

Introduction to Botany. Lecture 24

Alexey Shipunov

Minot State University

October 31, 2014



Outline

1 Questions and answers

2 Leaf

- Ecological adaptations of leaves

3 Stem and shoot

- Plant body
- Anatomy of primary stem



Outline

- 1 Questions and answers
- 2 Leaf
 - Ecological adaptations of leaves
- 3 Stem and shoot
 - Plant body
 - Anatomy of primary stem



Outline

- 1 Questions and answers
- 2 Leaf
 - Ecological adaptations of leaves
- 3 Stem and shoot
 - Plant body
 - Anatomy of primary stem



Previous final question: the answer

Which plants have more palisade mesophyll—heliophytes or sciophytes?



Previous final question: the answer

Which plants have more palisade mesophyll—heliophytes or sciophytes?

- Heliophytes (from Greek “Helios”, Sun)



Leaf

Ecological adaptations of leaves

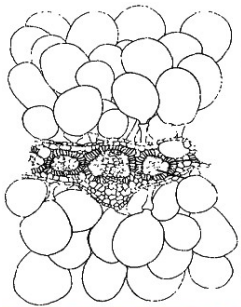


Leaves and soil

- Halophytes (accumulate, excrete or avoid NaCl)
- Nitrate halophytes (grow on soils rich of NaNO_3)
- Oxylophytes (grow on acidic soils)
- Calciphytes (grow on chalk soils rich of CaCO_3)



Leaf of salt-accumulating halophyte



Atriplex prostrata



Leaves and substrate

- Psammophytes (grow on sand)
- Petrophytes (grow on rocks)
- Rheophytes (grow in fast springs)



Rheophyte



Macarenia clavigera from Venezuela



River with rheophytes



They are flowering, too



Podostemum ceratophyllum (may be found even in ND!)



Leaves and metabolism

- Mycoparasites
- Hemiparasites
- Phytoparasites (root and stem)



Mycoparasite



Triuris hyalina from South America



Hemiparasite



Krameria parvifolia from southern Texas



Root parasite



Hydnora africana from South Africa



Stem parasite



Cuscuta europaea from Germany



Stem and shoot

Plant body



Structure of plant body: the first glance

- Shoot system (aboveground part: stems, leaves, buds, flowers, fruit)
- Root system (below-ground part: main roots and branches)
- Exceptions:
 - Some mosses and even ferns have only shoot system
 - Liverworts and hornworts frequently have only leaf-like thallus



Types of plant body

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

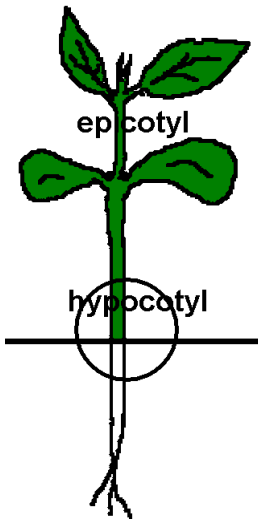


Organs of bipolar plant

- **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



Non-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

Organ systems: final

- Vegetative shoot system
- Generative shoot system
- Root system



Organs vs. organ systems

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



Origin of tissues and organs of plants

- Land colonization. Challenge: drying. Response: **epidermis** and **parenchyma**. Thallus body plan.
- New level of competition. Response: shoot body plan. Problem: big weight. Solution: **collenchyma**.
- Competition grows again. Response: grow higher. Weight grows. Response: use dead cells in **sclerenchyma**.
- Competition grows again. Response: grow faster. Solution: **meristems**.
- Size of plant is too big for plasmodesmata transportations. Solution: vascular tissues, **xylem** and **phloem**. Here plants with sporophyte dominance win the competition.
- Size of plant is too big for osmotic absorption of water. Solution: **absorption tissues**, roots, bipolar body plan. Now they are independent from water as much as possible—with an exception of generative system...
- Shoot system make leaves, stems and **branches**. Plants are facing new challenge!



Stem and shoot

Anatomy of primary stem



Stem: definition and functions

- Axial vegetative organ of shoot with functions of support and transportation
- Other functions:
 - ① Photosynthesis
 - ② Storage
- Features:
 - ① Radial structure
 - ② No root hairs
 - ③ Continuous growth



Protoderm to epidermis

- Stem apex meristem (SAM) produces **protoderm**
- Protoderm cells differentiate into epidermal cells

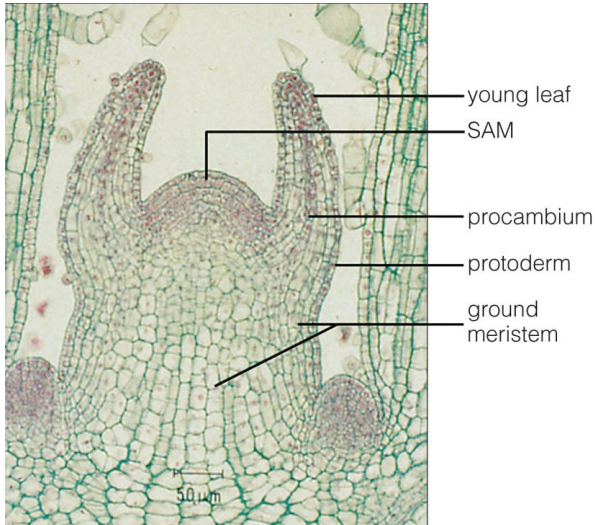


Ground meristem to cortex and pith

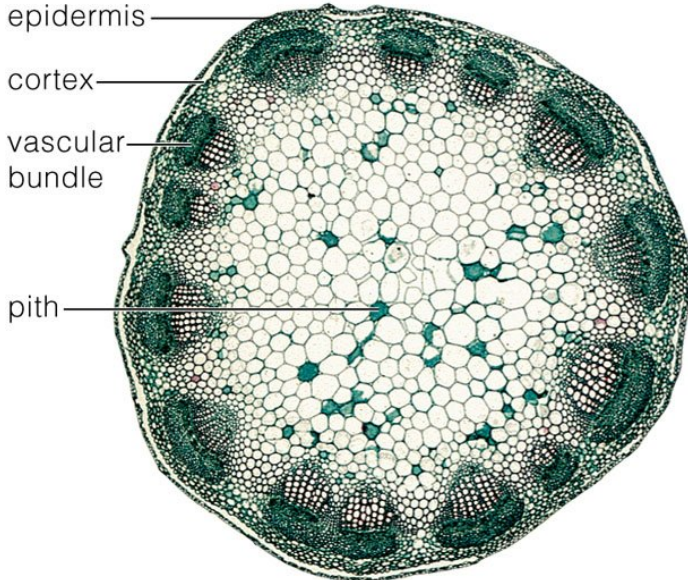
- SAM produces also **ground meristem**
- Ground meristem differentiates into **cortex** and **pith**
- Procambium raises between cortex and pith, it forms vascular bundles or vascular cylinder



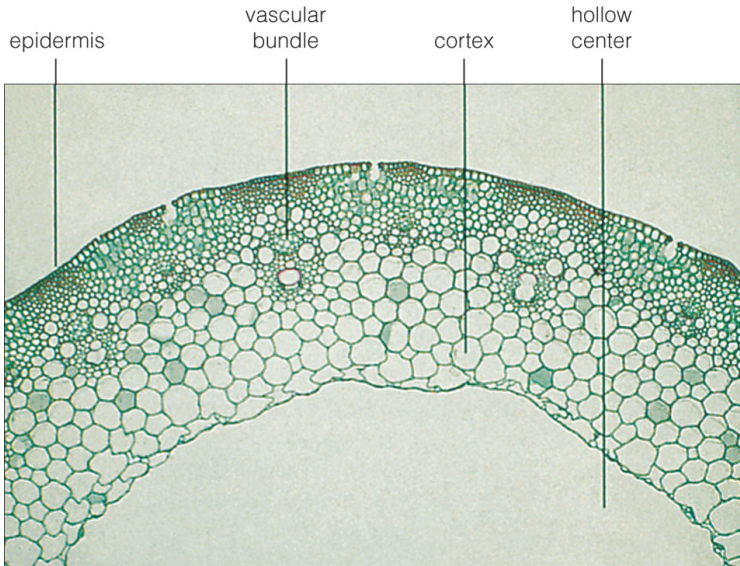
Three primary meristems: procambium, protoderm and ground meristem



Young stem with primary tissues



Older stem with hollow in the center



© 2006 Brooks/Cole - Thomson



Final question (2 points)



Final question (2 points)

Provide a list of plant **non-organs**.



Summary

- SAM produces **protoderm** and **ground meristem**, ground meristem differentiates into **cortex** and **pith**
- Procambium forms **vascular bundles** or vascular cylinder



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.

Chapters 6 and 5.

