

Introduction to Botany. Lecture 6

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Outline

1

Other tissues

- Poikilo- and homoiohydricity
- Absorption tissues
- Secretory tissues
- Additional meristems

2

Anatomy of stem

- From SAM to primary structure
- Vascular bundles

Outline

1 Other tissues

- Poikilo- and homoiohydricity
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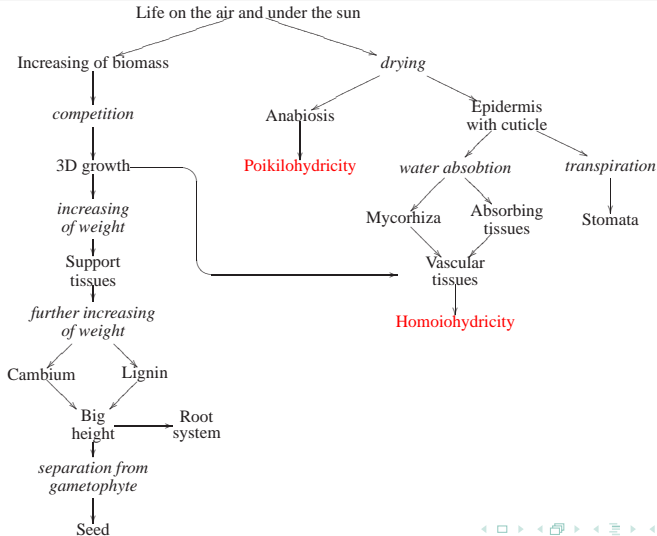
2 Anatomy of stem

- From SAM to primary structure
- Vascular bundles

Poikilo- and homoiohydrycity

- **Poikilohydric** plants do not save water, they survive even complete desiccation
- **Homoiohydric** plants save water, they always have similar water content and do not survive after desiccation
- Compare with poikilo- and homoiothermic animals (reptiles vs. mammals)

Origins of poikilo- and homoiohydricity



Absorption tissues

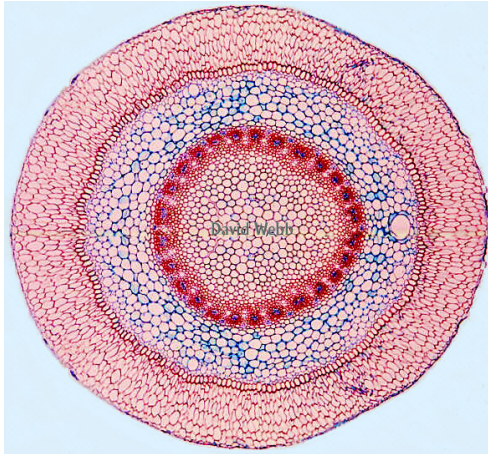
- Always primary, simple tissues
- **Rhizoderm**, or root hairs, originates from protoderm, but life span is much shorter than of epidermis
- **Velamen**, originates from root cortex

Rhizodermm



Root hairs of grass seedlings (LM)

Velamen

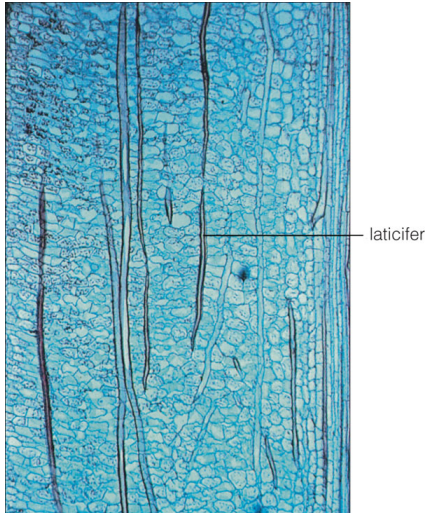


Outer cylinder is a velamen tissue of orchid root (LM, © D. Webb)

Secretory tissues

- Primary, simple or complex tissues
- Spreading across plant body, concentrating in leaves and young stems
- May secrete latex, volatile oils, mucus and other chemicals
- Functions vary: attraction or dis-attraction, communication, defense etc.

Laticifers



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Additional meristems

- **Intercalary** meristems: locate in stems, regulates stem elongation
- **Marginal** meristems are leaf-specific, they regulate shapes
- **Repair** meristems help to cure wounds, they form buds and roots in unusual places

Classification of tissues

Classification table: discussion

Tissues	Primary	Secondary
Simple
Complex

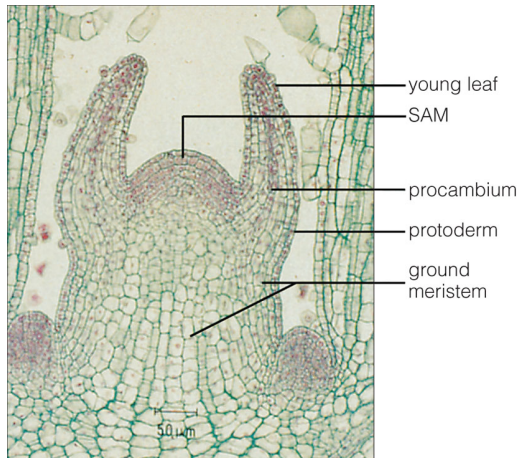
Protoderm to epidermis

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

Ground meristem to cortex and pith

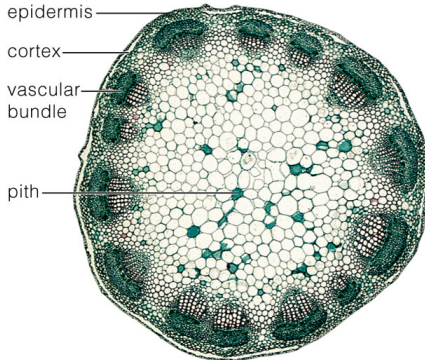
- SAM produces also **ground meristem**
- Ground meristem differentiates into **cortex** and **pith**
- Procambium raises between cortex and pith, it forms vascular bundles or vascular cylinder

Three primary meristems: procambium, protoderm and ground meristem



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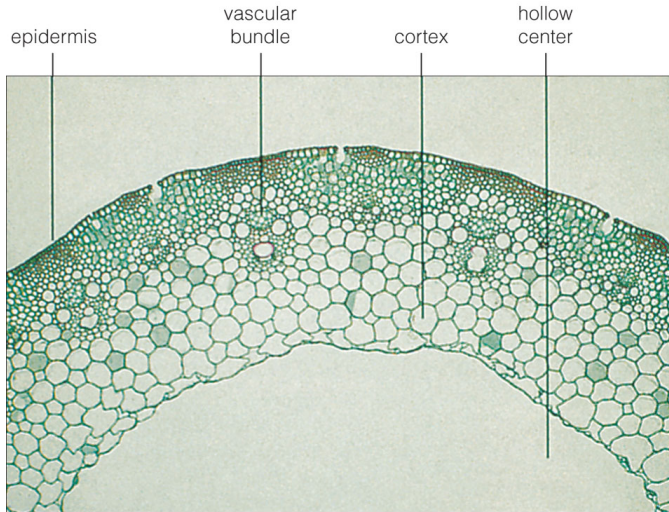
Young stem with primary tissues



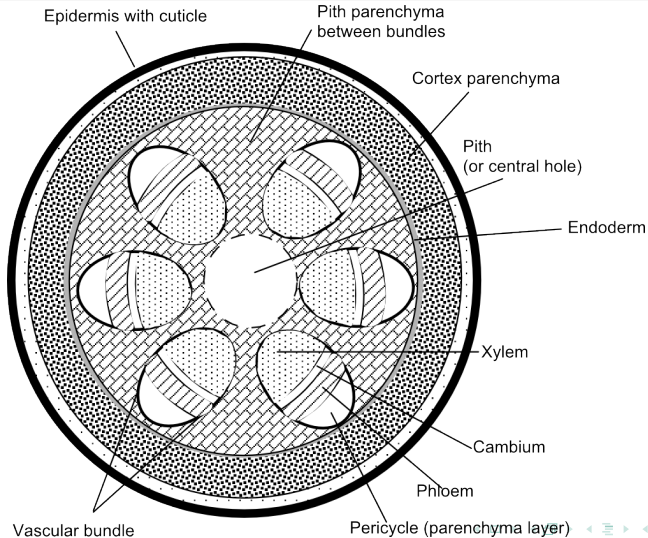
b

transverse section of a stem,
with enlargement of a vascular
bundle shown to the right

Older stem with hollow in the center



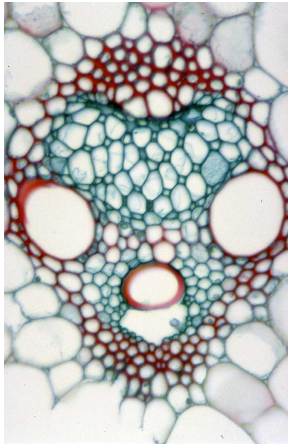
Primary structure of stem



Procambium to xylem and phloem

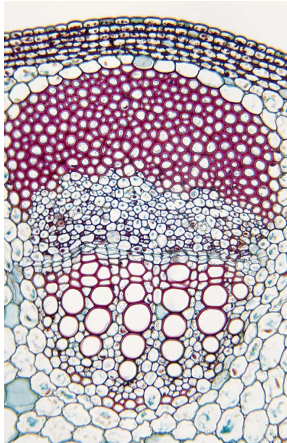
- Outer layers of procambium form **primary phloem**
- Inner layers become **primary xylem**
- Sometimes outermost layers of procambium form **pericycle** (parenchyma cells)
- In some cases, inner layers of cortex could form **endoderm**

Vascular bundle 1



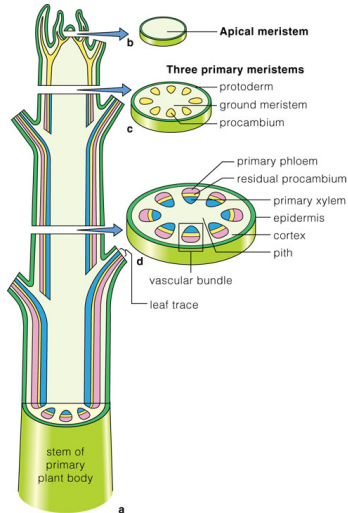
Corn (*Zea mays*) mature stem cross-section showing single vascular bundle, Brightfield (LM ×400)

Vascular bundle 2



Wild Sunflower (*Helianthus* sp.) with nearly mature vascular bundle (LM $\times 35$)

Origin of vascular bundles



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Vascular bundles

- Vascular bundles connect leaves and stems
- In many plants, they form **ring** on the cross-section of stem (“dicot” stem)
- Monocot stems usually have **dispersed** vascular bundles

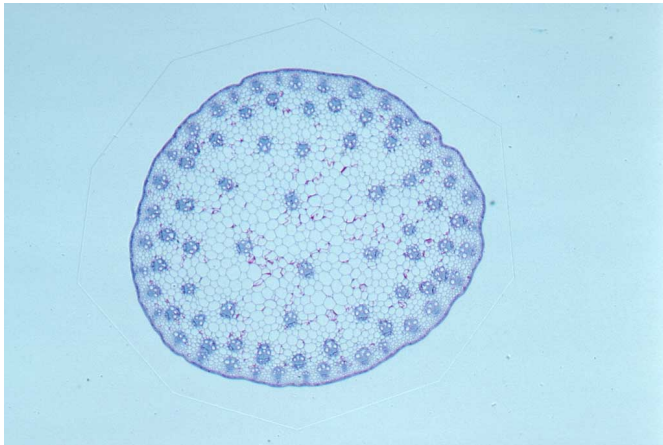
A longitudinal section of a plant stem. The stem is orange and contains several green vascular bundles. Some bundles are large and contain red and blue lines, while others are smaller and contain only red lines. The stem is divided into sections by nodes. A bracket on the left indicates an internode. Labels with leader lines point to 'leaf traces' at a node, a 'vascular bundle', a 'small vascular bundle', the 'petiole' of a branch, and a 'node'.

Diagram illustrating the structure of a plant stem, showing vascular bundles and nodes.

Labels:

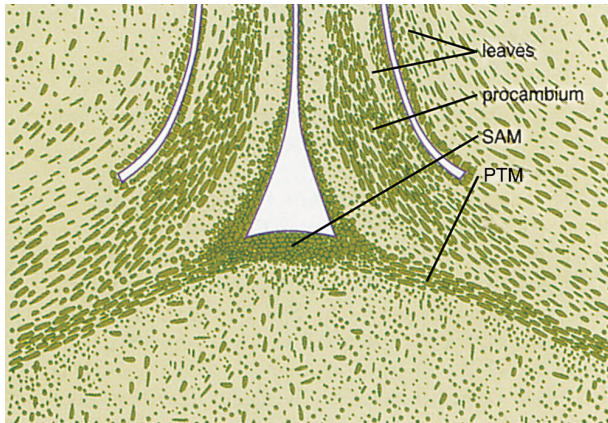
- internode
- leaf traces
- vascular bundle
- small vascular bundle
- petiole
- node

Monocot stem



Corn (*Zea mays*) stem (LM $\times 4$)

Primary Thickening Meristem (PTM)



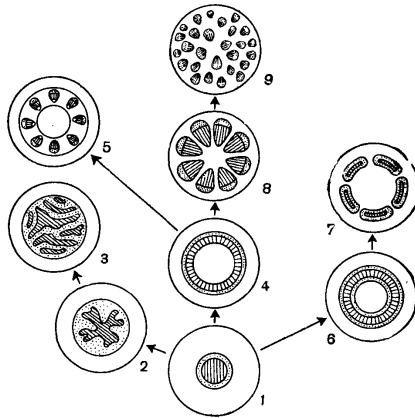
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PTM occurs only in “dicot” stems

Steles 1

- **Stele** is an overall configuration of primary vascular system of plant stem
- The most important kinds of steles are: **protostele**, **siphonostele**, **eustele** and **ataktostele***

Steles 2



(1) is protostele, (7) siphonostele (occurs in ferns), (8) eustele
("dicot" stem), (9) ataktostele (monocot stem)

Summary

- **Absorbtion** tissues take water from soil
- **Secretory** tissues extract different chemicals outside
- SAM produces **protoderm** and **ground meristem**, ground meristem differentiates into **cortex** and **pith**
- Procambium forms **vascular bundles** or vascular cylinder
- Outer layers of procambium transform into primary phloem, inner layers — into primary xylem
- Monocot stem usually has dispersed vascular bundles (**ataktostele**)

For Further Reading



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.
Plant Biology. 2nd edition.
Thomson Brooks/Cole, 2006.
Chapters 4.3, 5.2 and 5.3.