

# Introduction to Botany. Lecture 4

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# Honors students

- Choose class presentation
- Scientific essay
- Laboratory/field project

# Monday test: discussion

- Distinguish between ecological and taxonomic definition of plants
- **Ecologically**, plants are *photosynthetic organisms producing oxygen* and include some bacteria and algae
- **Taxonomically**, plants are *multi-tissued eukaryotes with primary plastids*, this is a kingdom Vegetabilia

# Outline

- 1 Cell
  - Other cell structures
- 2 Tissues
  - Plant body
  - Simple tissues
  - Dermal tissues

# Outline

## 1 Cell

- Other cell structures

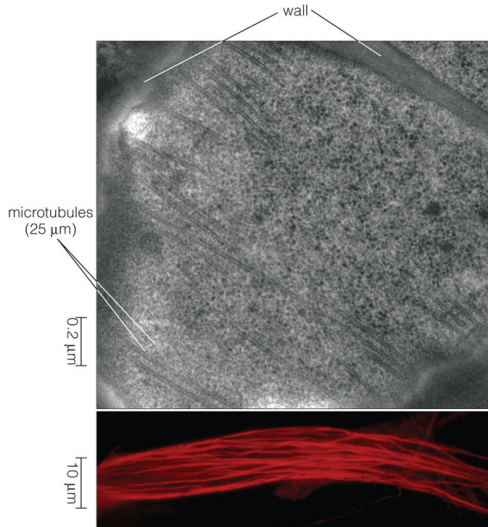
## 2 Tissues

- Plant body
- Simple tissues
- Dermal tissues

# Cytoskeleton 1

- Collection of long, filamentous structures within cytoplasm
- Microtubules. Movement based on tubulin-kinesins interactions. They are key organelles in cell division, form basis of cilia and flagella, serve as guides for movement of organelles within cell
- Microfilaments. Movement based on actin-myosin interactions. Serve as guides for movement of organelles within cell

# Cytoskeleton 2



# Structure of plant body

- Shoot system (Above ground 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\*



# Origin of tissues and organs

Open discussion\*

# 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

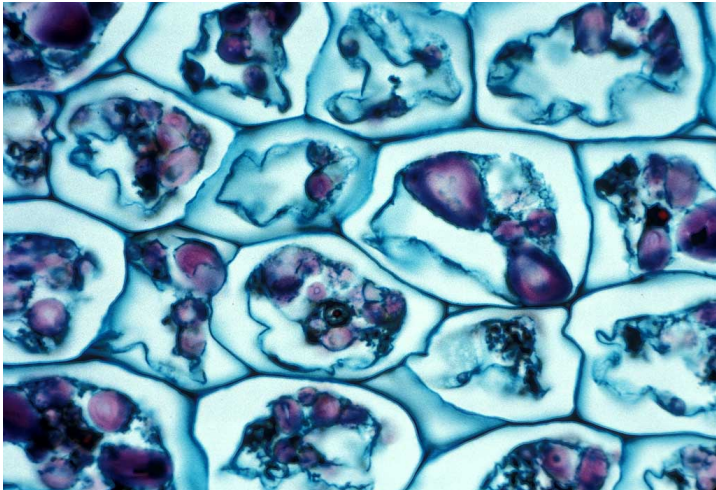
# Simple and complex tissues

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

# Parenchyma (ground tissue)

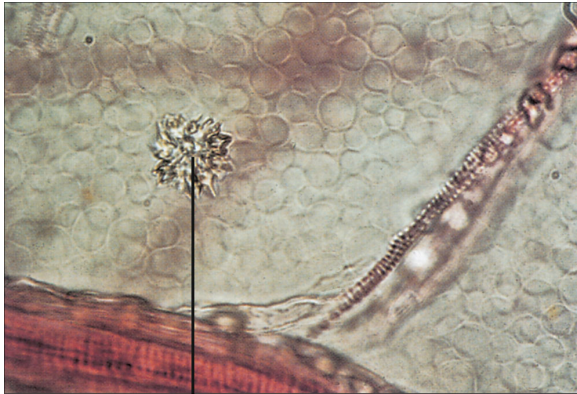
- Spherical or elongated cells
- Thin primary cell wall
- Sometimes, crystal inclusion bodies
- Main functions: photosynthesis\* and storage

## Parenchyma 2



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

# Parenchyma 3

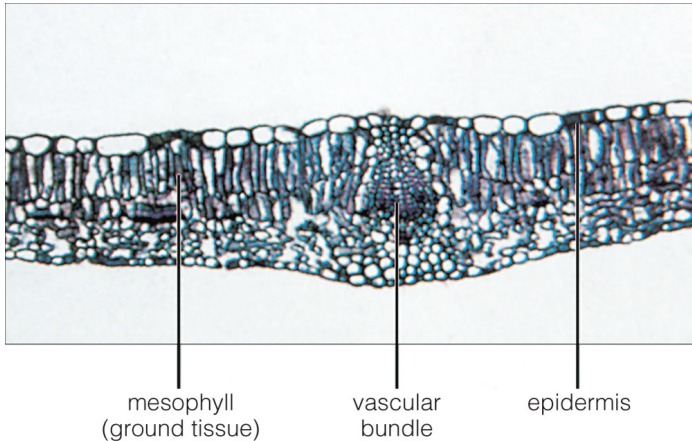


crystal

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

# Parenchyma 4



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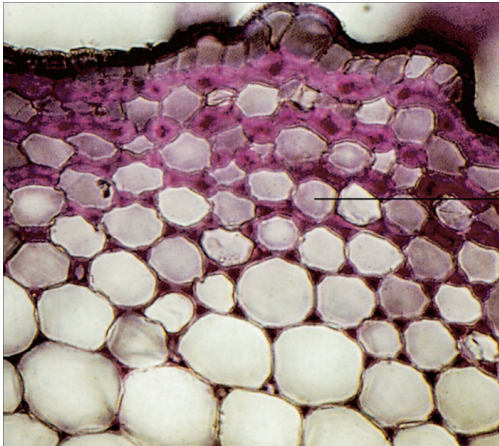
Photosynthetic parenchyma in lilac (*Syringa vulgaris*) leaf

# Collenchyma 1

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



# Collenchyma 2



collenchyma cell

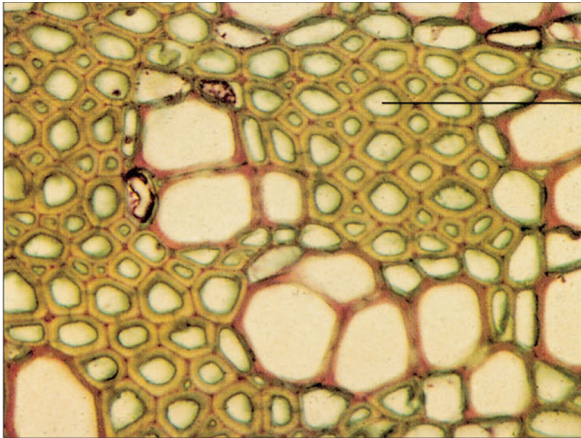
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Collenchyma cells of marigold (*Calendula officinalis*)

# Sclerenchyma 1

- From very long (fiber) cells to 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 2

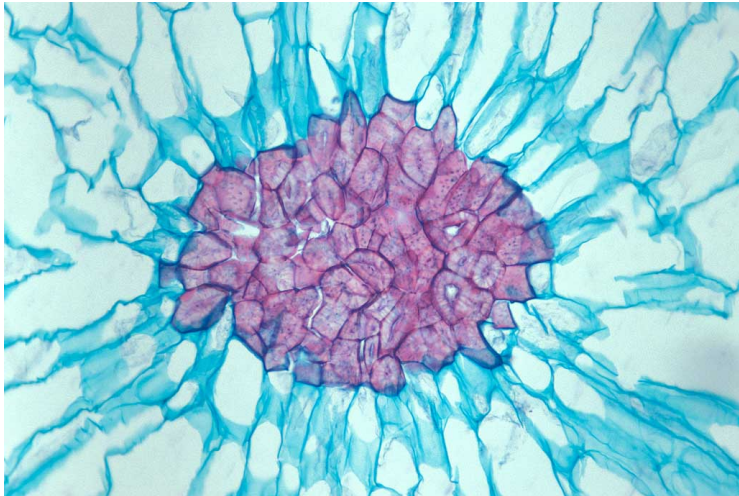


fiber

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

## Sclerenchyma 3



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

# Sclerenchyma 4

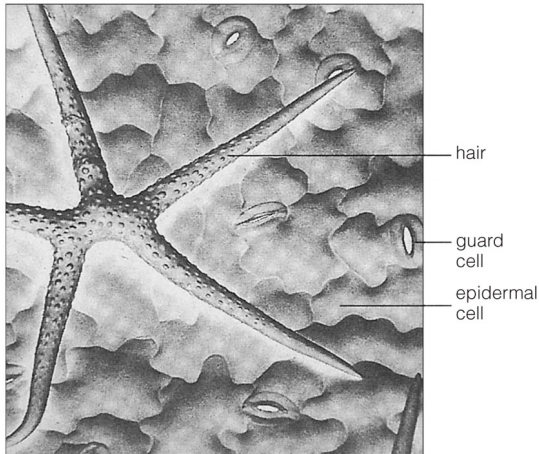


Sclereids from cherry (*Prunus* sp.) pit (LM  $\times 400$ )

# Epidermis 1

- Complex tissue of different cell types: epidermal cells, stomata cells (guard + subsidiary), and trichomes
- Shapes and chemical compounds vary
- Main functions: gas exchange, transpiration, defense

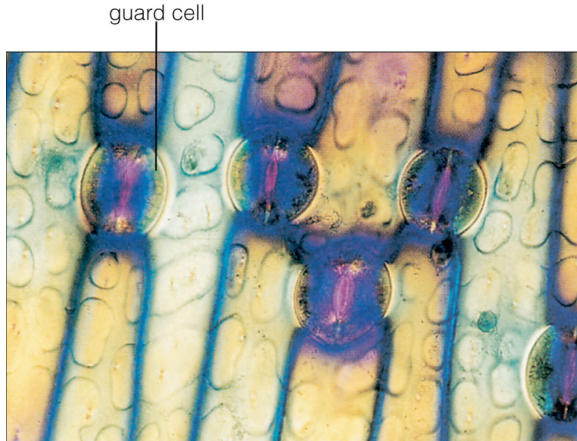
## Epidermis 2



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

# Epidermis 3



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Stomata with support cells and pore (*Iris* sp.)



# Primary and secondary tissues

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

# Summary

- **Cytoskeleton** controls form of cell and movements within a cell
- 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 support tissues
- **Epidermis** is a complex tissue which include stomata

# For Further Reading



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.  
*Plant Biology*. 2nd edition.  
Thomson Brooks/Cole, 2006.  
**Chapters 4.1–4.2.**