

Introduction to Botany. Lecture 5

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September 2nd, 2011

Outline

- 1 Questions and answers
- 2 Cell
- 3 Tissues
 - Plant body
 - Simple tissues
 - Dermal tissues

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Previous final question: the answer

What is the difference between symplast and apoplast?

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What is the difference between symplast and apoplast?

- Symplast: cytoplasm of different cells connected with plasmodesmata
- Apoplast: cell walls connected side-by-side

Plant tissue as a stack of carton boxes



- Plant tissue may be imagined as a stack of wet carton boxes
- Every box has a balloon inside

Plant and animal cells: differences (at least 5)

Structure of plant body

- Shoot system (aboveground part: stems, leaves, buds, flowers, fruit)
- Root system (below-ground part: main roots and branches)
- However, some plants do not have root system, primarily or secondarily (some mosses have only shoot system, some other plants have only *thallus*)

Origin of tissues and organs of plants: two first steps

Definition of tissues and organs

- **Tissue** is a union of cells which have common origin, function, and similar morphology
- **Organ** is a union of different tissues which have common function(s) and origin

Simple and complex tissues

- **Simple tissues** have only one kind of cells
- **Complex tissues** have more than one cell type. This tissue type is unique for plants

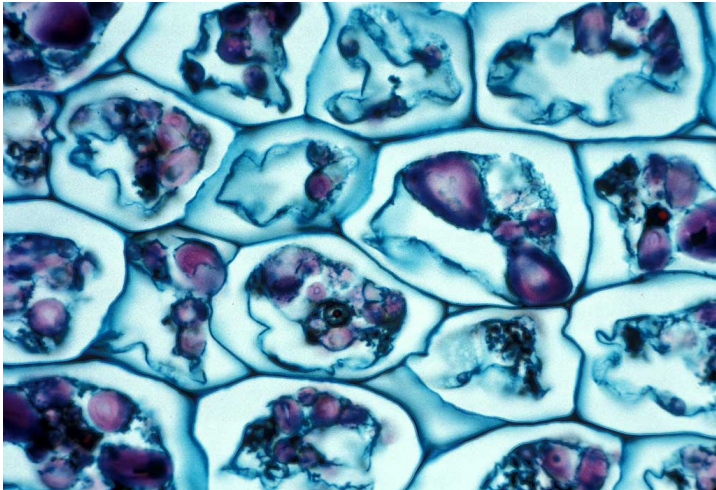
Primary and secondary tissues

- **Primary tissues** originate from stem or root apex
- **Secondary tissues** originate from lateral meristems

Parenchyma (ground, main tissue)

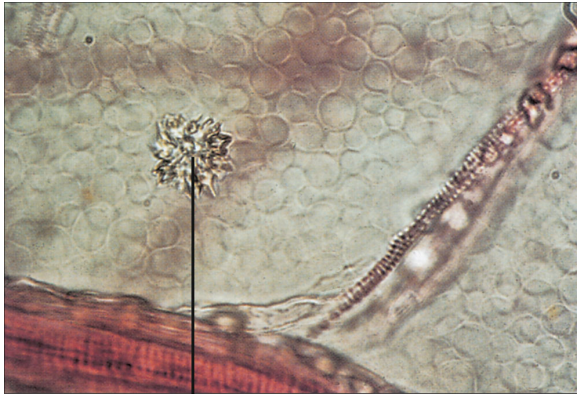
- Spherical or elongated cells
- Thin primary cell wall
- Sometimes, crystal inclusion bodies
- Main functions: photosynthesis and storage

Parenchyma cells of a potato



Parenchyma cells of a potato; the central cell shows obvious nucleus with starch stained purple (LM $\times 83$)

Parenchyma with crystals

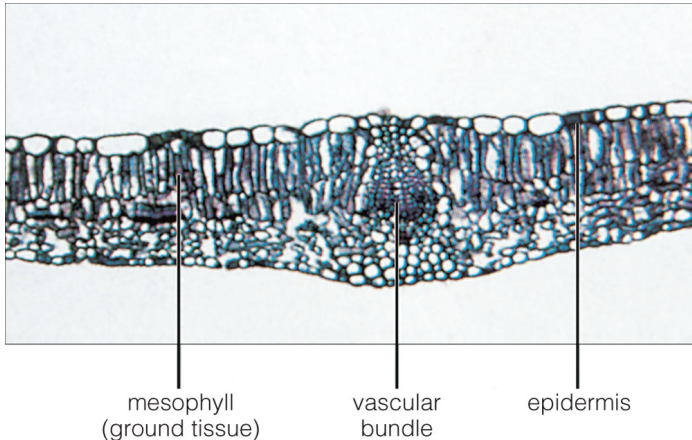


crystal

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Parenchyma cells often include crystals (e.g., of calcium oxalate)

Photosynthetic parenchyma



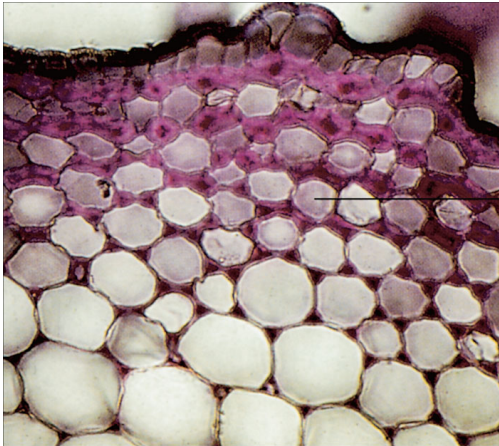
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Photosynthetic parenchyma in lilac (*Syringa vulgaris*) leaf

Collenchyma: living supportive tissue

- Elongated cells
- Thick primary cell wall (pectins + cellulose)
- Main functions: mechanical support of young stems and leaves

Angled collenchyma



collenchyma cell

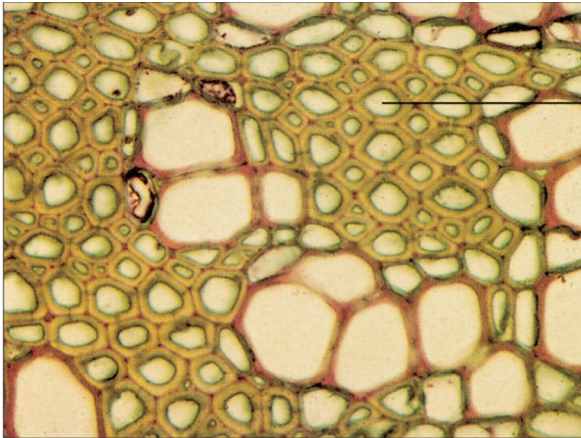
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Collenchyma cells of marigold (*Calendula officinalis*)

Sclerenchyma: dead supportive tissue

- Long cells (sclerenchyma fibers) or short crystal-like cells (sclereids)
- Dead cells with thick secondary cell wall, rich of lignin
- Supports weight of older plant organs, makes fruits non-edible before they become rip, makes stems firm

Sclerenchyma fibers

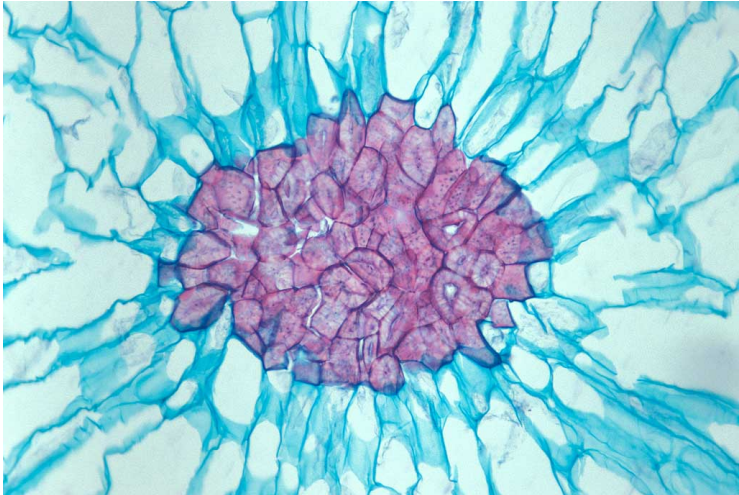


fiber

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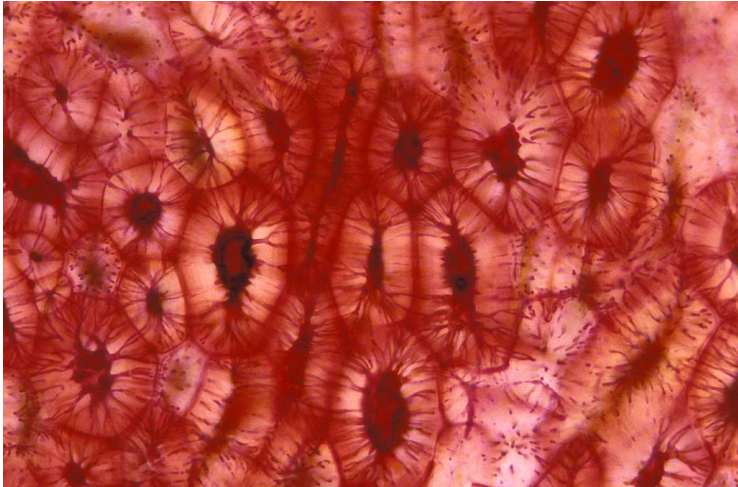
Cross-section of sclerenchyma fibers in geranium (*Pelargonium* sp.)

Stone cells



Stone cells (kind of sclereids) in pear fruit (*Pyrus communis*)

Sclereids from cherry pit

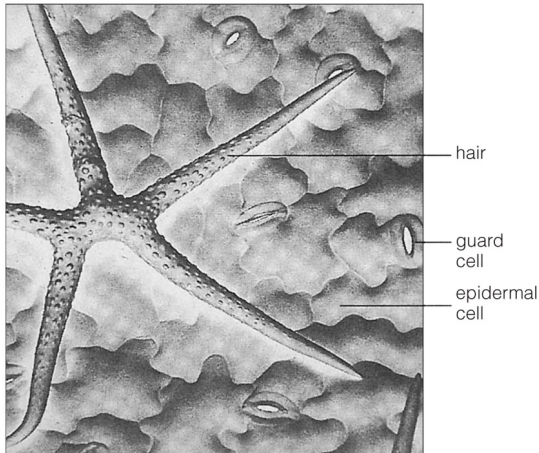


Sclereids from cherry (*Prunus* sp.) pit (LM $\times 400$)

Epidermis: the complex tissue

- Complex tissue of different cell types:
 - ① Epidermal cells
 - ② Stomata cells:
 - Guard cells
 - Subsidiary cells
 - ③ Trichomes
- Shapes and chemical compounds vary
- Main functions: gas exchange, transpiration, defense

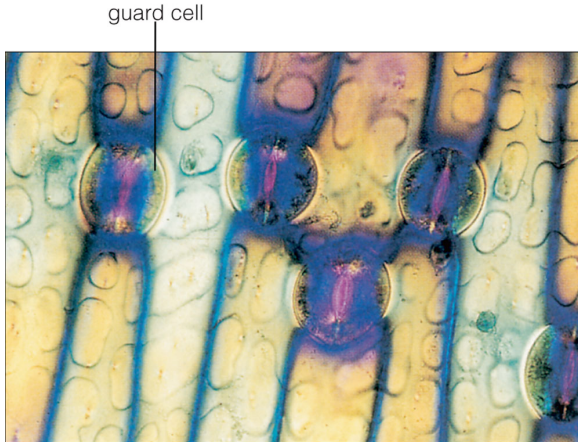
Epidermal cells



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Three kinds of Shepard's purse (*Capsella bursa-pastoris*) epidermal cells

Stomata



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Stomata with guard cells and pores (*Iris* sp.)

Final question (1 point)

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Please tell the difference between sclereids and sclerenchyma fibers

Summary

- The structure of plant body, its organs and tissues is a result of land colonization
- **Complex tissues** have different cell types, **secondary tissues** originate from lateral meristems (i.e., cambium)
- **Parenchyma**, or ground tissue, is a main component of young plant organs
- **Collenchyma** and **sclerenchyma** are simple supportive tissues
- **Epidermis** is a complex tissue which includes stomata

For Further Reading



J. E. Bidlack, Sh. H. Jansky.
Stern's introductory plant biology. 12th edition.
McGraw-Hill, 2011.
Chapter 4.



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.
Plant Biology. 2nd edition.
Thomson Brooks/Cole, 2006.
Chapter 4.