

Introduction to Botany. Lecture 8

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September 12th, 2010

Monday test (5 points)

- 1 Differences between xylem and phloem (> 1)

Monday test (5 points)

2 Example of absorption tissue (> 0)

Monday test (5 points)

8 What is protoderm?

Monday test (5 points)

4 What is ataktostele?

Monday test (5 points)

5 Components of bark (> 1)

Outline

- 1 Wood
- 2 Plant body
- 3 Morphology of shoot
 - Components of shoot
 - Branching
 - Arrangement of leaves

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Two taxonomic terms

“Gymnosperms” All seed plants except angiosperms =
Spermatophyta – Magnoliopsida

“Dicots” All angiosperms except monocots =
Magnoliopsida – Liliidae

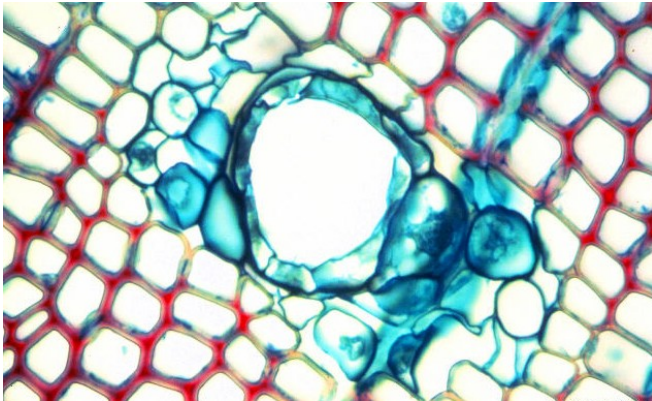
Conifer wood

- 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)



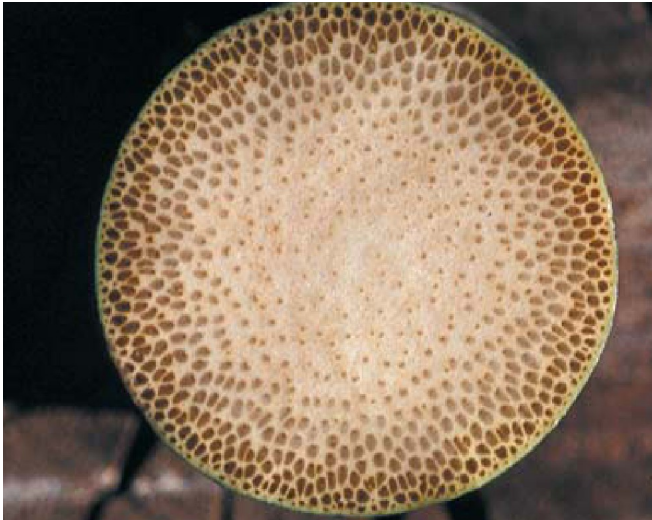
Resin duct in pine wood (©BSA)



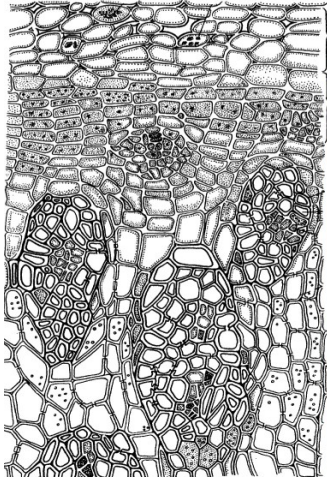
Monocot “wood”

- 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**

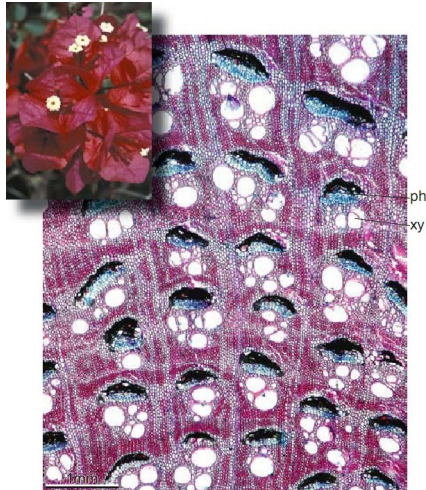
Cross section of palm (*Phoenix canariensis*) trunk



Dragon tree (*Dracaena draco*)



Anomalous secondary growth in Bougainvillea (*Bougainvillea spectabilis*)



Types of plant body

- **Thallous** (flat, with non-differentiated organs)
- **Shoot** body (roots are absent)
- **Bipolar** body (root and shoot systems)

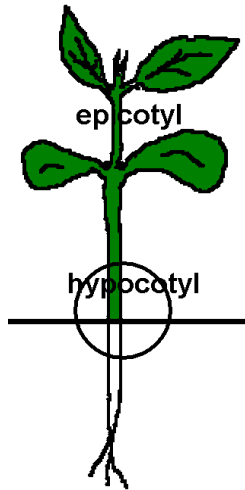
Organs of bipolar plant

- **Leaf:** flat lateral organ with restricted growth
- **Stem:** axial aerial organ with continuous growth
- **Root:** soil organ modified for absorption
- **Floral unit (FU):** stable element of generative system

Pseudo-organs

- *Hypocotyl*: transition between stem and root
- *Epicotyl*: first internode of plant
- *Bud*: shoot “embryo”
- *Fruit*: temporary structure, ripe FU
- *Seed*: chimeric structure, has two or three genotypes

Hypocotyl and epicotyl



Organ systems

- Vegetative shoot system
- Generative shoot system
- Root system

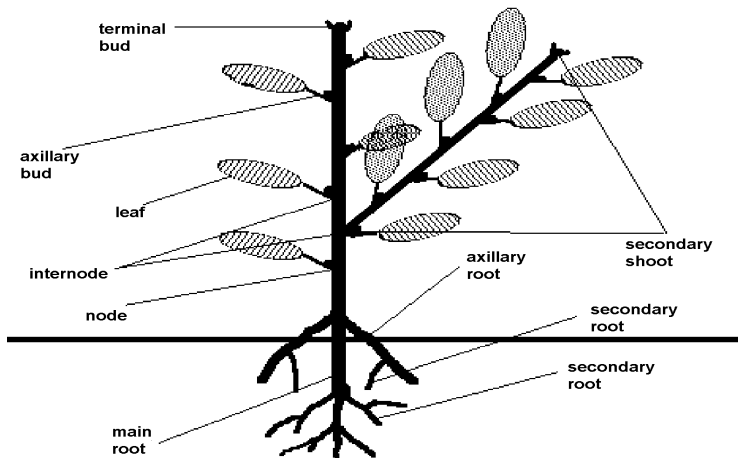
Organs vs. organ systems

...	Vegetative shoot system	Generative shoot system	Root system
Leaf	+	+	—
Stem	+	+	±
Root	±	±	+
FU	—	+	±

Components of vegetative shoot system

- 1 Main and secondary shoots
- 2 Terminal and axillary (lateral) buds
- 3 Nodes and internodes
- 4 Leaves

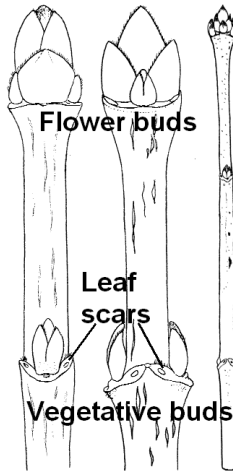
Components of shoot



Winter shoot

- 1 Vegetative, flower, and mixed buds
- 2 Leaf and bud scars
- 3 Leaf traces

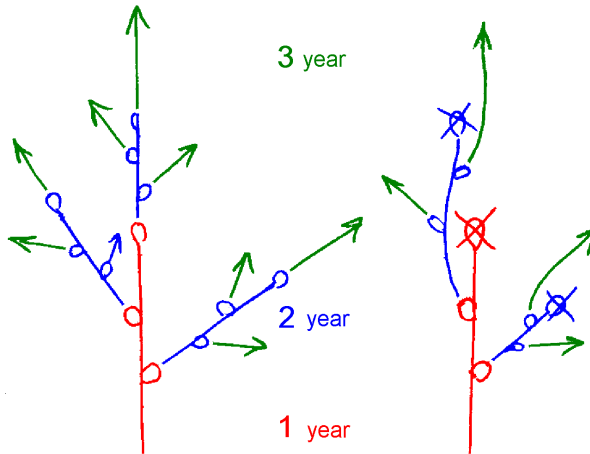
Winter shoot of maple (*Acer platanoides*)



Types of branching

- **Monopodial:** buds do not degrade, all shoots continue to grow
- **Sympodial:** terminal buds degrade, the lateral shoot closest to terminal bud becomes terminal shoot

Monopodial (left) and sympodial branching



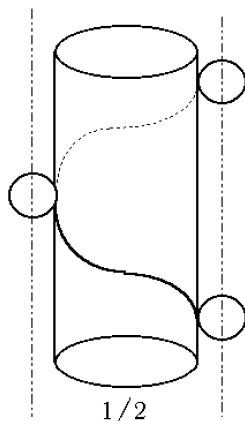
Arrangement of leaves

- One leaf per node: **spiral** arrangement
- Two leaves per node: **opposite** arrangement
- > 2 leaves per node: **whorled** arrangement

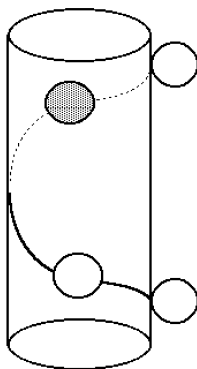
Spiral arrangement

- Multiple types of leaf spiral leaf arrangement mostly follow **Fibonacci rule**
- Formulas of leaf arrangements is very similar to Fibonacci fractions: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$, $\frac{3}{8}$, $\frac{5}{13}$, *et cetera**
- Numerator is number of spiral circulations, denominator is number of leaves

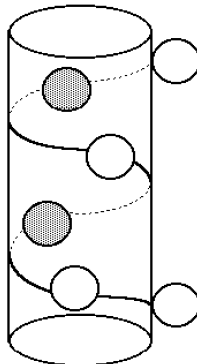
Formulas of spiral arrangement



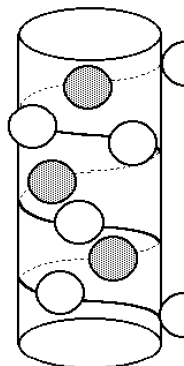
$1/2$



$1/3$



$2/5$



$3/8$



Inner leaf



Outer leaf

----- Orthostychy

Summary

- Conifers have the simpler structure of wood
- Monocots usually do not have true wood, but some of them have **anomalous secondary growth**
- It is possible to divide plant body to different **organs** and/or **organ systems**
- Bud, fruit and seed are **pseudo-organs**
- **Sympodial** branching is evolutionary more advanced than **monopodial**
- Spiral arrangement of leaves follows **Fibonacci** rule

For Further Reading



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.
Plant Biology. 2nd edition.
Thomson Brooks/Cole, 2006.
Chapter 5.