

Introduction to Botany. Lecture 24

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Outline

1 Questions and answers

2 Stem and shoot

- Plant body
- Anatomy of primary stem



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- 2 Stem and shoot
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Previous final question: the answer

Which plants have more palisade mesophyll—heliophytes or sciophytes?



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Which plants have more palisade mesophyll—heliophytes or sciophytes?

- Heliophytes (from Greek “Helios”, Sun)



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)

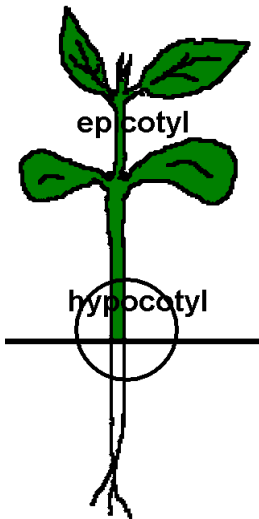


Organs of bipolar plant

- **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



Not 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

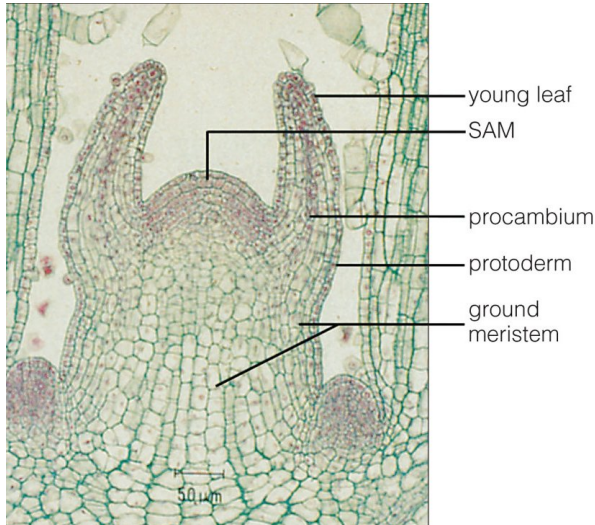


Ground meristem to cortex and pith

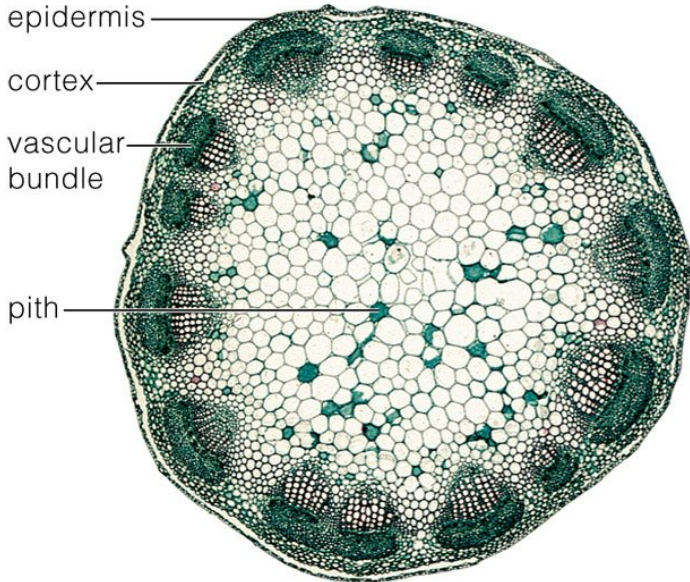
- SAM produces also **ground meristem**
- Ground meristem differentiates into **cortex** and **pith**
- Procambium raises between cortex and pith, it forms vascular bundles or vascular cylinder



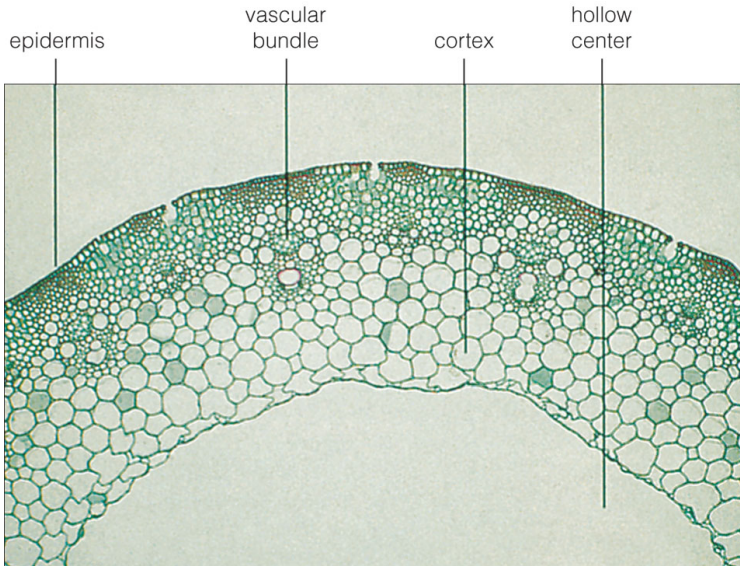
Three primary meristems: procambium, protoderm and ground meristem



Young stem with primary tissues



Older stem with hollow in the center



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Final question (2 points)



Final question (2 points)

Provide a list of plant 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.

Chapter 5.

