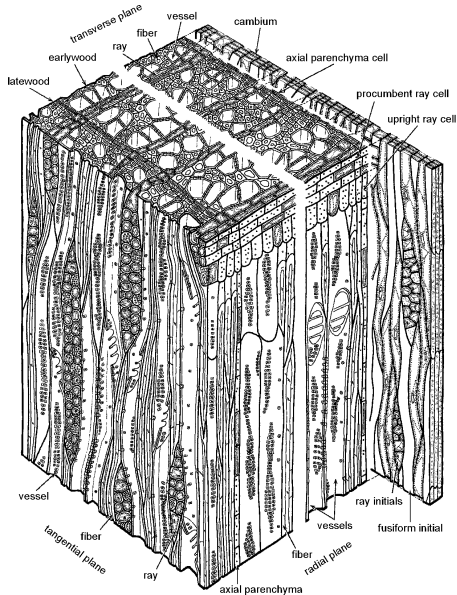


Three planes of view

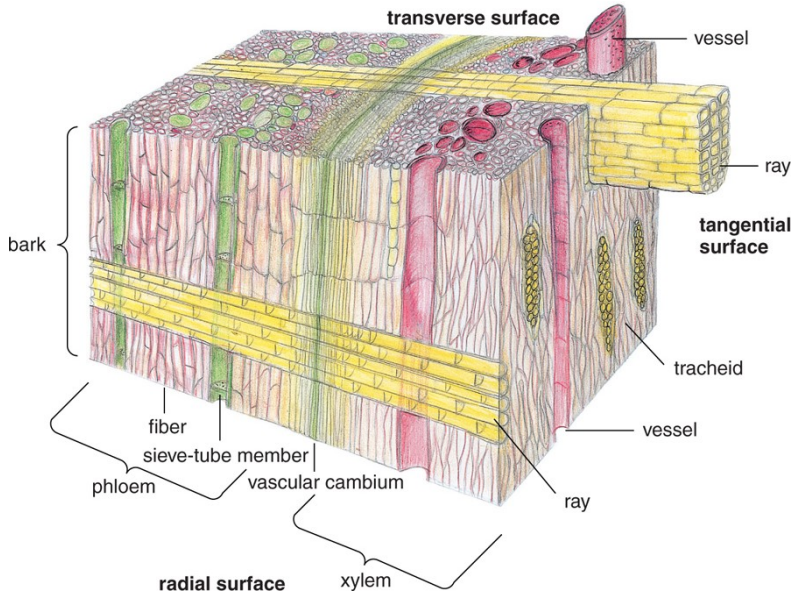
- **Transverse** (cross-section)
- **Radial** (longitudinal section from center to periphery and perpendicular to stem surface)
- **Tangential** (longitudinal section parallel to stem surface)



Three plains of maple (*Acer* sp.) wood



Three plains again (the scheme)



Earlywood and latewood

- **Earlywood** (springwood) contains more parenchyma and often have larger vessel elements
- **Latewood** (summerwood) often have small vessel elements and looks darker



Diffuse and ring porous wood

- In **ring porous** wood (like in red oak) bigger vessel elements concentrate in earlywood
- In **diffuse porous** wood larger vessel elements spread across early- and latewood (American elm)



Diffuse and ring porous wood in two species of cinquefoil (*Potentilla* spp.)



ew
lw

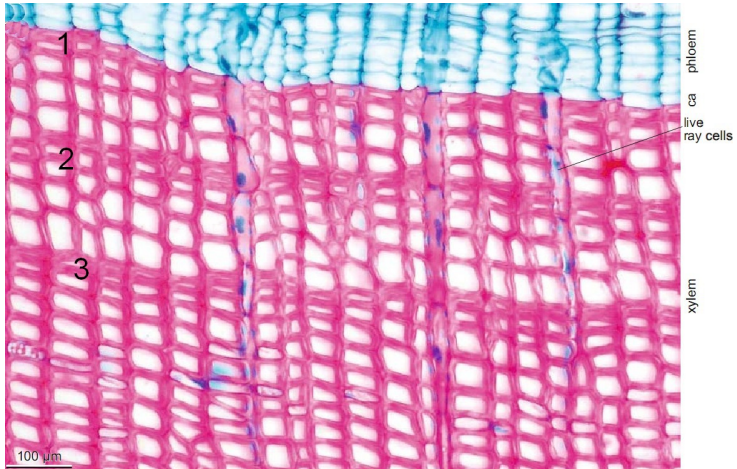


Annual rings

- Interleaving early- and latewood from to sequential years form an impression of annual ring
- “Ring” is just a layer of darker (i.e., smaller) cells
- Tropical trees do not form annual rings



Annual rings in juniper (*Juniperus* sp.)

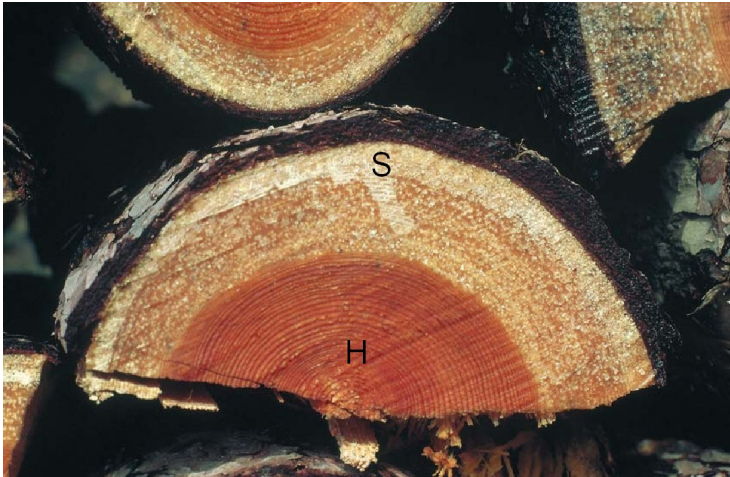


Sapwood and heartwood

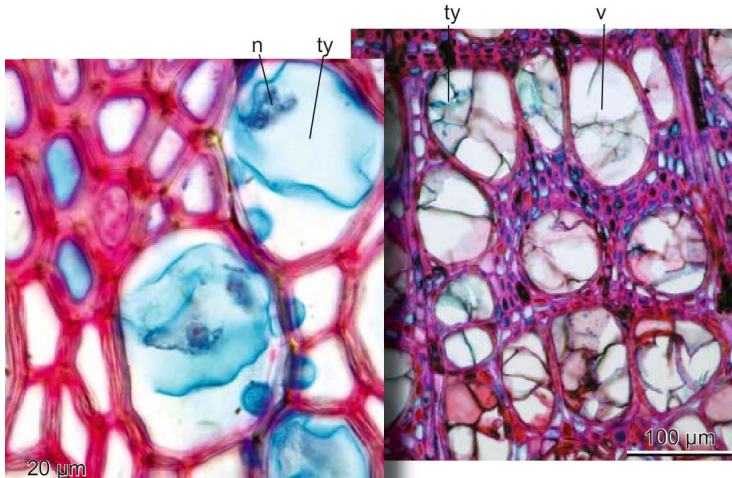
- **Sapwood** is a peripheral layer of working xylem, it usually has relatively light color
- **Heartwood** is a central, non-functional, old, dark-colored xylem



Sapwood and heartwood of European pine (*Pinus sylvestris*)



Tyloses



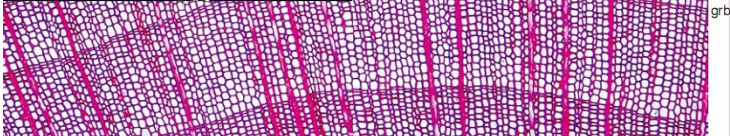
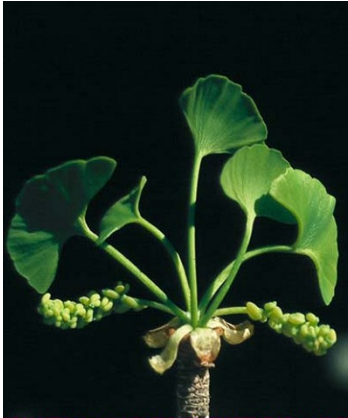
Tyloses control the winter functioning of vessels

Conifer wood

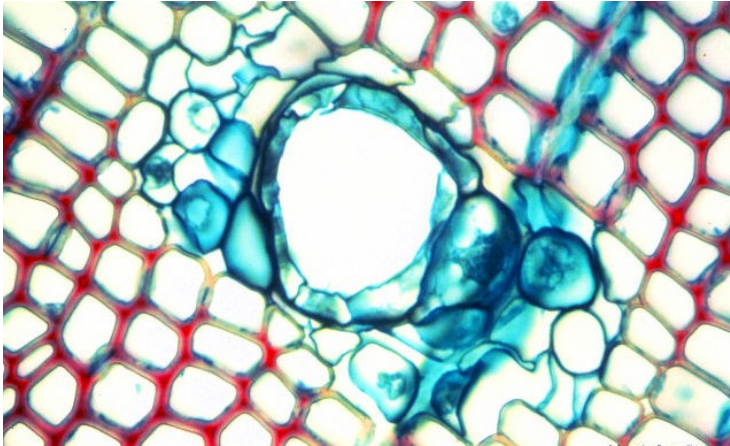
- Simpler structure, few cell types
- Simple rays
- Sometimes have **resin ducts**; resin secreted by epithelial cells



Ginkgo (*Ginkgo biloba*) wood (not a conifer, but gymnosperm)



Resin duct in pine wood (©BSA)

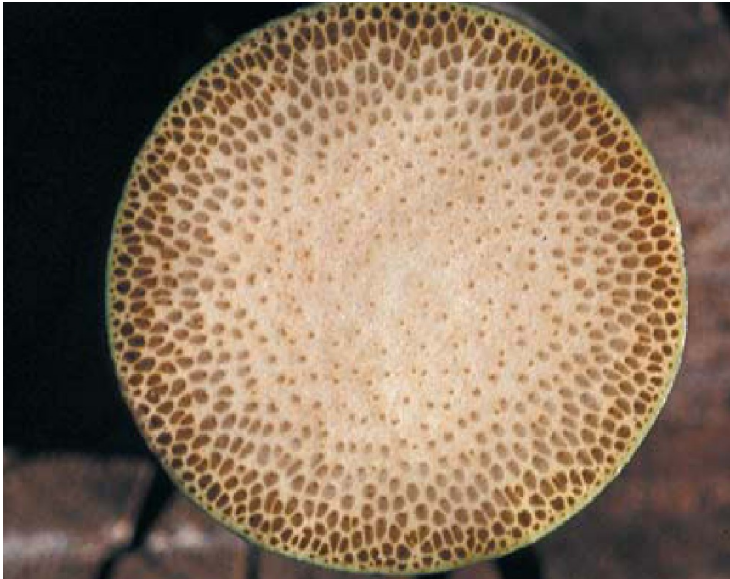


Monocot “wood”

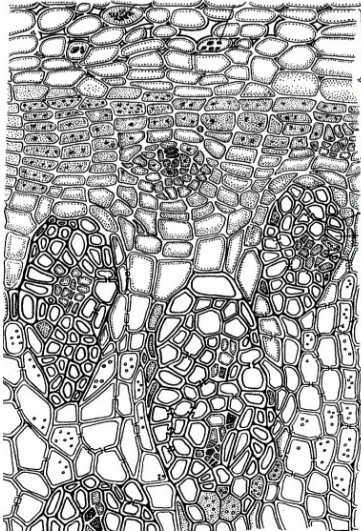
- Most of monocots do not have lateral meristems and therefore have no true wood
- Palms have only primary tissues; their trunk widens from bottom to top
- Some monocots (dragon trees) have **anomalous secondary growth**



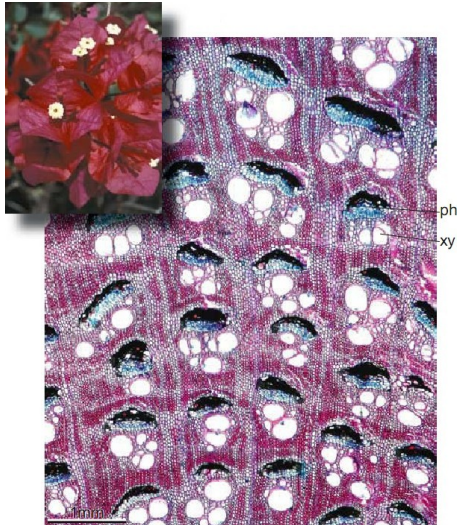
Cross section of palm (*Phoenix canariensis*) trunk



Dragon tree (*Dracaena draco*) and its anomalous cambium



Anomalous secondary growth in *Bougainvillea* (*Bougainvillea spectabilis*)



Secondary stem

Life forms



Life forms

- It is a different view on the plant diversity
- Life forms represent different lifestyles
- For example, trees, shrubs and herbs are life forms

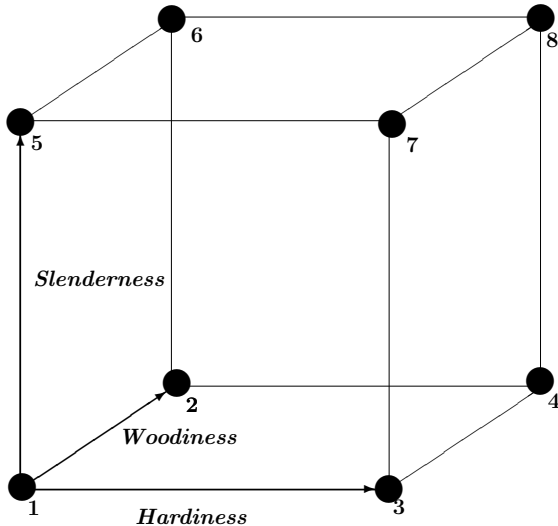


Life forms: dynamic approach

- **Hardiness:** sensitivity to all negative influence
- **Woodiness:** % of cells with secondary walls
- **Slenderness:** proportion of vertically ordered stems



Life form cube



#1 could be similar to duckweed, #8—to sequoia



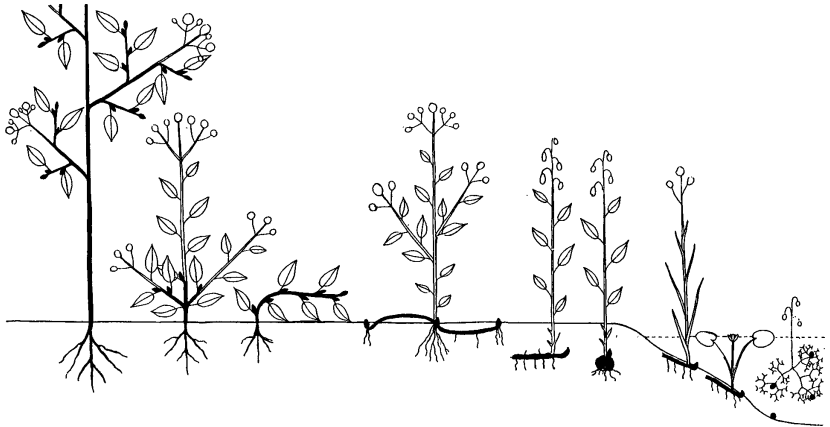
Life forms: Raunkiaer's approach

- **Phanerophytes**: winter buds openly exposed
- **Chamaephytes**: winter buds under snow
- **Hemicryptophytes**: winter buds on soil surface
- **Cryptophytes**: winter buds in the soil
- **Therophytes**: no winter buds, only seeds

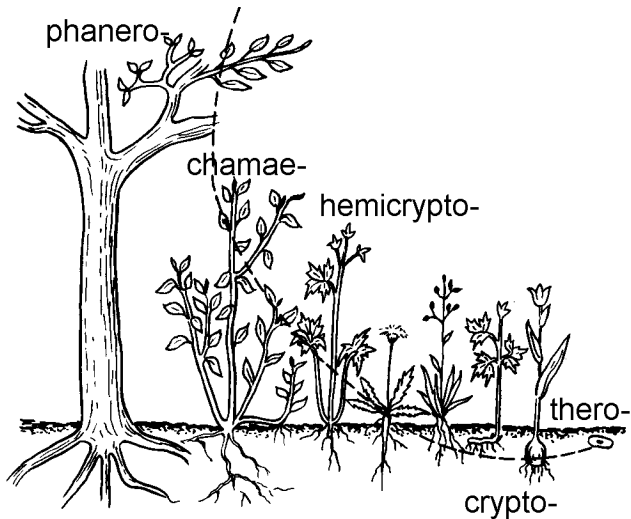
The Raunkiaer system is very useful to characterize the whole *floras*, especially temperate floras



Raunkiaer classification (after Raunkiaer, 1937)



Raunkiaer classification again

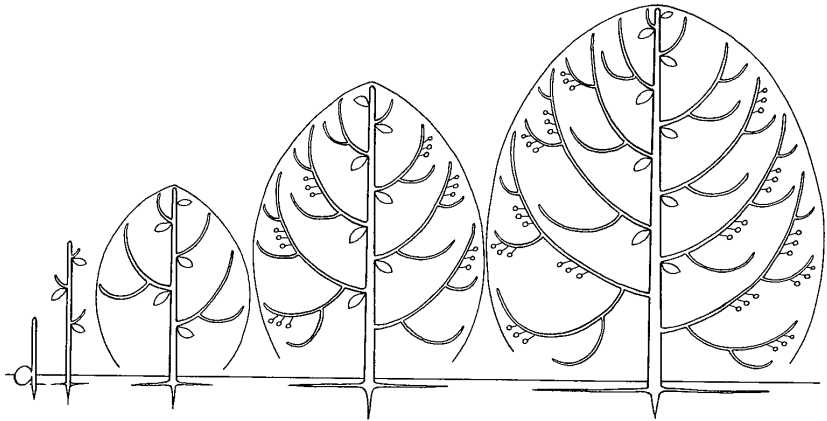


Life forms: architectural models

- Developed for tropical trees, but also cover temperate forms which are less diverse
- Each model has a name of famous botanist, e.g. Thomlinson, Cook, Attims
- Based on the character of branching, development of generative shoots, directions of growing



Example of architectural model: Attimis



Many temperate trees are growing according to this model

Final question (2 points)



Final question (2 points)

Please describe the difference(s) between heartwood and sapwood



Summary

- **Wood** is a secondary xylem
- Life forms represent different “life styles” of plant



For Further Reading



A. Shipunov.

Introduction to Botany [Electronic resource].

2010—onwards.

Mode of access:

http://ashipunov.info/shipunov/school/biol_154



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.

Plant Biology. 2nd edition.

Thomson Brooks/Cole, 2006.

Chapter 5.

