

# Introduction to Botany. Lecture 24

Alexey Shipunov

Minot State University

October 30, 2015



## 1 Questions and answers

## 2 Stem and shoot

- Plant body
- Anatomy of primary stem



# Outline

## 1 Questions and answers

## 2 Stem and shoot

- Plant body
- Anatomy of primary stem



# Previous final question: the answer

Which problems to solve hydrophytes typically have?



# Previous final question: the answer

Which problems to solve hydrophytes typically have?

- Gases access
- Low light



# 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)



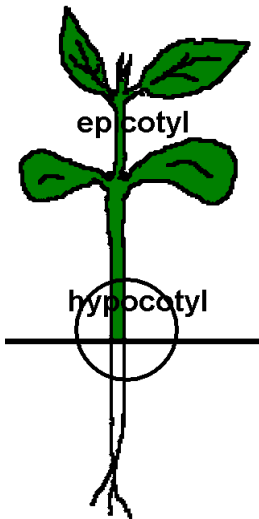


# Organs of bipolar plant

- **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

- Shoot system: vegetative and generative
- Root system



# 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



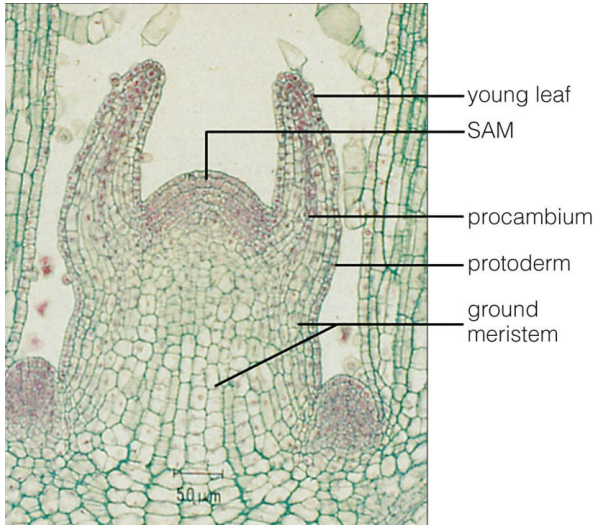
# Ground meristem to cortex and pith

- 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

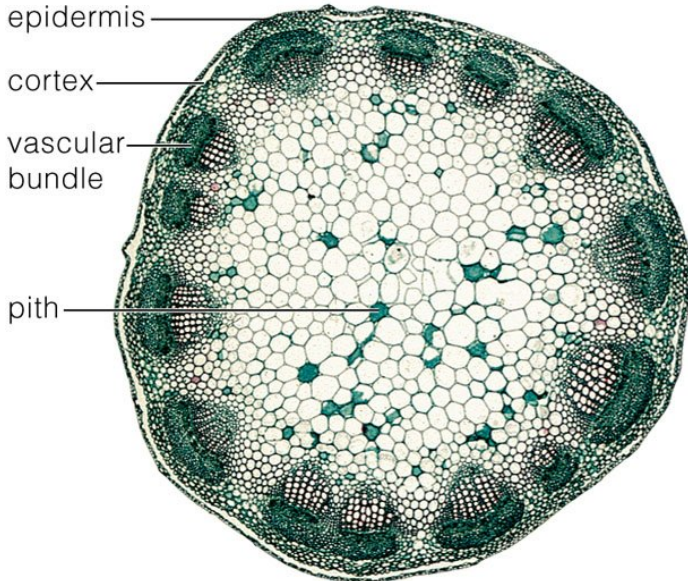




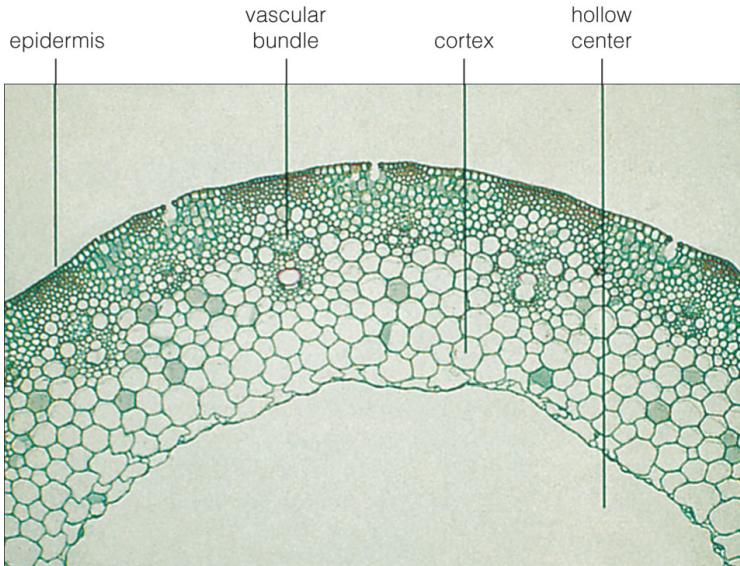
# Three primary meristems: procambium, protoderm and ground meristem



# Young stem with primary tissues



# Older stem with hollow in the center



© 2006 Brooks/Cole - Thomson

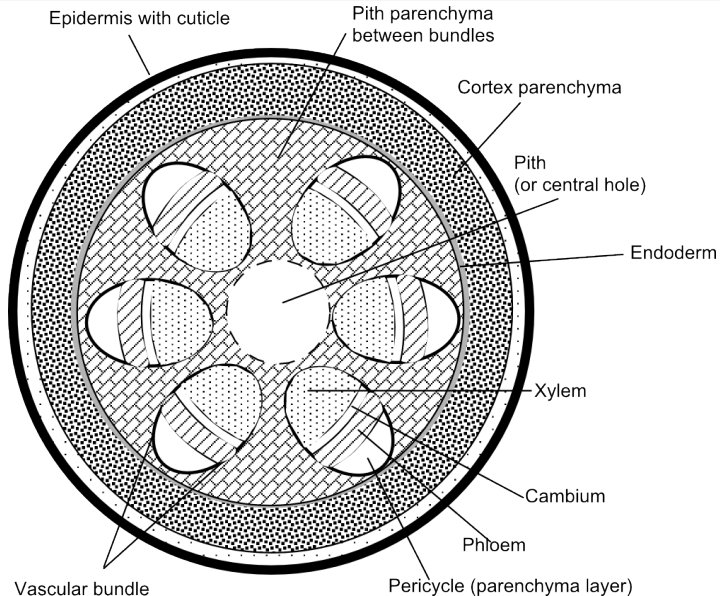


# Procambium to xylem and phloem

- Outer layers of procambium form **primary phloem**
- Inner layers become **primary xylem**
- Middle layer could be completely spent **or** will make cambium for the secondary thickening
- Sometimes outermost layers of procambium form **pericycle** (parenchyma cells)
- In some cases, inner layers of cortex could form **endoderm**



# Primary structure of stem



# 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].

2015.

Mode of access:

[http://ashipunov.info/shipunov/school/biol\\_154](http://ashipunov.info/shipunov/school/biol_154)

