Plant Book

EVERY calorie of energy from what we eat COMES FROM PLANTS!!!

Copy this onto the front cover of your booklet within the circle

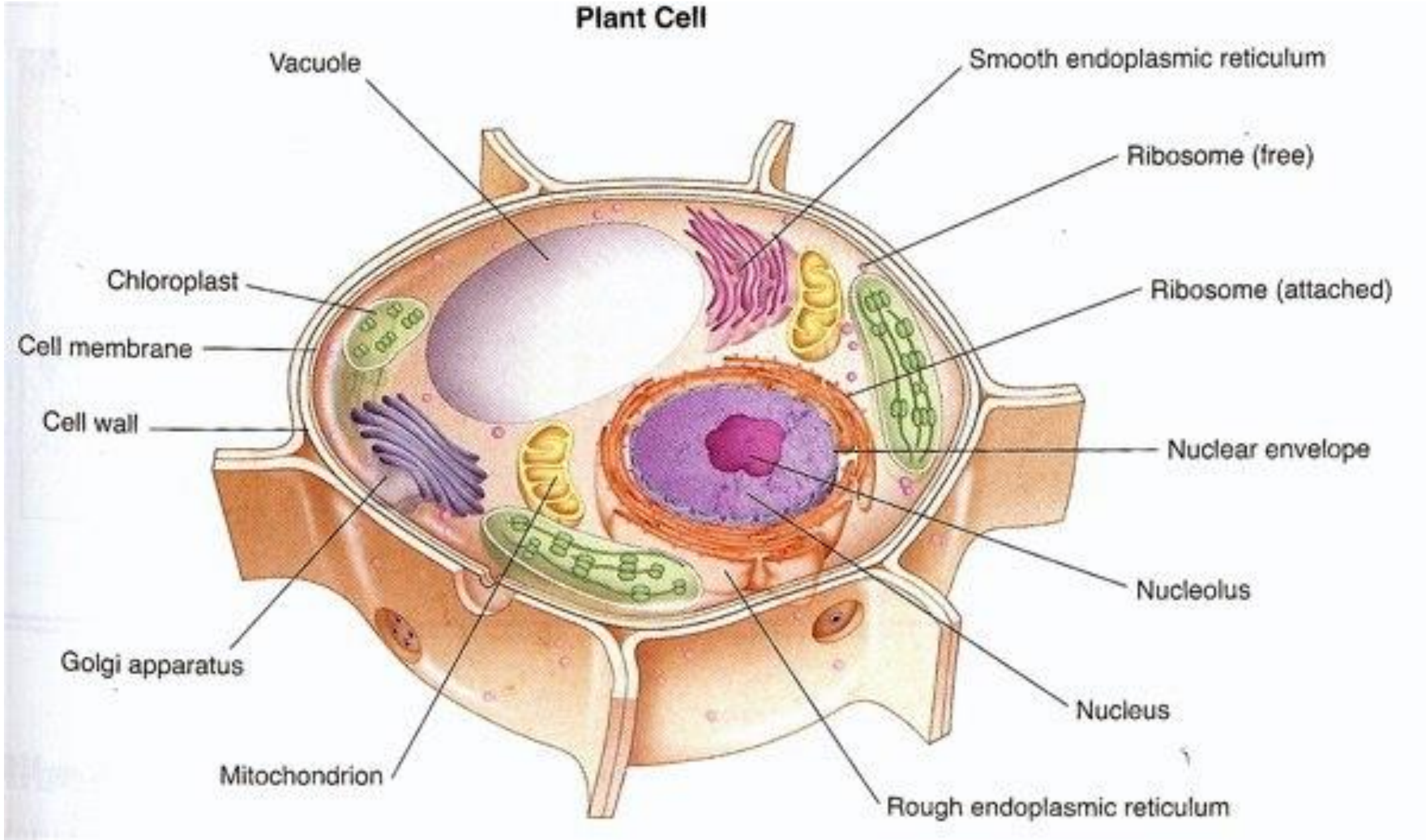
What plants need to survive

1. Sunlight for photosynthesis
2. Water and minerals
3. Gas exchange (CO_2 absorption & release of O_2)
4. Optimal temperatures (affects metabolic rate & enzymes)

Booklet page 2;
textbook page 206-207

Day 1

1. Use the diagram that will follow to label and color a plant cell diagram
2. Using COLOR PENCIL ONLY, shade in the diagram with appropriate colors.
3. Neatness counts in your grade
4. Write a complete narrative for the illustration explaining why the cell is so complex (There is an example on the next slide that you may use to teach you how to write a good page narrative for the rest of the plant book)


Plant Cell
Vacuole
Smooth endoplasmic reticulum
Ribosome (free)
Chloroplast
Ribosome (attached)
Cell membrane
Cell wall
Nuclear envelope
Nucleolus
Golgi apparatus
Nucleus
Mitochondrion
Rough endoplasmic reticulum

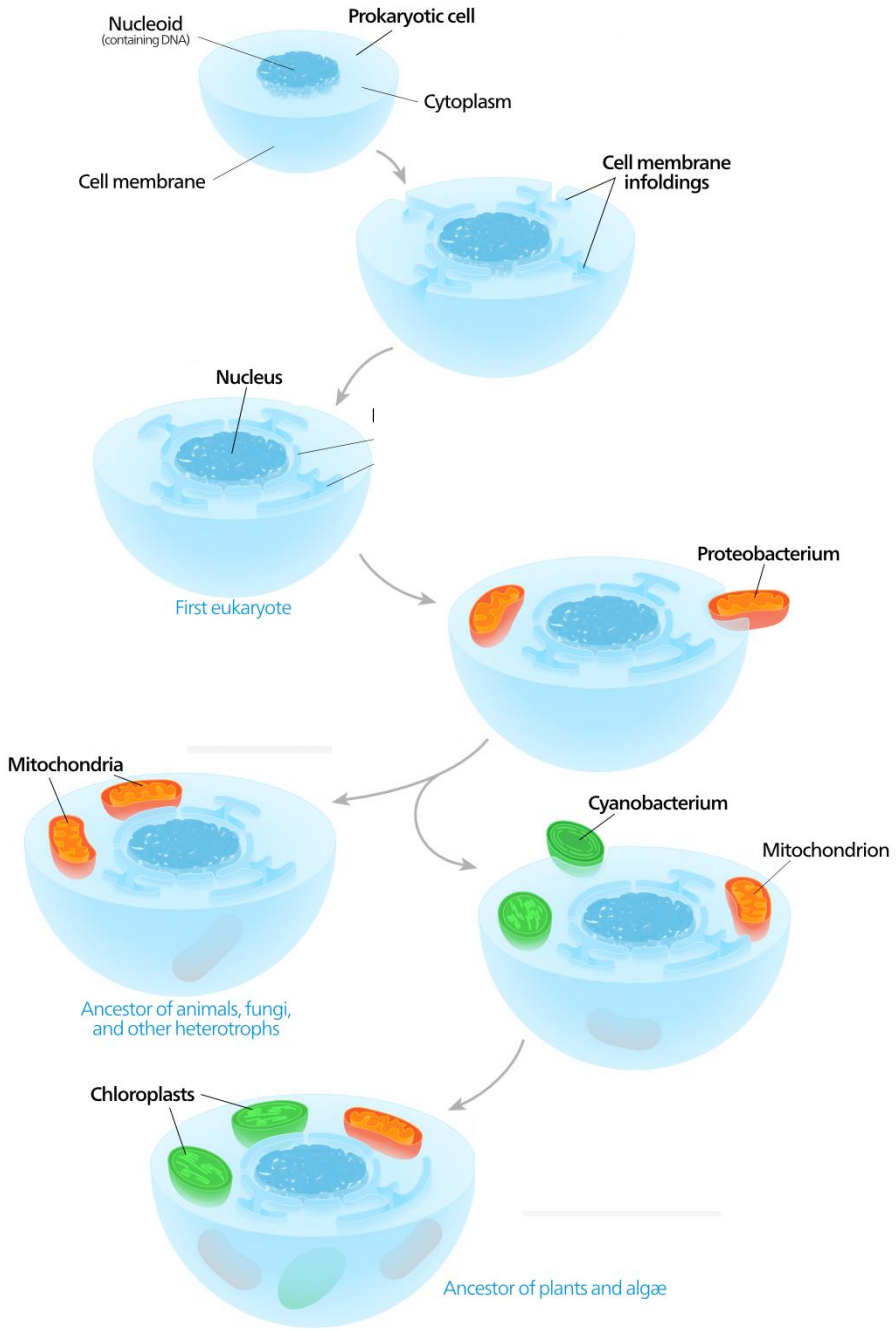
Example Narrative

…copy this onto the bottom of page 2 of your booklet. Yes, word for word exactly as shown

This illustration shows the typical components of a plant cell including the cellulose cell wall, large central vacuole and the green chloroplasts.

Plant cells evolved from unicellular green algae, however, all plants are multicellular.

The plant cell is the basic unit of structure & function of all plants. Plant cells provide the energy for ecosystems. Life on this planet would not exist if not for plants.



Endosymbiotic Theory

- **Lynn Margulis** proposed that certain organelles evolved from a symbiotic relationship between a host cell and early prokaryotes
- **Mitochondria** were once free-living chemosynthetic aerobic prokaryotes
- **Chloroplasts** were once free-living photosynthetic prokaryotes

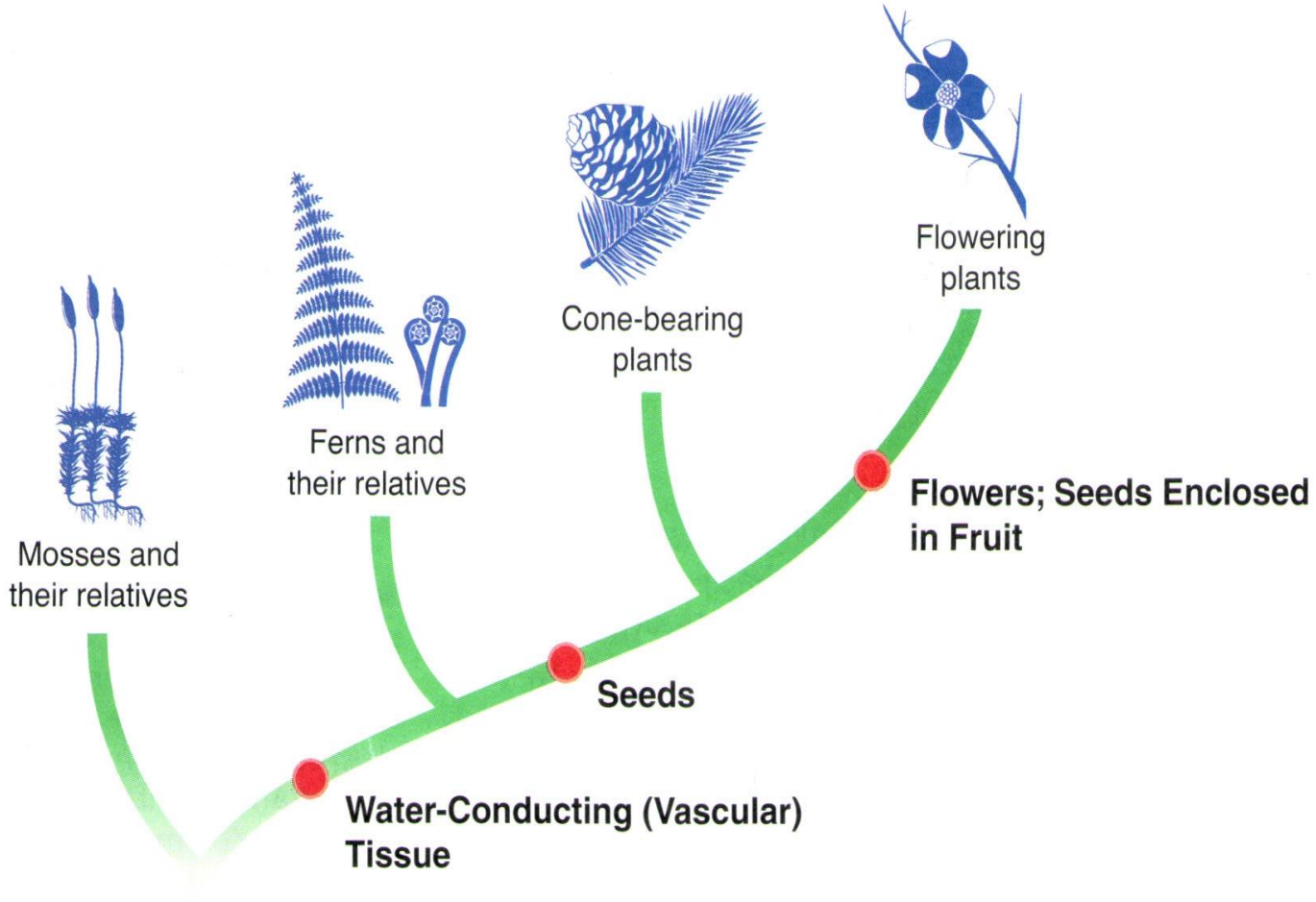
Endosymbiosis video link

Watch the Bozeman Science video on Endosymbiosis:

- https://www.youtube.com/watch?v=-FQmAnmLZtE

Check out the TED-ed video on Endosymbiosis:

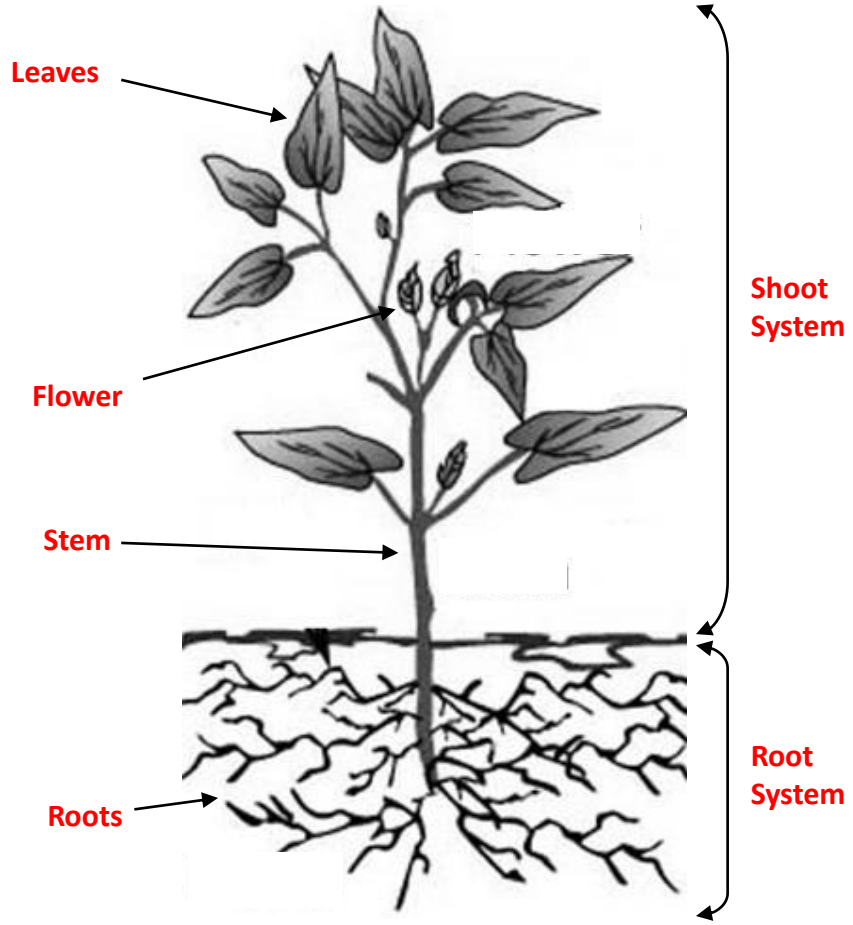
- https://www.youtube.com/watch?v=9i7kAt97XYU



(Protist)

Narrative: Compare this cladogram to a timeline. What are some similarities between a cladogram and a timeline? What are some differences?

Body Systems of Plants

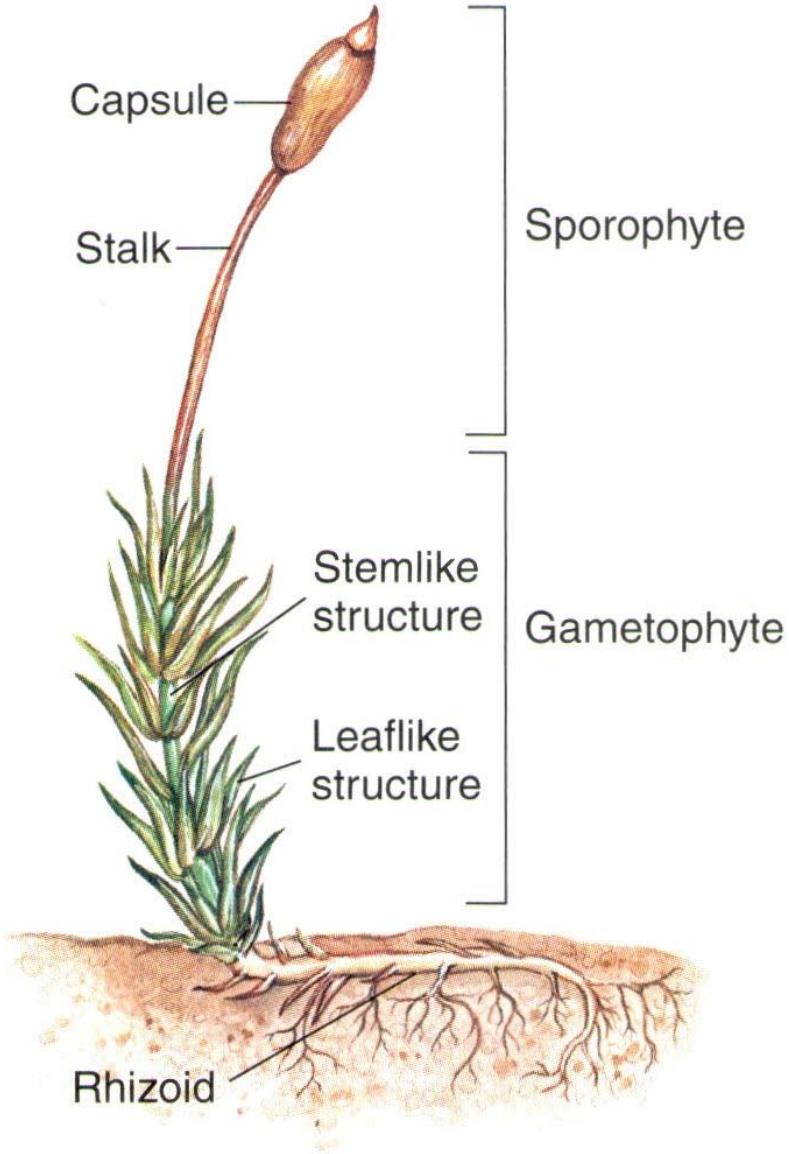


- Composed of root and shoot systems
- Includes flowers for more efficient reproduction
- Includes seeds and sometimes fruits for dispersal

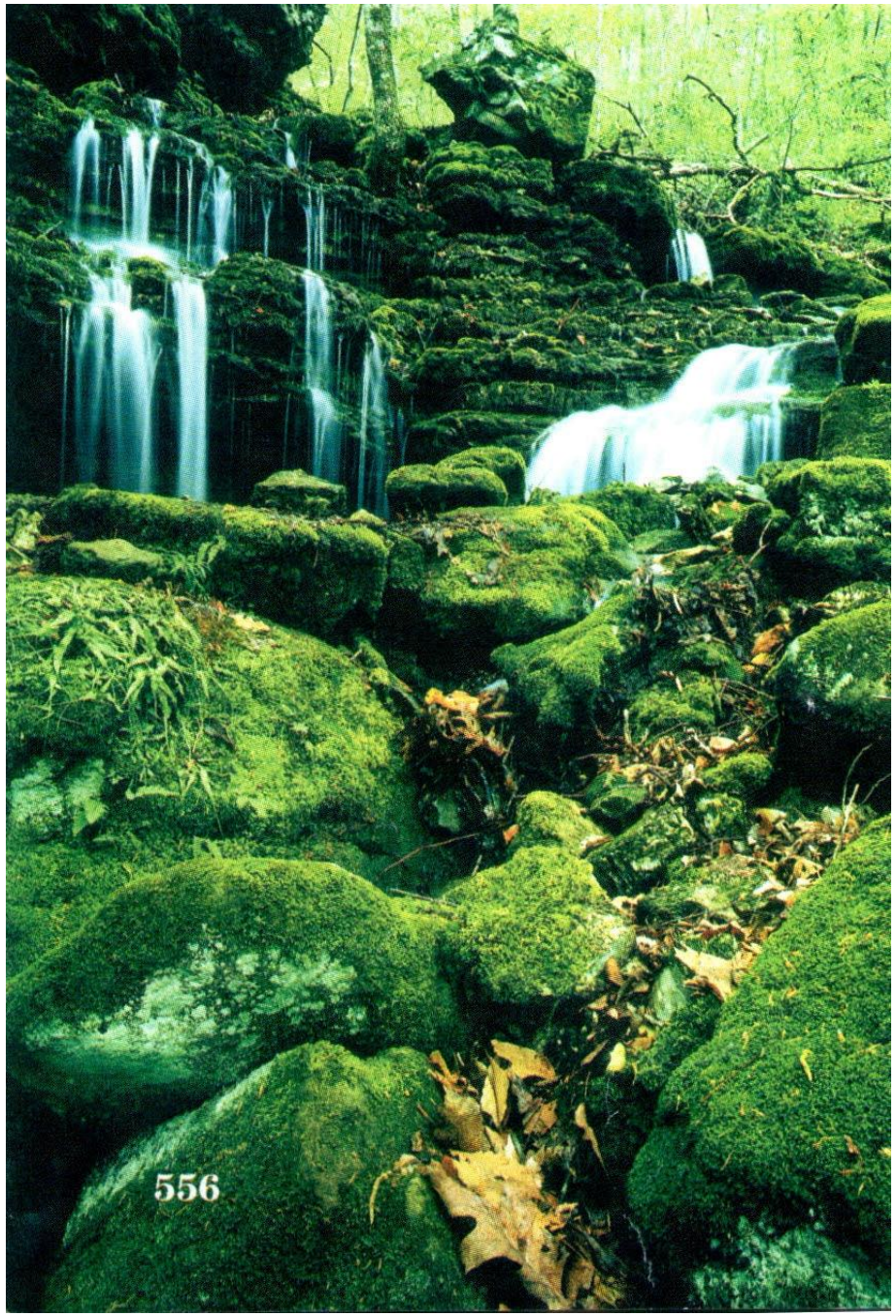
Narrative: In what way do plant systems compare to the systems found within the human body? Can we live without a critical system? Can a plant survive without a critical system?

Bryophyte Structures & Adaptations

Booklet page 6; textbook page 641



- Very small structures
- No vascular tissues
- No seeds
- Reproduces via spores
- Only thrive in moist soils



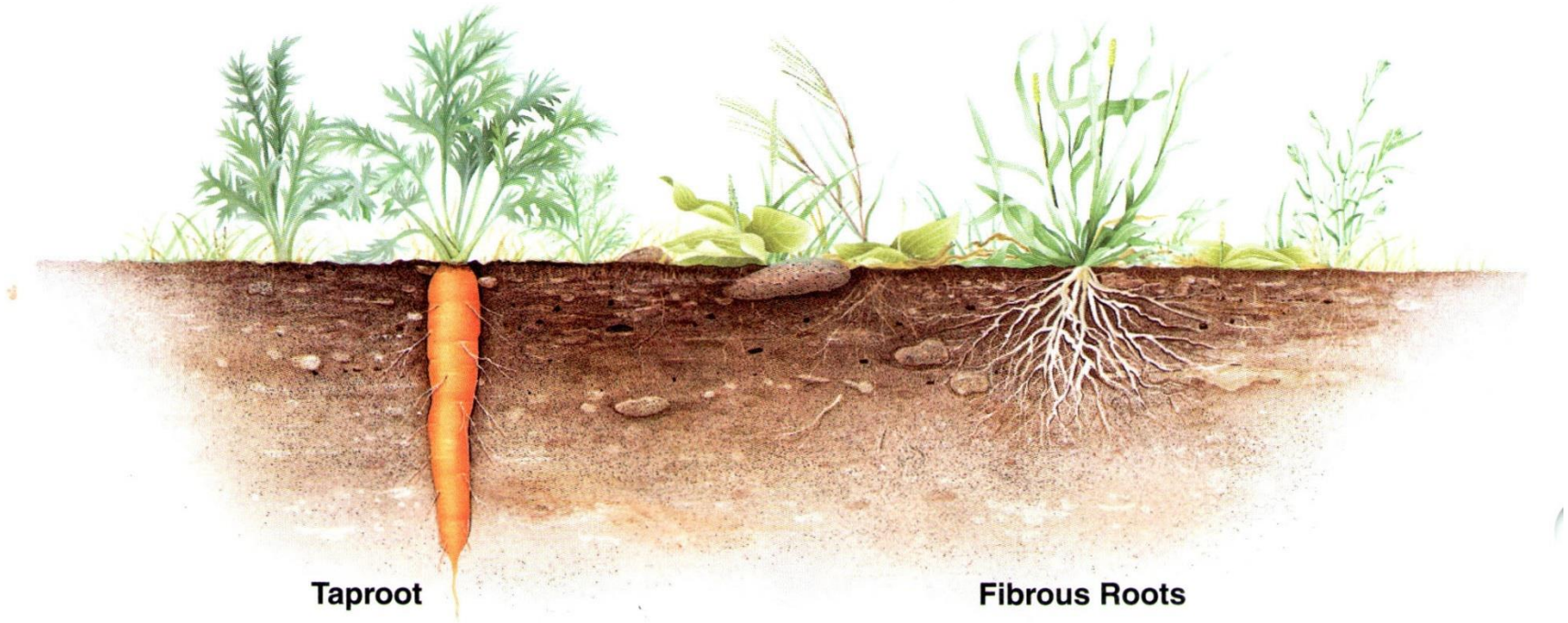
Mosses

- Bryophytes have no roots or vascular tissues (veins).
- Why must bryophytes be close to water or in moist areas to survive?
- If they have no roots, how do they get their water? (think about what we've talked about for movement of water)

Root System Adaptations

Booklet page 7; Txt 669-670

Figure 23–6 Plants have taproots, fibrous roots, or both. Taproots have a central primary root and generally grow deep into the soil. Fibrous roots are usually shallow and consist of many thin roots.



- What advantages do fibrous roots have over tap roots?
- What advantages do tap roots have over fibrous roots?

Taproot – found on dicot angiosperms

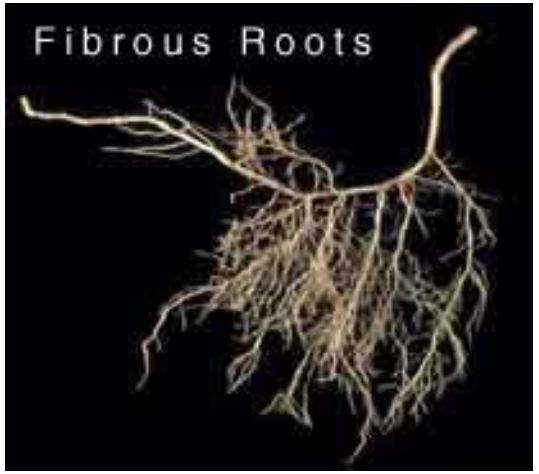
Not in booklet

- one long, main root from which all others branch
- good for growing toward deep water source

Not in booklet

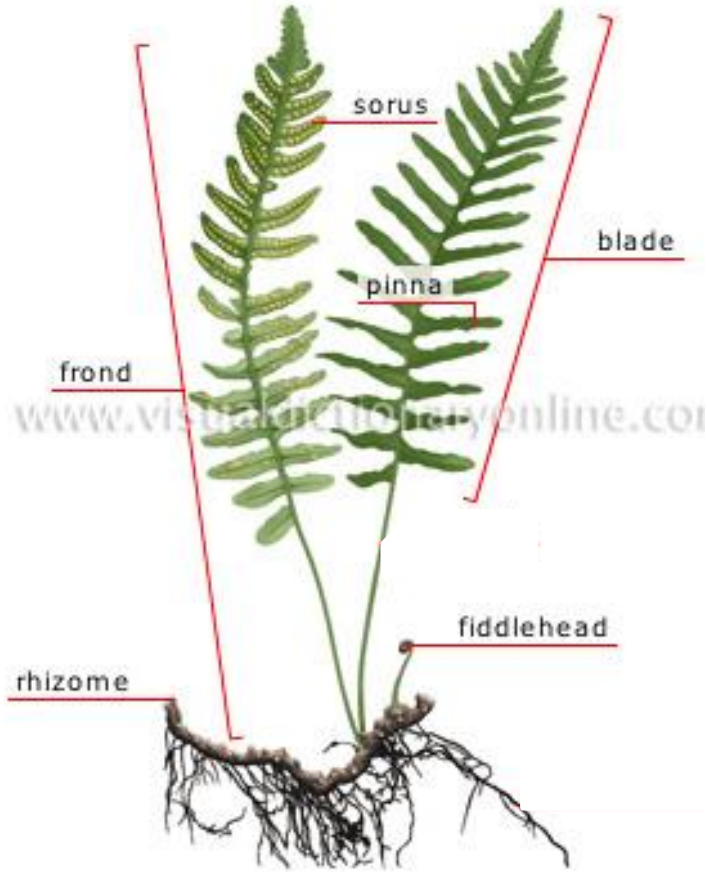
Fibrous root – found on monocot angiosperms

- Many, spreading, branching roots.
- Good for absorbing shallow water and also good for binding soil to prevent erosion



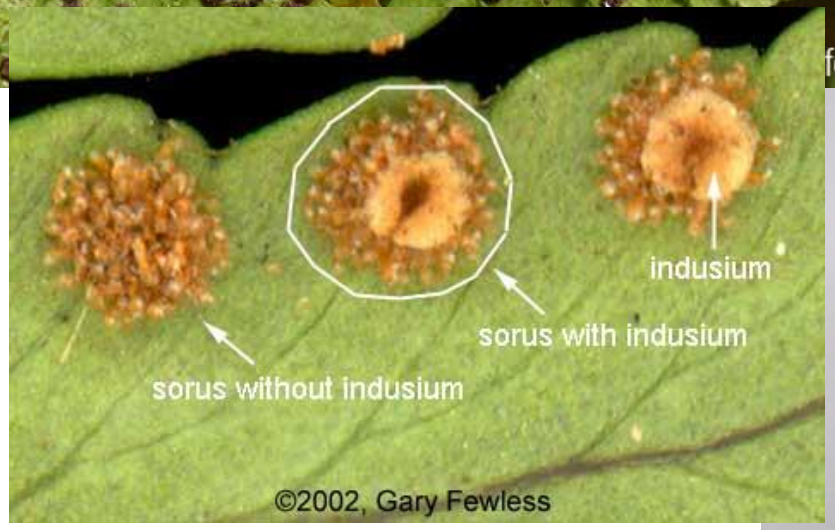
Fern Structures & Adaptations

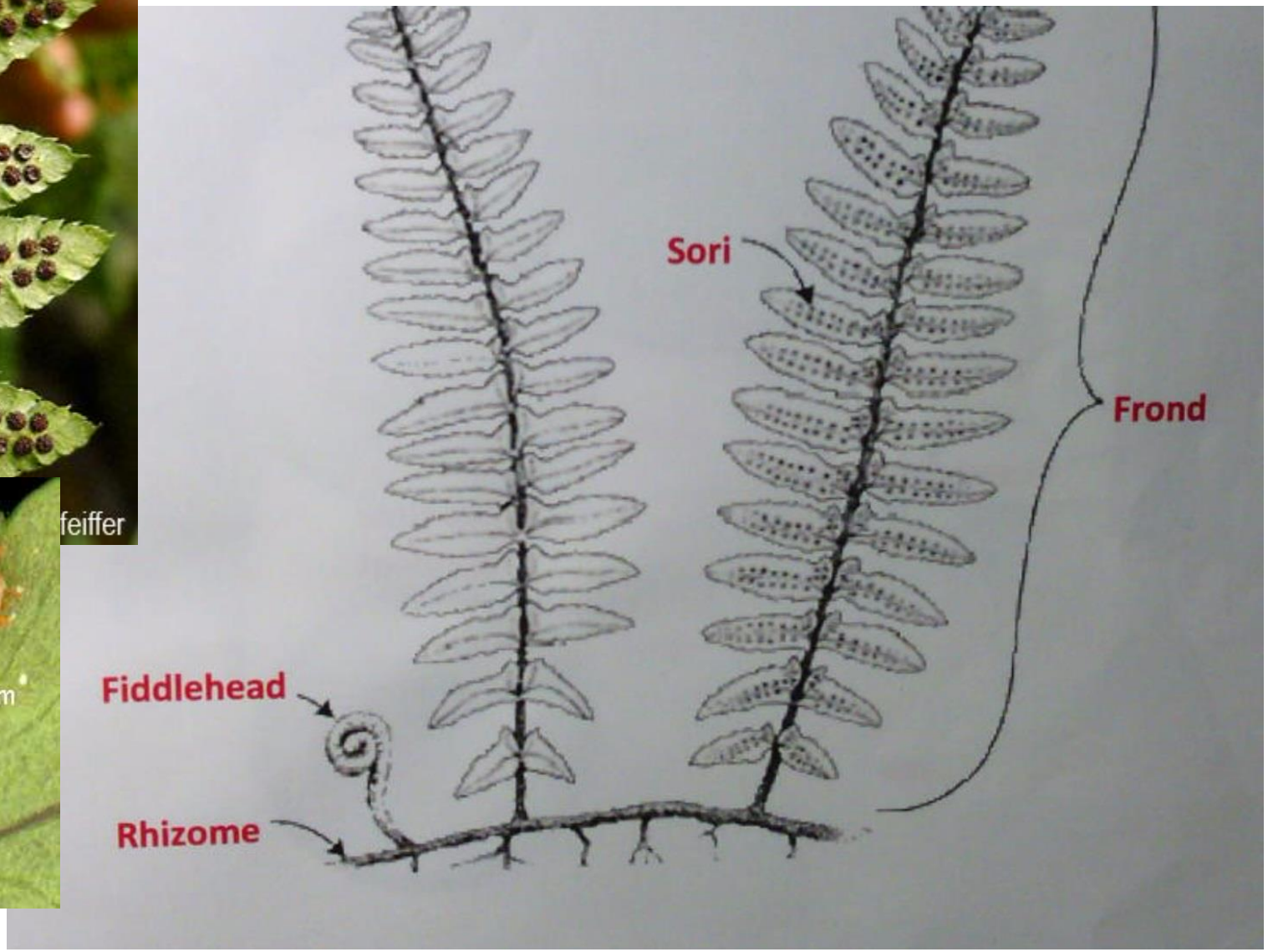
Booklet page 8; textbook page 644



- Contains vascular tissue
- Reproduce via spores…no seeds
- Must be in a wet environment to help fertilization


feiffer

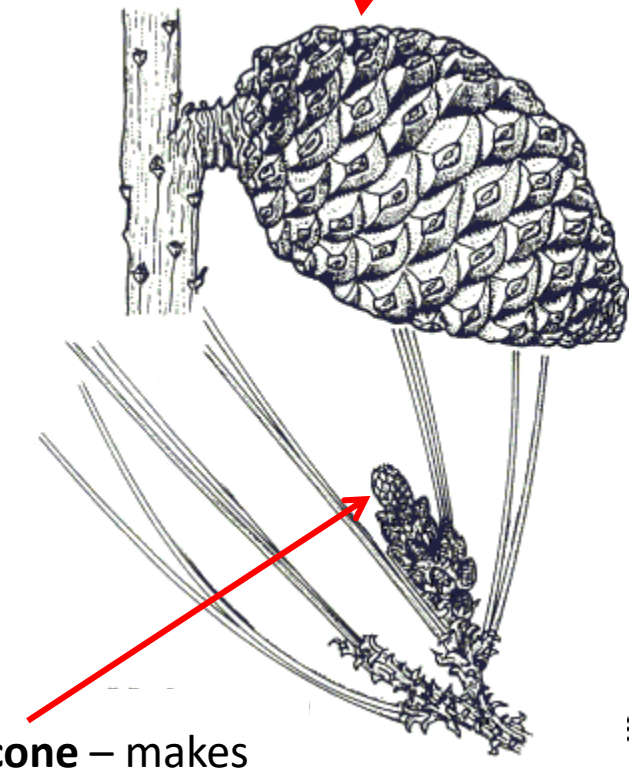

indusium
sorus with indusium
sorus without indusium
©2002, Gary Fewless


Sori
Frond
Fiddlehead
Rhizome

Gymnosperm Reproductive Structures

Booklet page 9; Txt 648-649

- Gymnosperms have separate male and female gametophyte making structures (Cones)



Female cone – makes the ovum that develop into seeds

Male cone – makes the pollen that contains sperm to fertilize the ovum

What structural adaptation allowed the gymnosperms to proliferate (spread across the land)?
[use the images to give you an idea]

Gymnosperm Structures & Adaptations

- Gymnosperms are the first seed bearing plants.
- They reproduce using pollen and ovum
- Pollen is the male gametophyte (similar to sperm in animals but is carried by wind)

Not in book

Gymnosperms are wind pollinated

- This is how gymnosperms release pollen

- Hypothesize as to the advantage producing such huge numbers of pollen grains…..

- Most of it ends up missing female structures
- *Why would this reproductive tactic be less useful as new, more efficient plants evolved?*

Booklet page 10; Txt 666

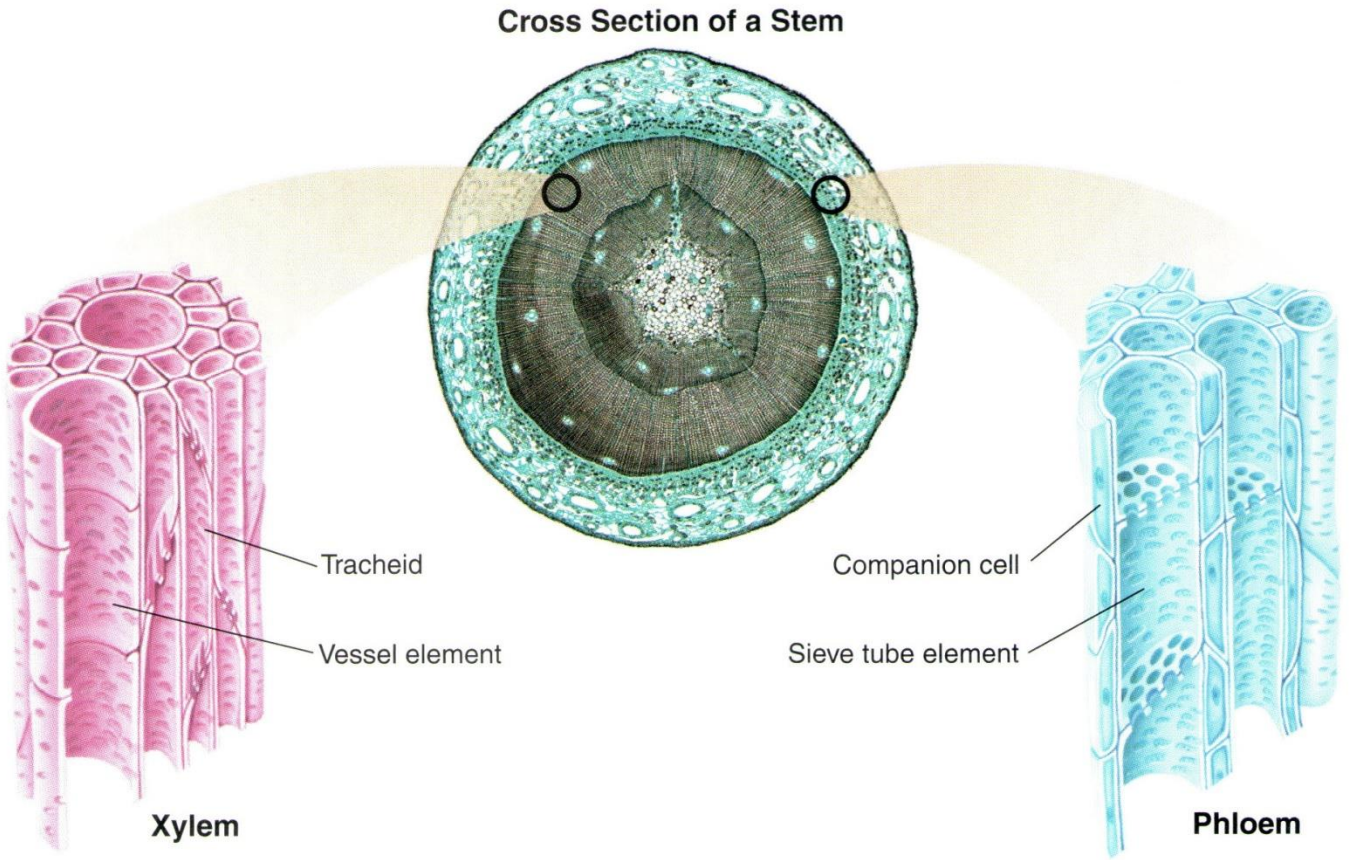
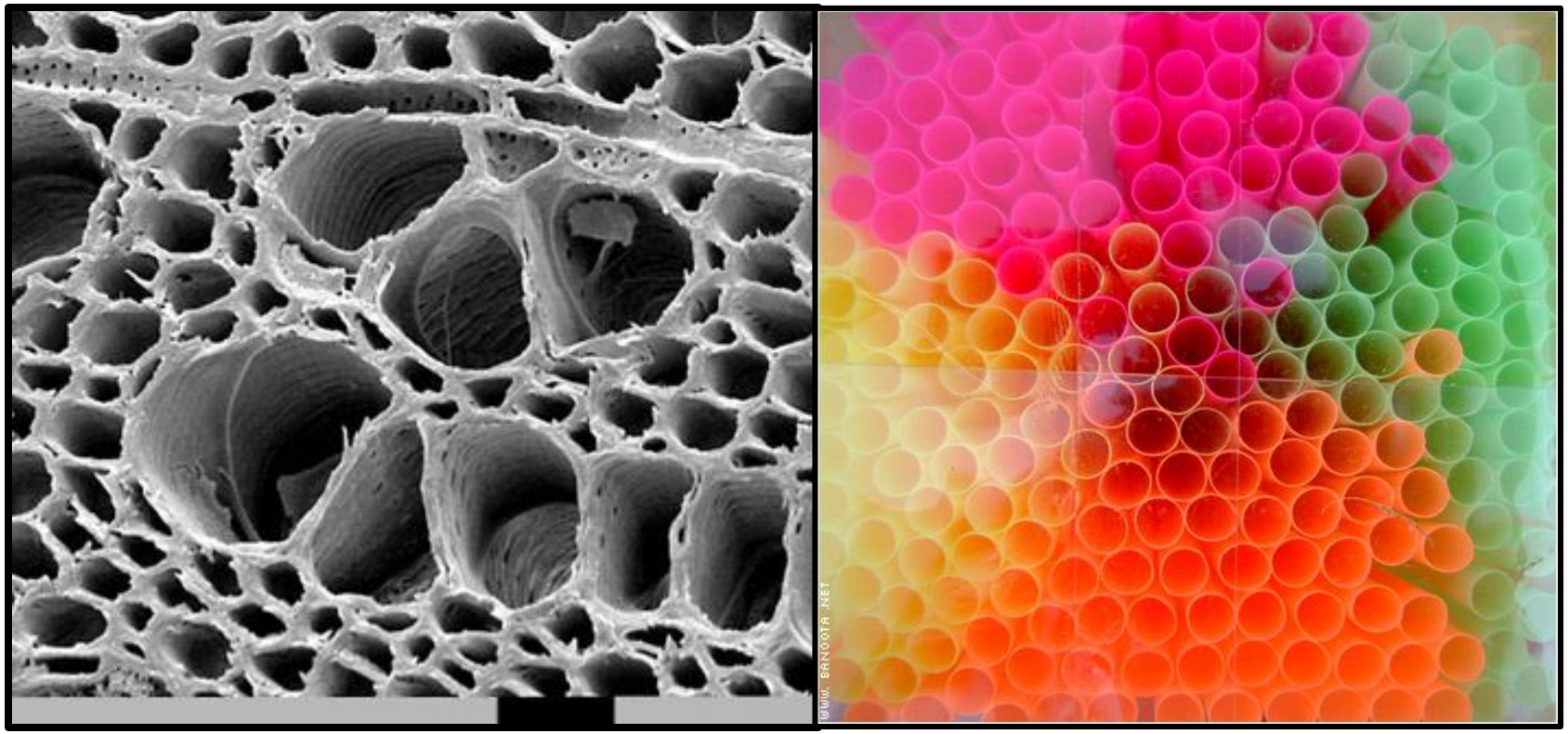


Figure 23–3 Vascular tissue is made up of several different types of cells. Xylem consists of tracheids and vessel elements. Phloem consists of sieve tube elements and companion cells. Xylem tissue (left) conducts water from the roots to the rest of the plant. Phloem tissue (right) conducts a variety of materials, mostly carbohydrates, throughout a plant.

Vascular Tissue Xylem & Phloem

Not in booklet

Xylem cells are arranged like a bunch of straws.



Movement of Materials through Vascular Tissue

Booklet page 11; Txt 687

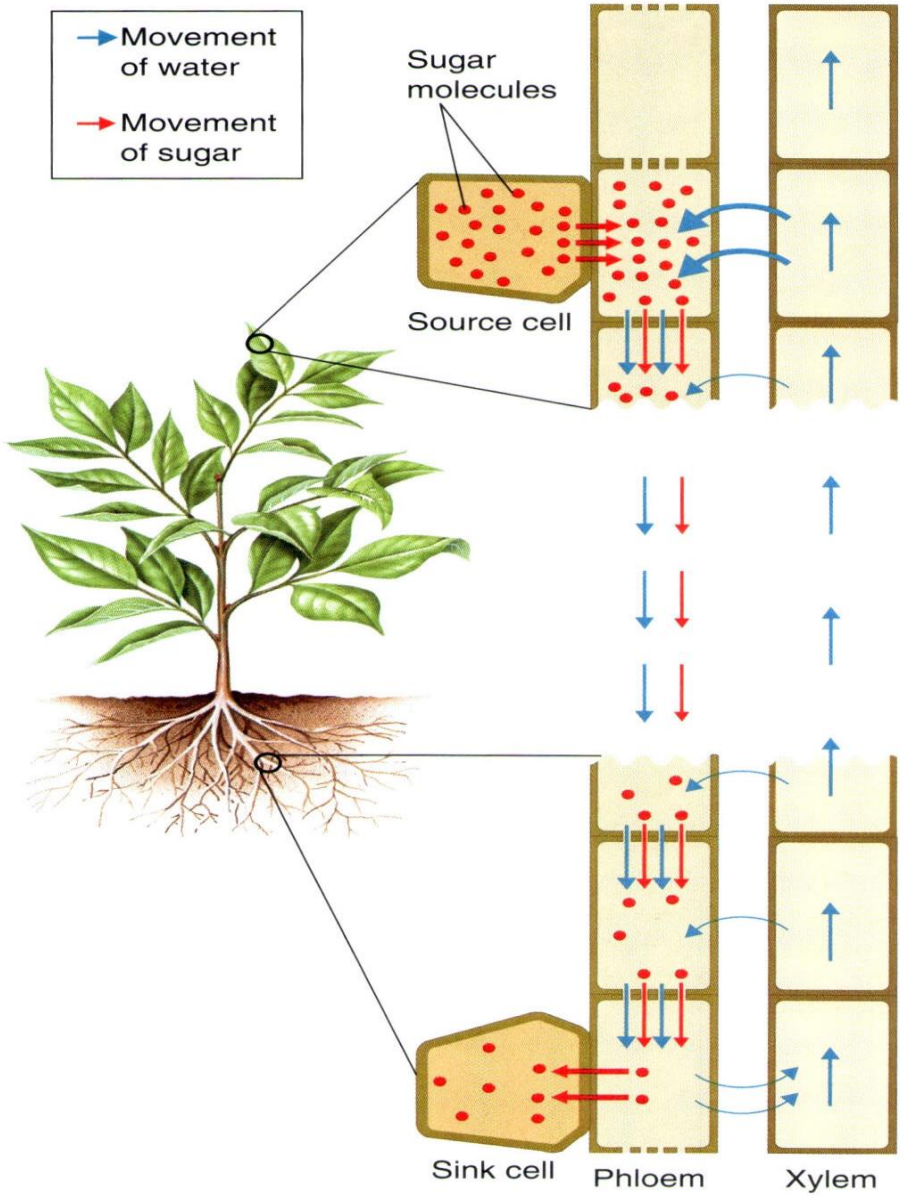
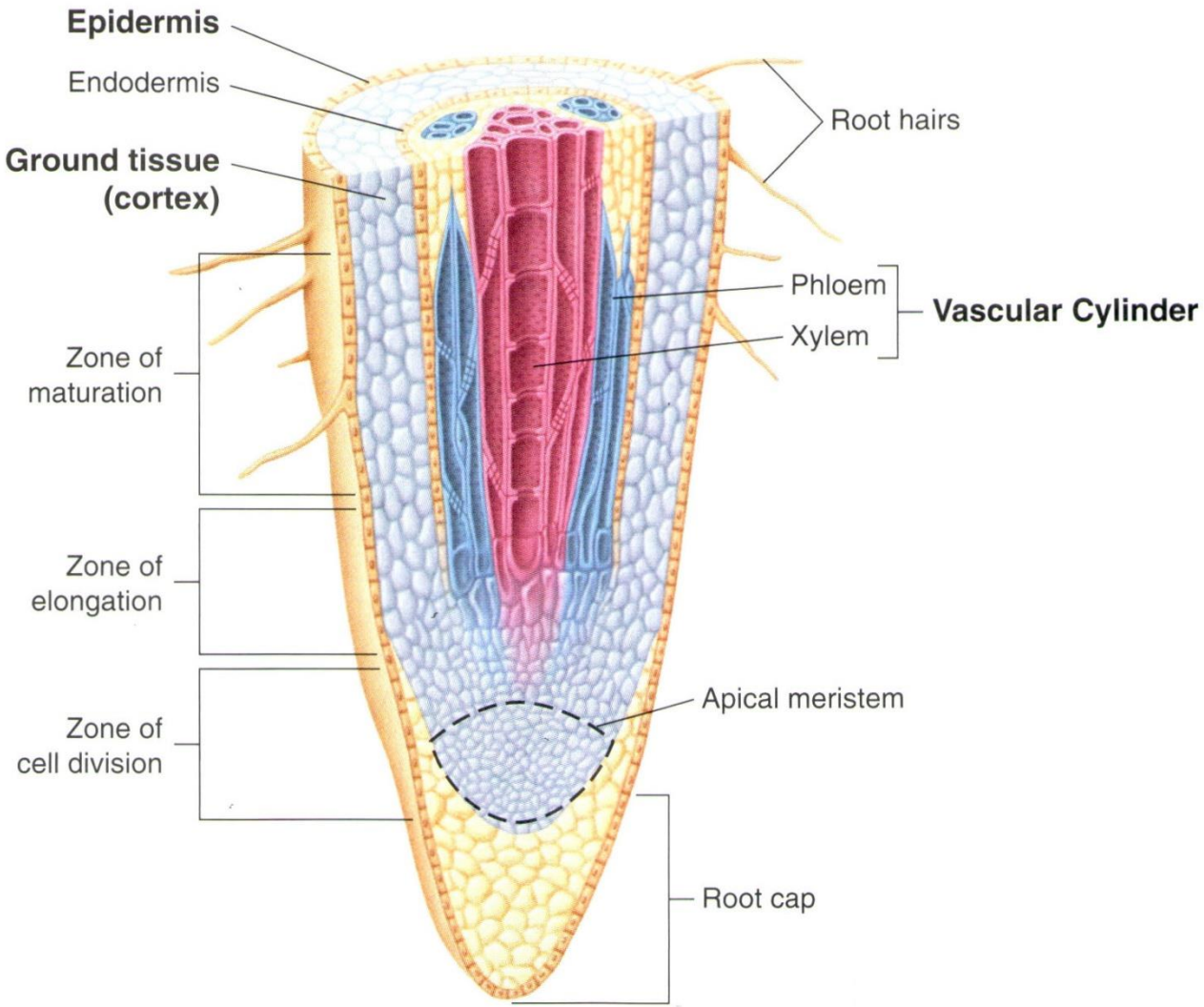


Figure 23–24 The diagram shows the movement of sugars and water throughout the phloem and xylem as explained by the pressure-flow hypothesis. Materials move from a source cell, where photosynthesis produces a high concentration of sugars, to a sink cell, where sugars are lower in concentration. **Interpreting Graphics** *What is the source of the water that forces nutrients through phloem tissue?*

Root Adaptations and Meristem Tissue

Booklet page 12; Textbook p. 670

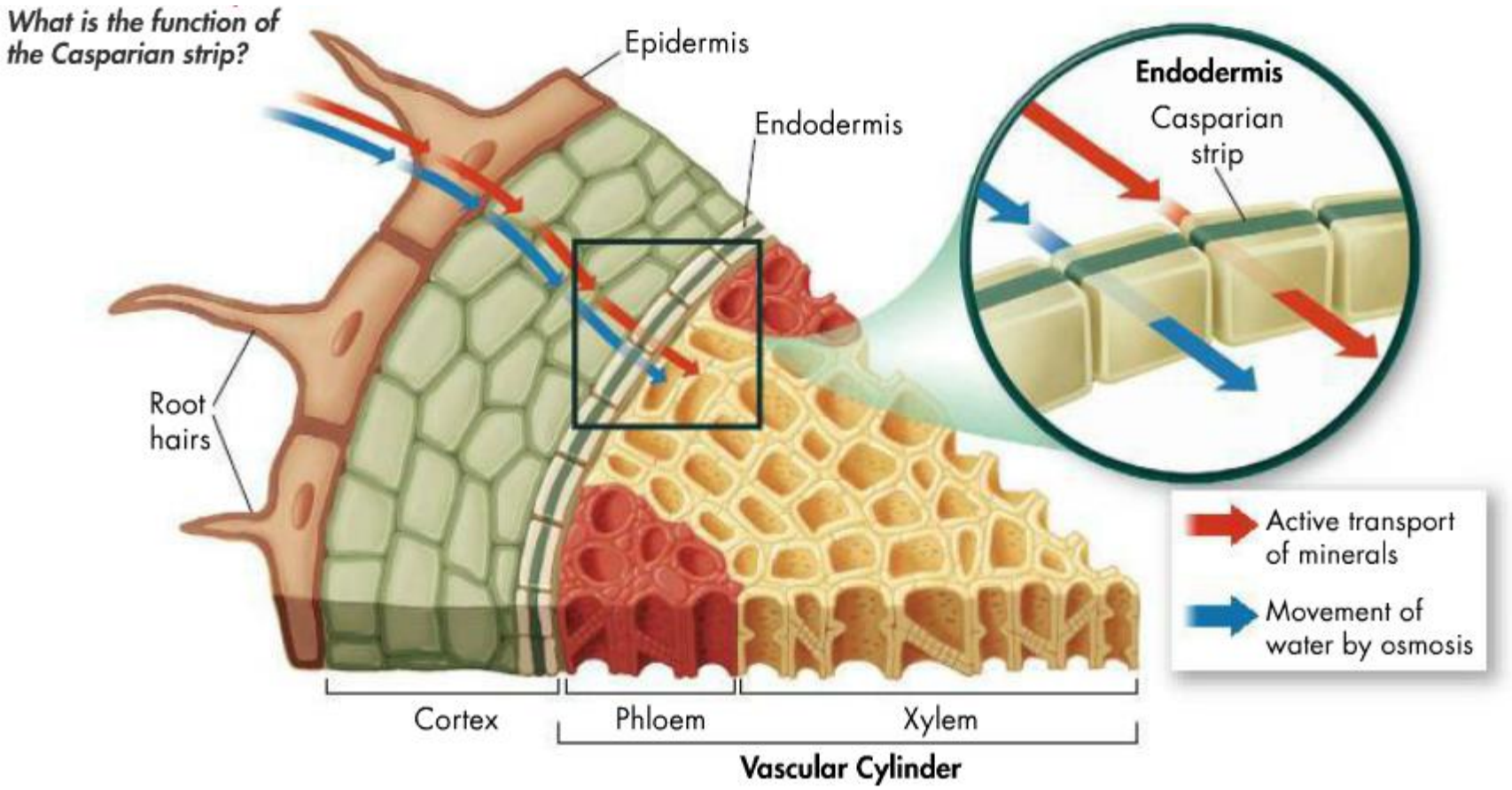


▲ **Figure 23–7** A root consists of a central vascular cylinder surrounded by ground tissue and the epidermis. Compare how cells in different regions of the root are structurally specialized for different functions. Root hairs along the surface of the root aid in water absorption. Only the cells in the root tip divide. In the area just behind the root tip, the newly divided cells increase in length, pushing the root tip farther into the soil. The root cap, located just ahead of the root tip, protects the dividing cells as they are pushed forward. Dicot roots, such as the one shown in the cross section, have a central column of xylem cells arranged in a radiating pattern. **Inferring** *How are root hairs structurally specialized?*

In what zone do we see that cells are differentiating?

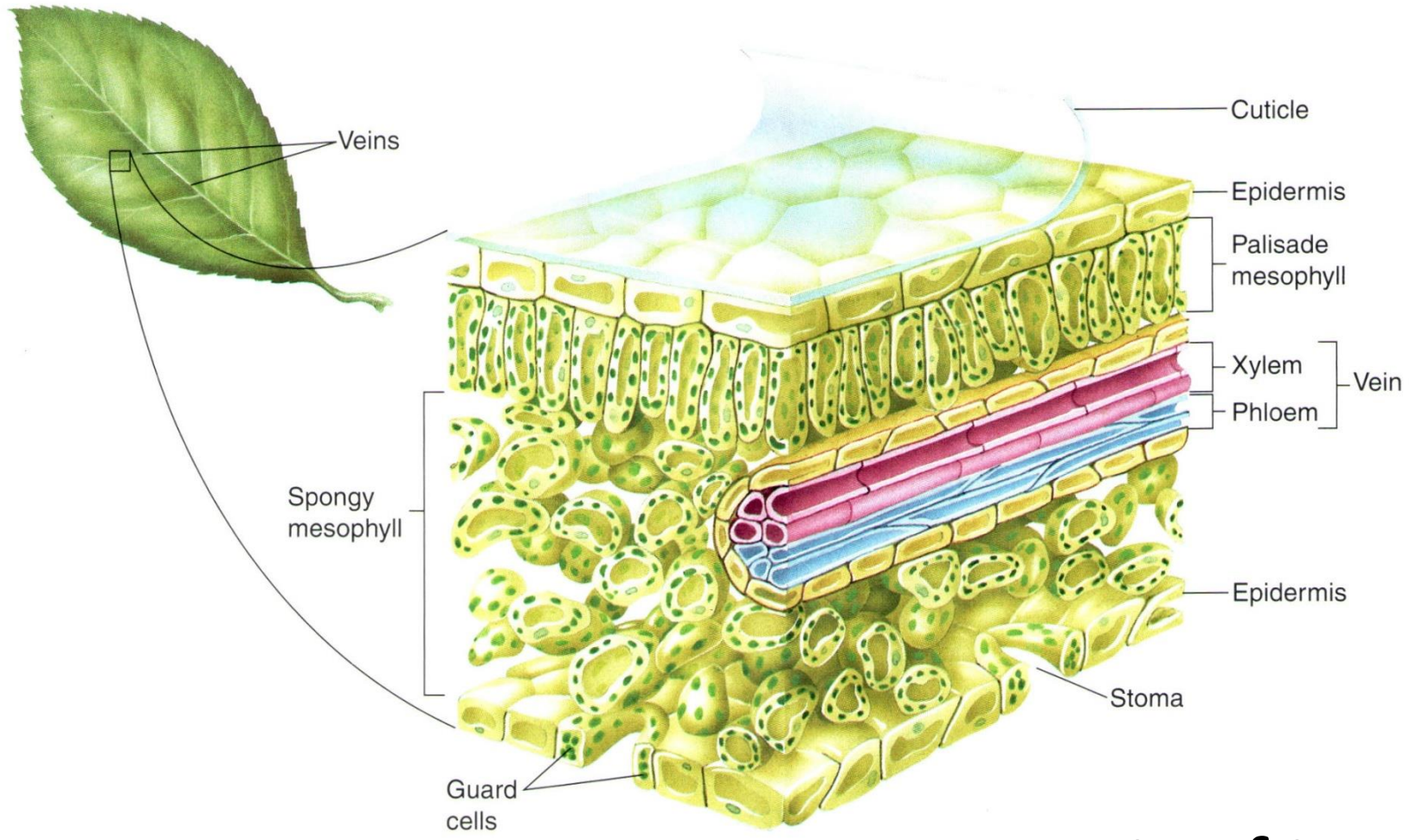
Movement of water into plant tissues

Booklet page 13; Txt 672



How does the adaptation of root hairs help the plant to take up water?

Booklet page 14; Txt 681



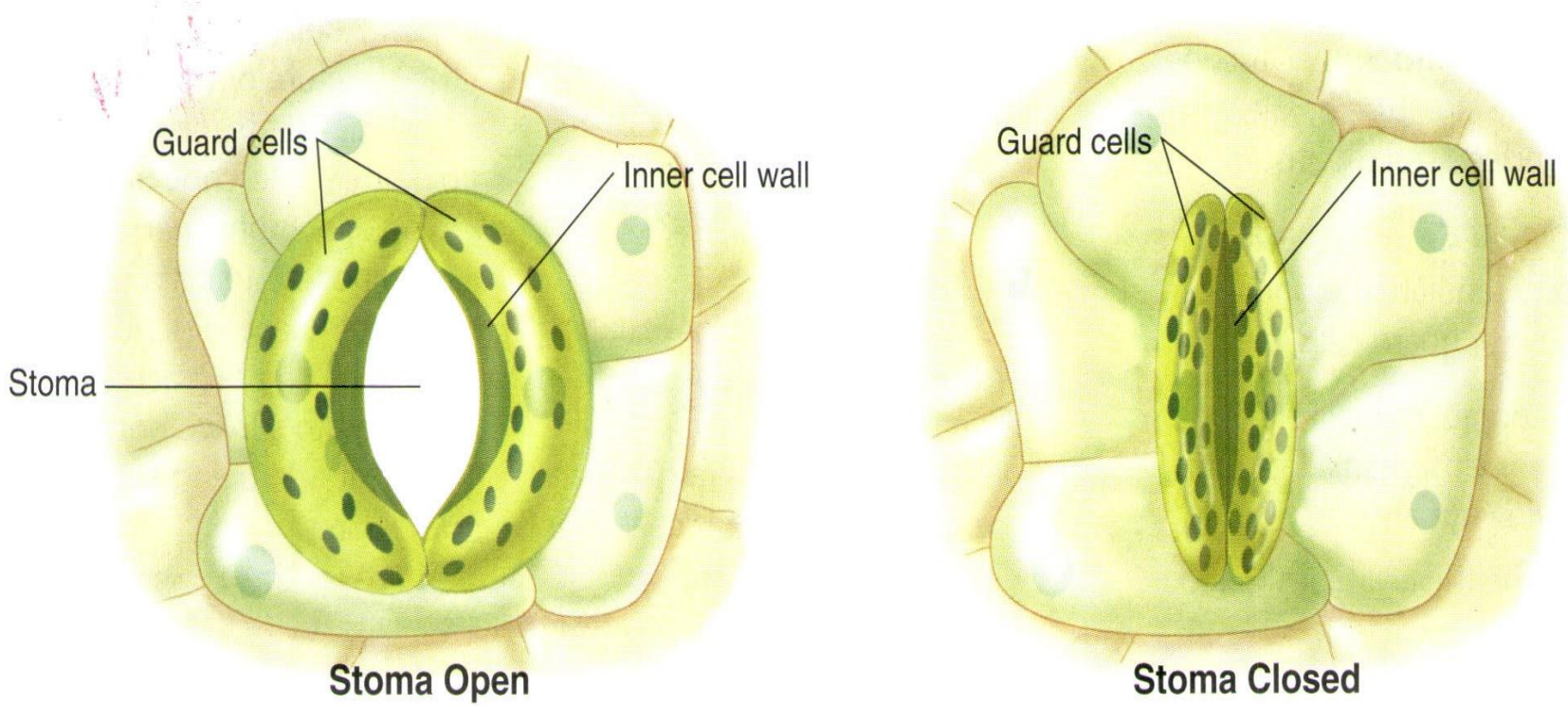
▲ **Figure 23–18** Leaves **absorb light and carry out most of the photosynthesis in a plant.** Some of the most important manufacturing sites on Earth are found in the leaves of plants. The cells in plant leaves are able to use light energy to make carbohydrates. Compare the structure of the different kinds of cells in a leaf.

Leaf Layers & Structures

Why do you suppose that a modern leaf structure (tight column cells on the top layer and spongy air space on the bottom layer) help plants be successful?

Guard Cells & Stomata – Stoma

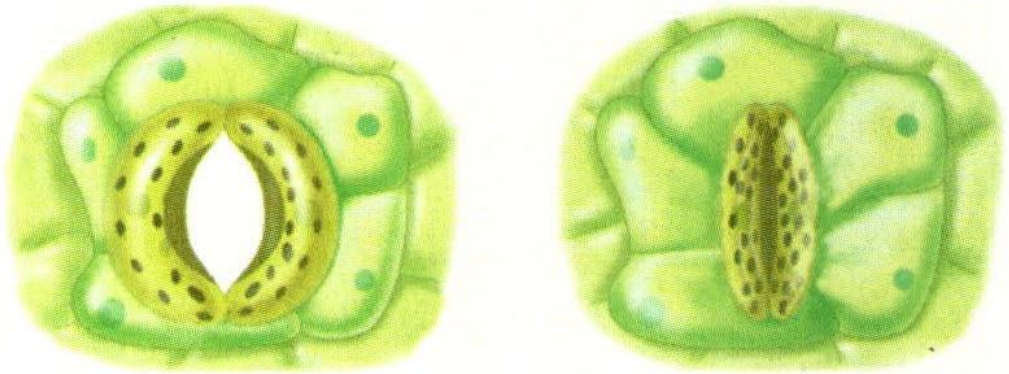
Booklet page 15; Txt 682



Why do plants open their stomata?
Why do plants close their stomata?
When a plant closes their stomata, what is the negative consequence?

Understanding

Not in booklet



Stoma Open

Stoma Closed

As shown in the diagram above, stomata can open and close as needed. What overall process in the plant is dependent on this ability of the stomata?

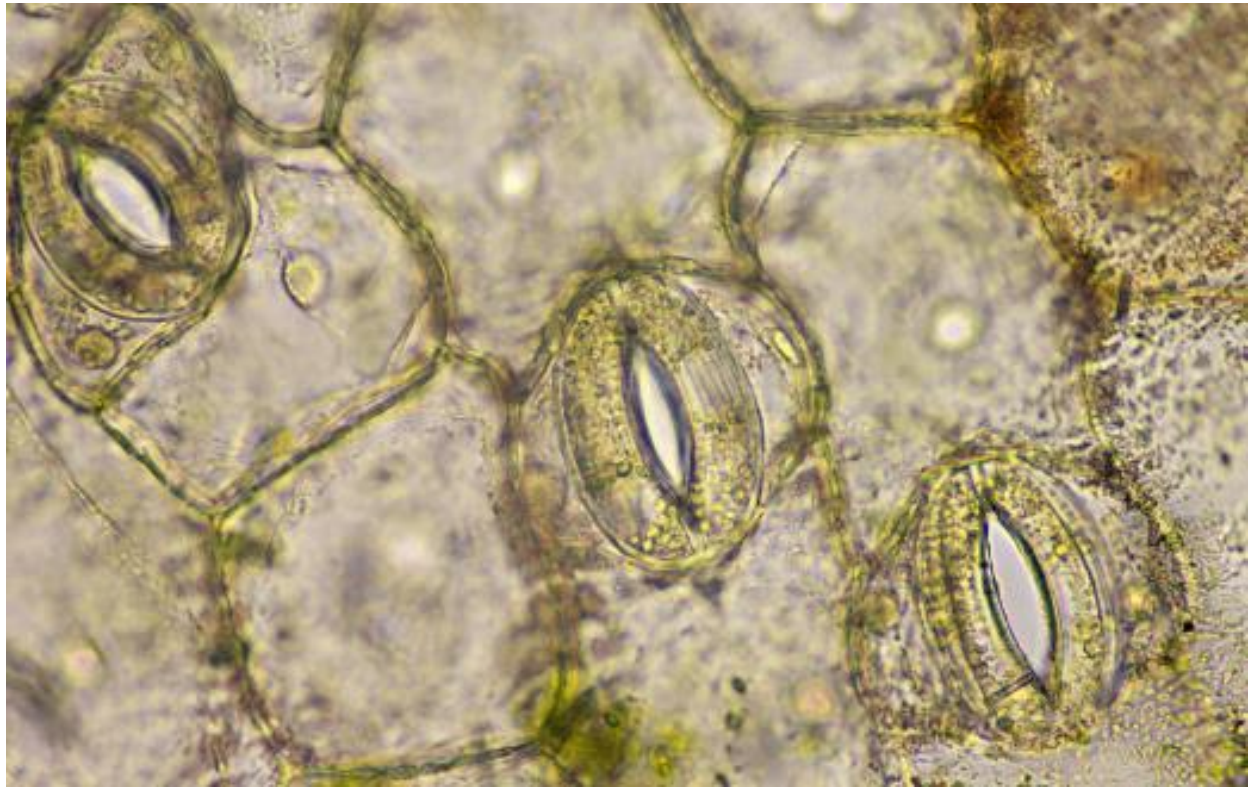
A Storage of energy

B Repair of tissues

C Synthesis of molecules

D Maintenance of homeostasis

Stomata under the scope



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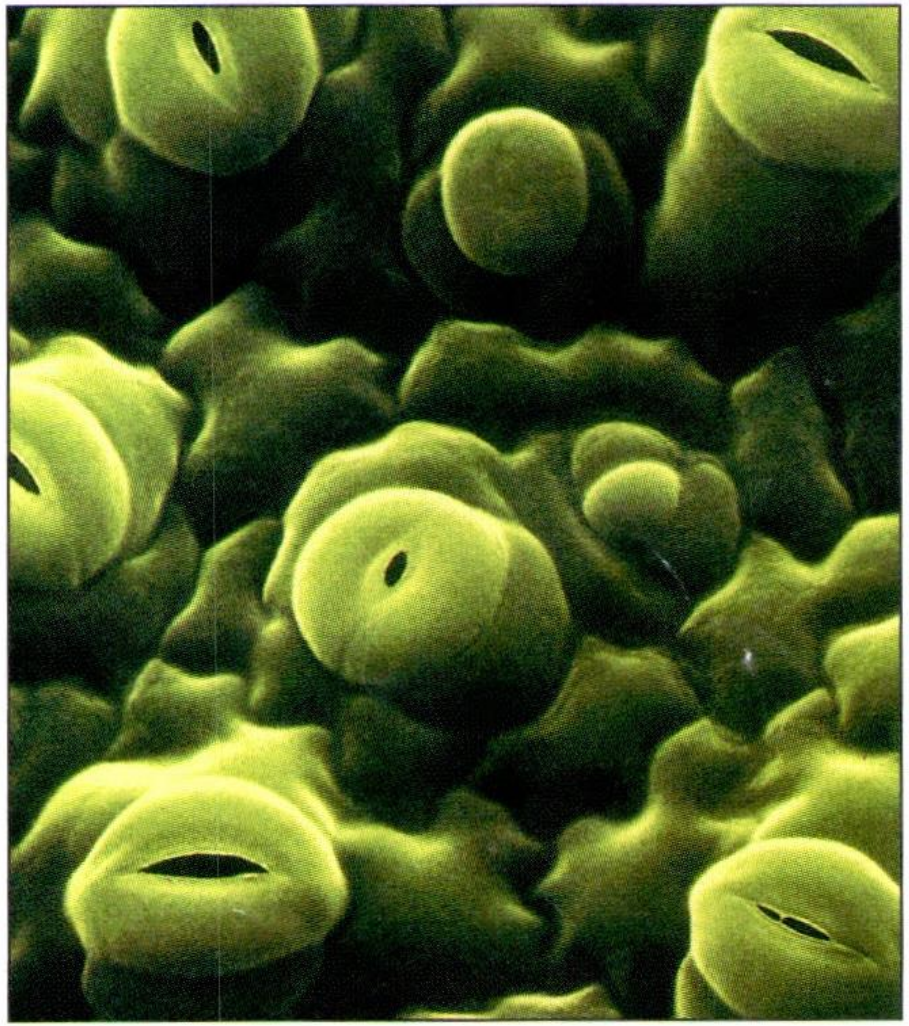
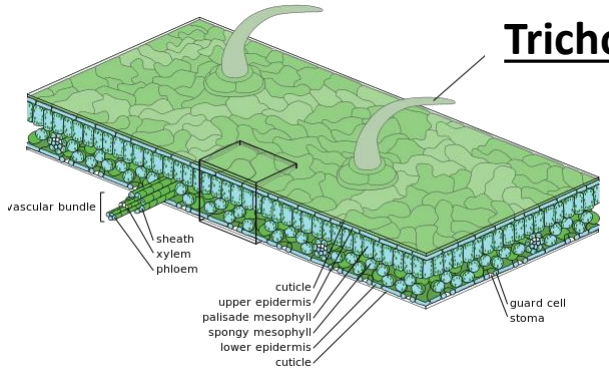


(magnification: 420×)

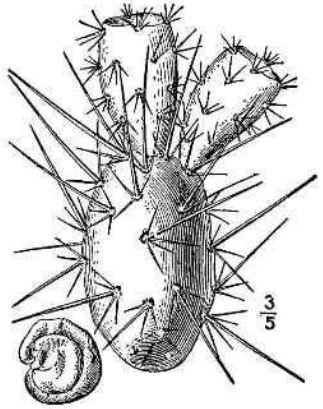
Figure 23–19 **Plants regulate the opening and closing of their stomata to balance water loss with rates of photosynthesis.** A stoma opens or closes in response to the changes in pressure within the guard cells that surround the opening. When the guard cells are swollen with water (bottom, left), the stoma is open. When the guard cells lose water (bottom, right), the opening closes, limiting further water loss from the leaf.

Leaf Adaptations

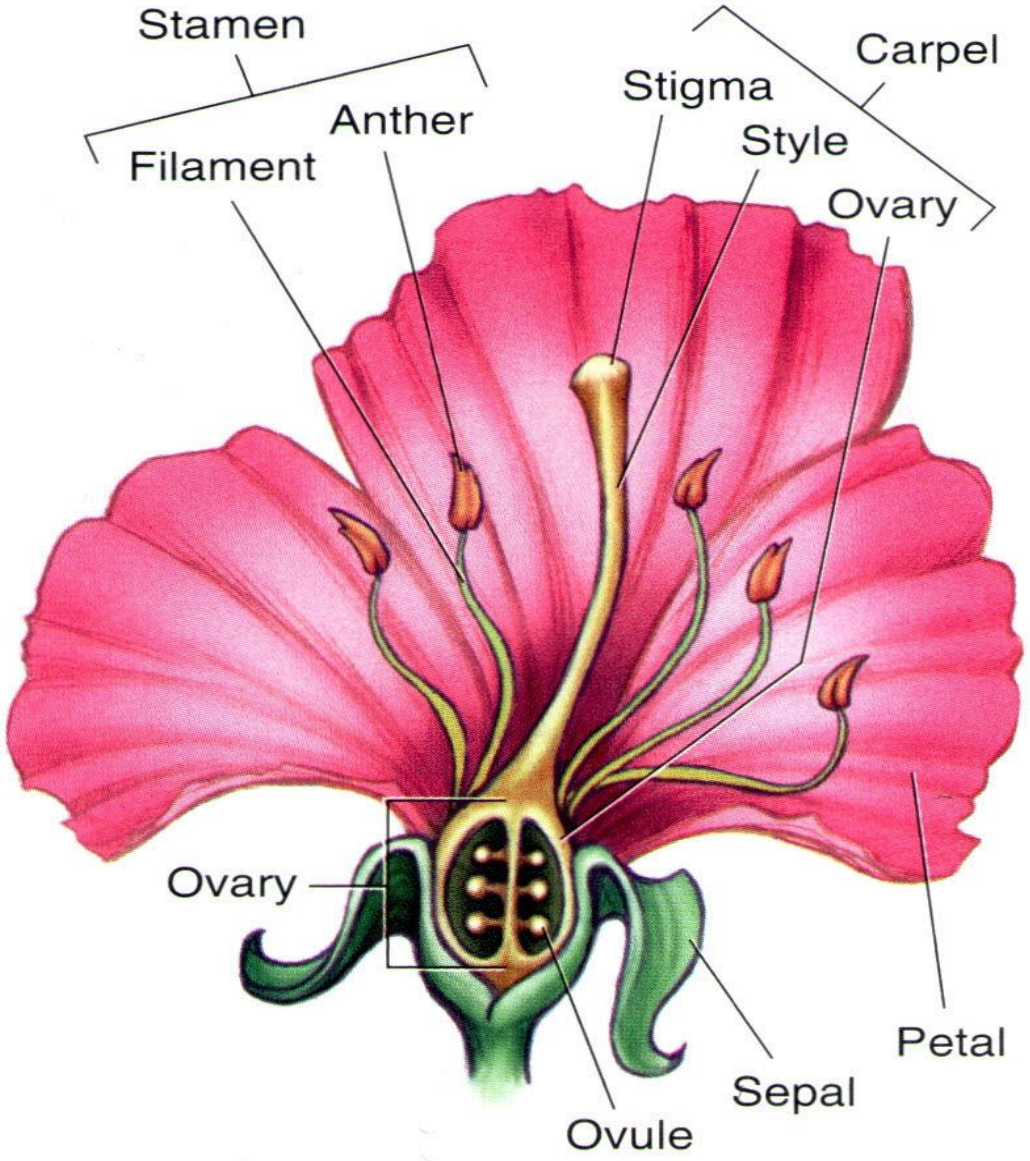


Trichomes – multiple purposes such as: help to trap moisture around the leave surface, ward off predators, etc

Spines – modified leaves to protect instead of photosynthesize



Needles – small compact leaves that can resist very cold weather and stay green all year



- Parts of a typical COMPLETE flower.

▲ **Figure 24–5** This diagram shows the parts of a typical flower. The flowers of some species, however, may not have all the parts shown here. **Flowers are reproductive organs that include sepals, petals, stamens, and carpels.**

Flower Lab

Booklet page 18-19, Dissection done in class

Structure	Number	Description (color, length, shape)	Function	Drawing
Sepals				
Petals				
Stamens				
Anthers				
Pollen grains				
Carpel (pistil)				
Stigma				
Style				
Ovary				
Ovule				

♂

♀

Seed Dispersal Methods

Types of Seed Dispersal:

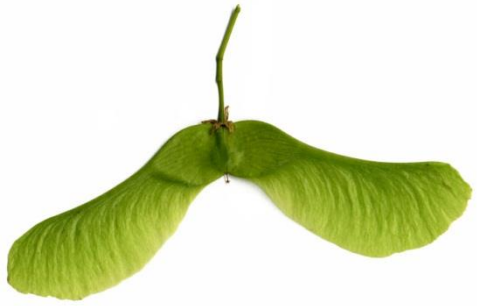
- Wind Dispersal
- Water Dispersal
- Animal External (burrs)
- Animal Internal (fruits)

Seed Dispersal Methods

Booklet page 20; Txt 705

Wind dispersal – adaptations on seed to be moved by wind or air currents

Ex: dandelion seeds, maple seeds, evergreen seeds



Not in booklet

Figure 24–12 **Wind-dispersed seeds are typically lightweight.** Tumbleweed plants, which live in a hot, dry, and windy environment, release small seeds as the plants are blown along open stretches of land. **Inferring** *How do the structural adaptations of tumbleweeds enable them to survive?*

- What adaptation do tumble weeds have that facilitate production of offspring?

Seed Dispersal Methods

Water dispersal – adaptations on seed to be moved by flowing water

Ex: coconut seeds, mangrove seeds

Seed Dispersal Methods

Animal (external) – adaptations on seed to catch in the coats of animals for transport

Ex: sticker burrs,

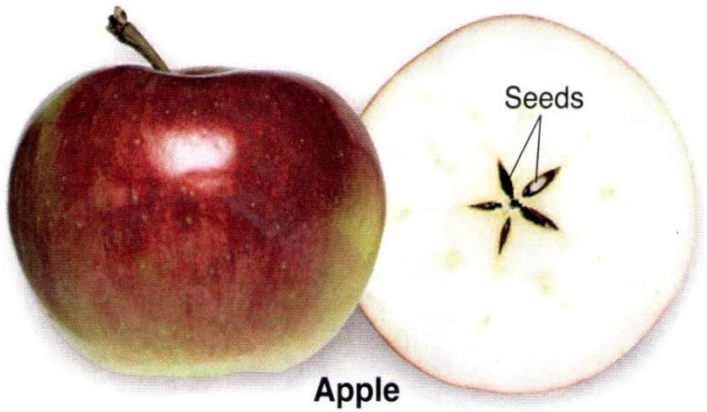
These seeds are like velcro to our clothes

Seed Dispersal Methods

Booklet page 22; Txt 705

Animal (internal) – seeds encased in fruits that eaten and deposited by animal movement

Ex: all edible fruits



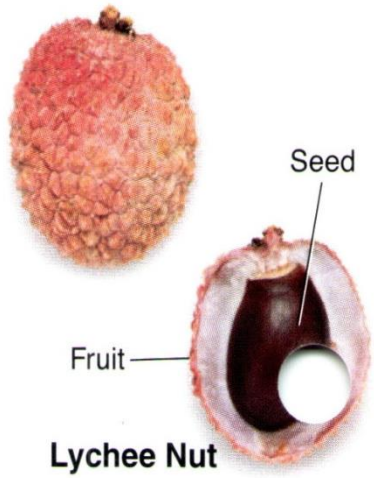


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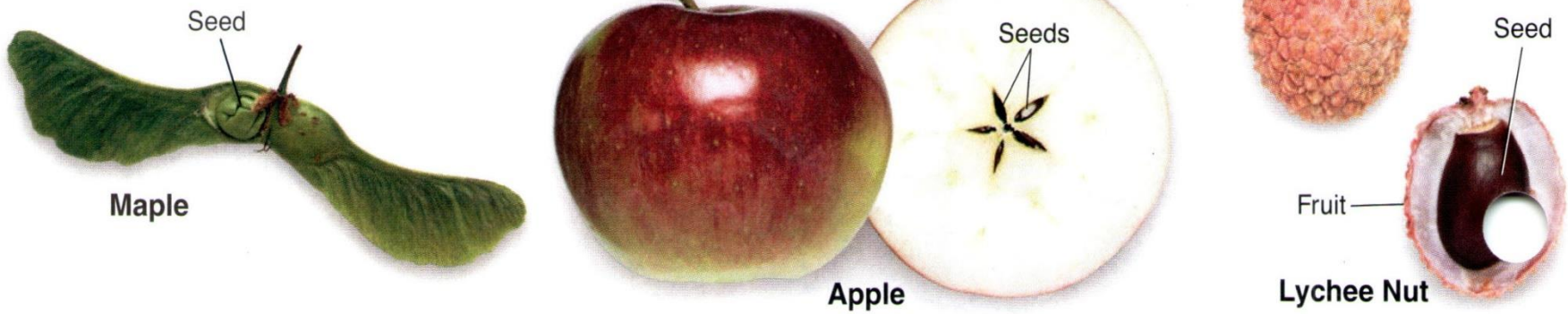
Figure 24–10 As seeds mature, **the ovary walls thicken to form a fruit that encloses the developing seeds.** Like the flowers from which they develop, fruits vary in structure. They can contain one seed, as in the lychee nut, or several, as in the apple. Fruits also have different amounts of tissue, which often relates to the mode of seed dispersal.

CHECKPOINT *What is a fruit?*

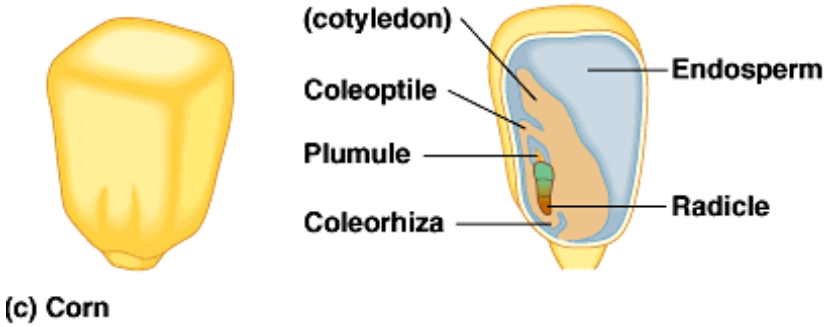


- What is a fruit?
- What is it’s purpose?

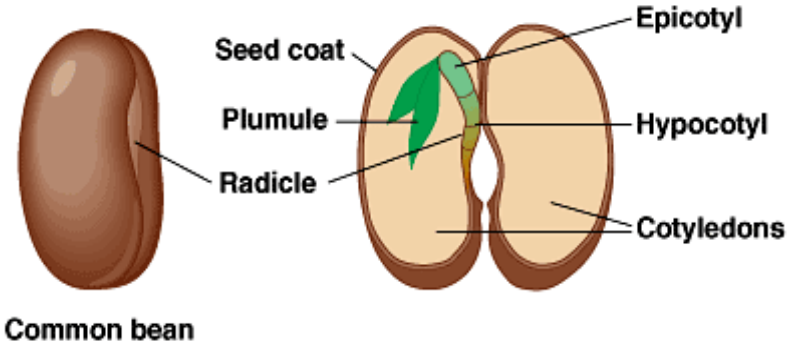
Germination of Seeds: monocot vs dicot

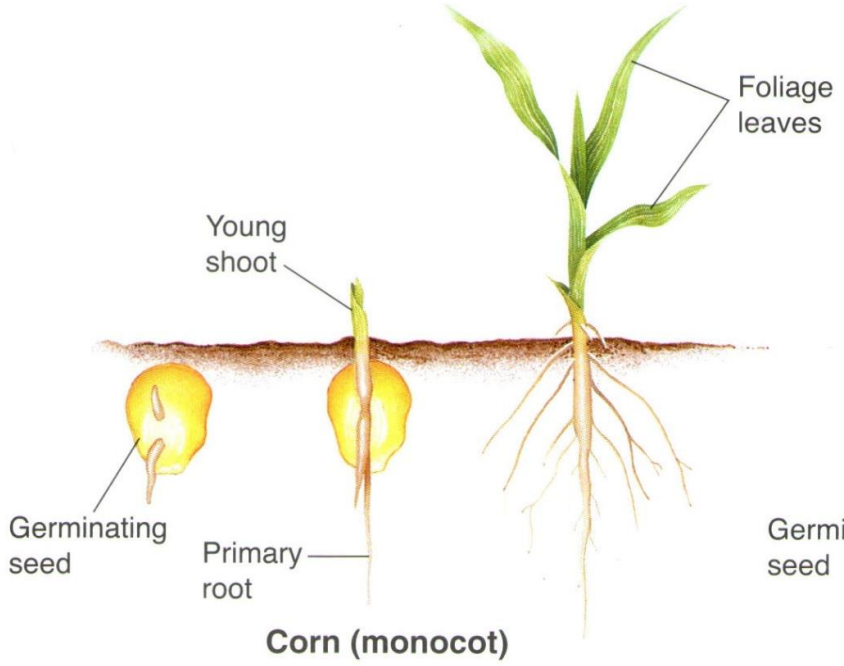
Booklet page 21; Txt 707

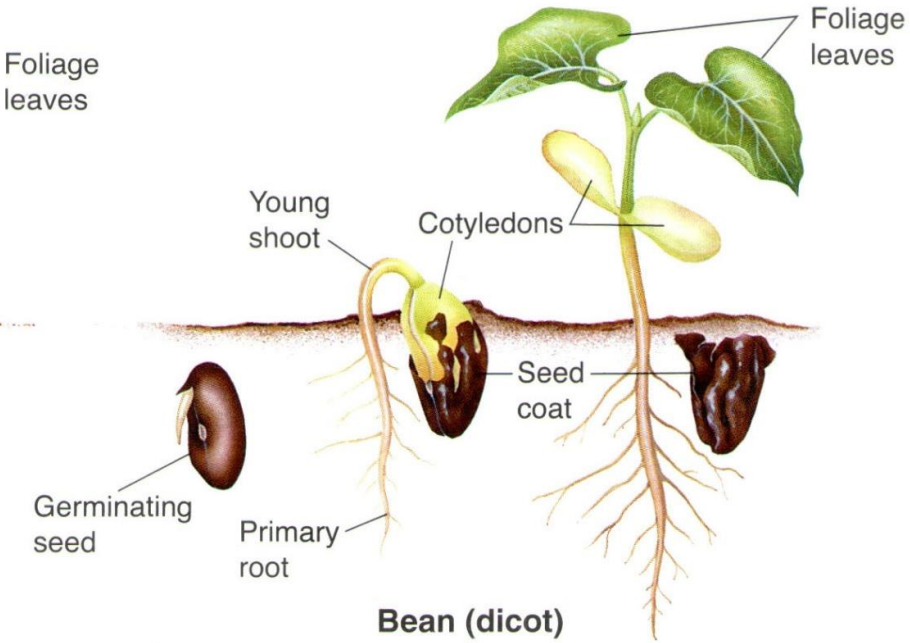
Monocotyledon



Dicotyledon



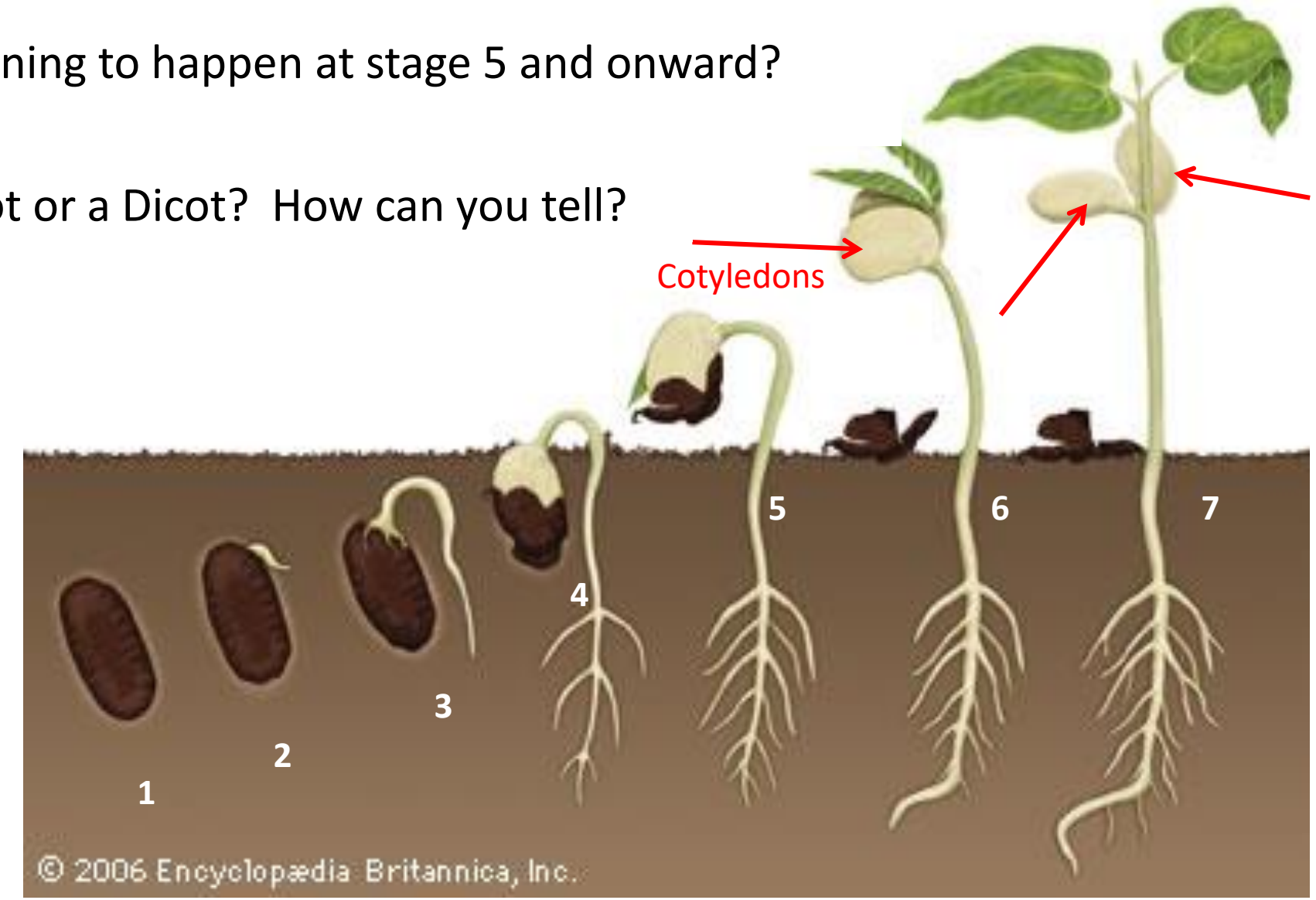




A. Through what cellular process is the plant getting it's energy at stages 1-4?

B. What process is beginning to happen at stage 5 and onward?

C. Is this plant a Monocot or a Dicot? How can you tell?



Tropism

- **Tropism**: growth of plant parts in the direction of or away from the direction of a stimulus

- Ex: phototropism, gravitropism, thigmotropism

http://plantsinmotion.bio.indiana.edu/plantmotion/starthere.html

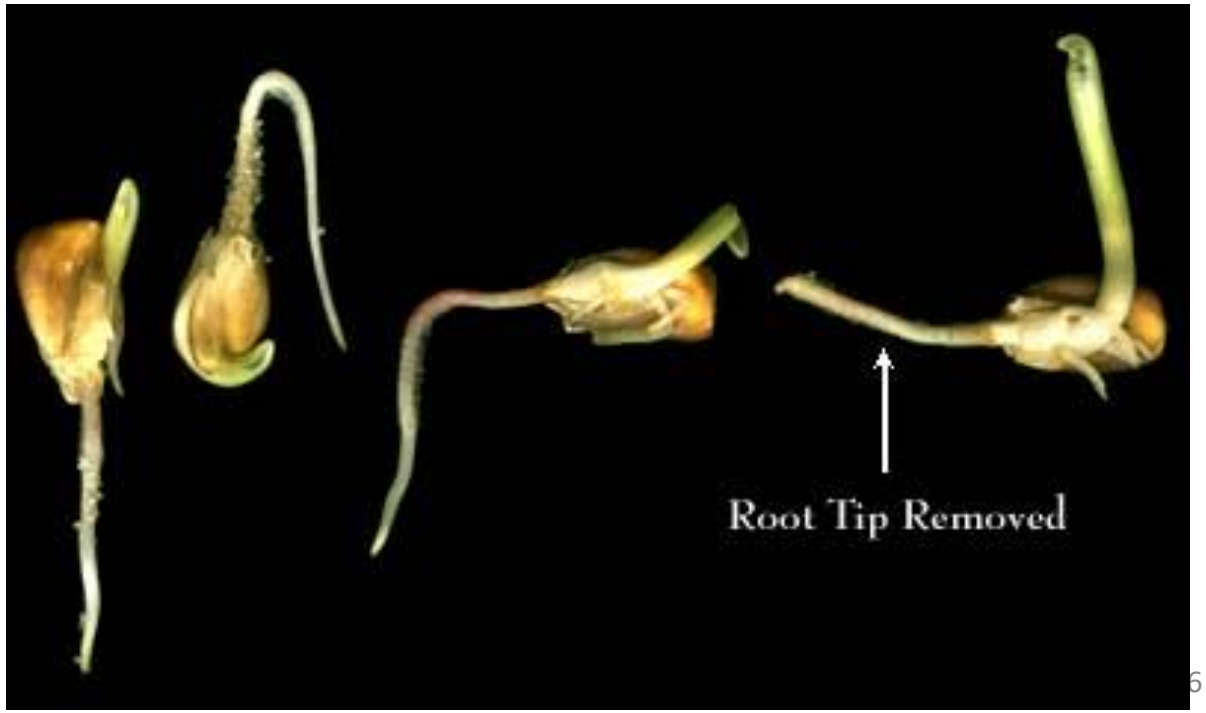
Phototropism

- Growth response toward a light stimulus
- Phototropism = move toward light
- Ex: sunflower

Gravitropism/Geotropism

Booklet page 22; Txt 712

- Gravitropism (or geotropism)
- toward earth's center
- Ex: roots (positive) & stems (negative)



Thigmotropism

- Response of plants to touch
- Toward a support or something "touched"

- **<u>Tendrils</u>**: cellular growth near leaf base that helps the leaves attach to substrate
- Ex: tendrils on a climbing vine

Venus Fly Trap

- Thigmotropism in a Venus fly trap 3 min Venus Fly Trap
- Thigmotropism in Mimosa-Sensitive Plant
- Phototropism by Cameron Wright

Plant Hormones

Booklet pg 23; Txt 709

Name	Affect on plant
Gibberellin	Stimulates stem elongation, pollen development, pollen tube growth, fruit growth and seed development
Cytokinin	Regulates cell division in shoots and roots, promotes movement of materials into sink tissues, stimulates seed germination
Ethylene	**Promotes ripening of fruits, promotes root hair formation**
Auxin	**Stimulates stem elongation, regulates development of fruit, important for photo- and gravitropism**
Abscisic Acid	Inhibits growth when needed, promotes seed dormancy, promotes programmed cell death to let leaves fall off

End of Booklet

Not in booklet

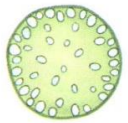
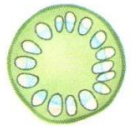
Bee covered in pollen

Not in Booklet

Comparing Monocots vs Dicots

Figure 22–25 Monocots and dicots are named for the number of seed leaves, or cotyledons, in the plant embryo. The table compares the characteristics of monocots and dicots.

Characteristics of Monocots and Dicots

	Monocots	Dicots
Seeds	Single cotyledon 	Two cotyledons 
Leaves	Parallel veins 	Branched veins 
Flowers	Floral parts often in multiples of 3 	Floral parts often in multiples of 4 or 5 
Stems	Vascular bundles scattered throughout stem 	Vascular bundles arranged in a ring 
Roots	Fibrous roots 	Taproot 

Flowers and seeds

- Flowers purpose is for sexual reproduction of the plant.
- Flowering plants are the most biologically successful land plants.
- Seeds contain
  - the embryo
  - a food source for the offspring
  - A seed coat for protection

vocabulary

- **Pollination** – transfer of the male pollen grains from one flower to another
- **Double fertilization** – 2 sperms are contained in each pollen tube
- **Zygote** – fertilized egg
- **Embryo** – developing offspring
- **Dissemination** - Spreading of seeds

- Flower Dissection Images follow…

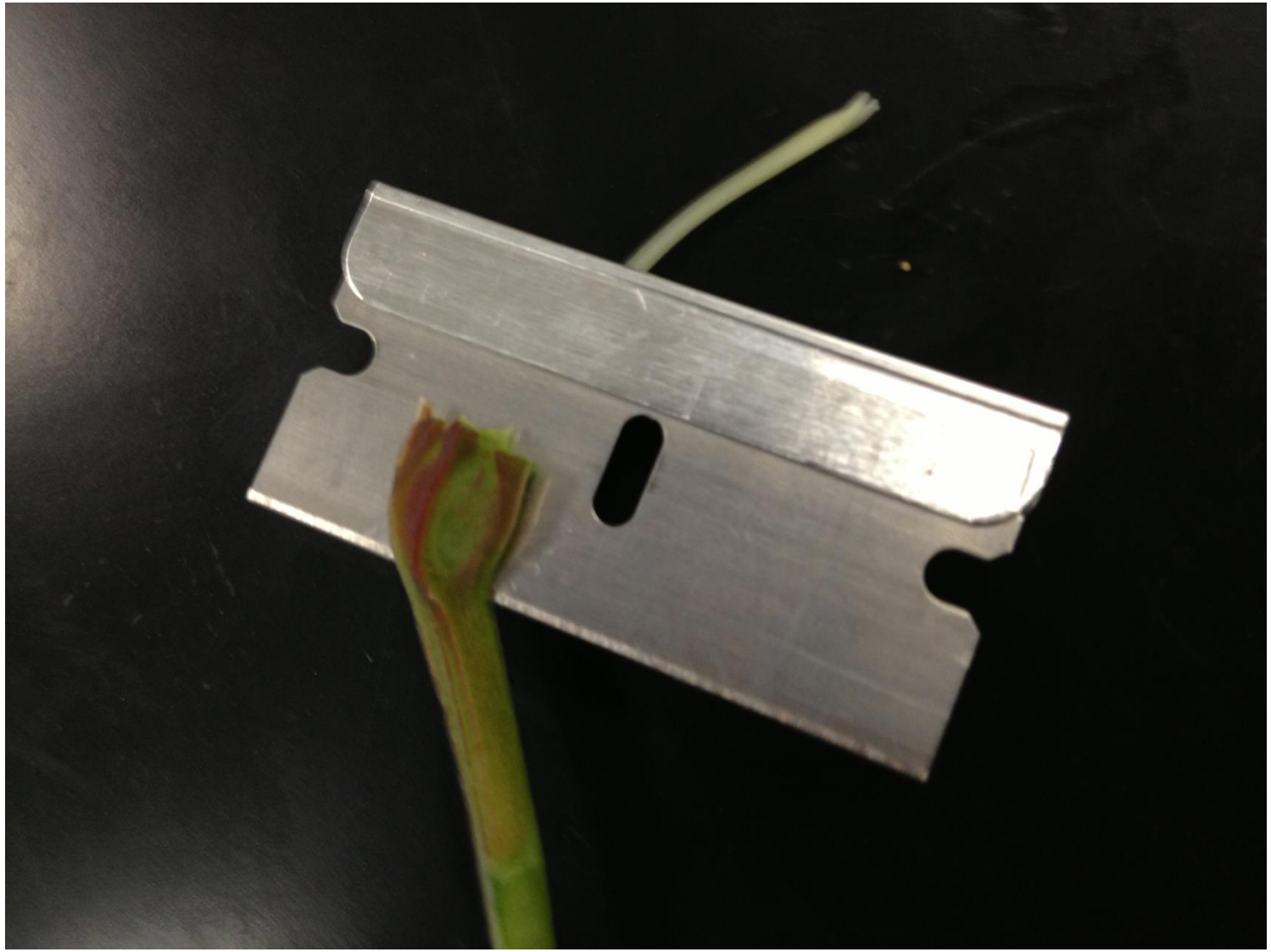
Petals

What parts remain?

Stamens

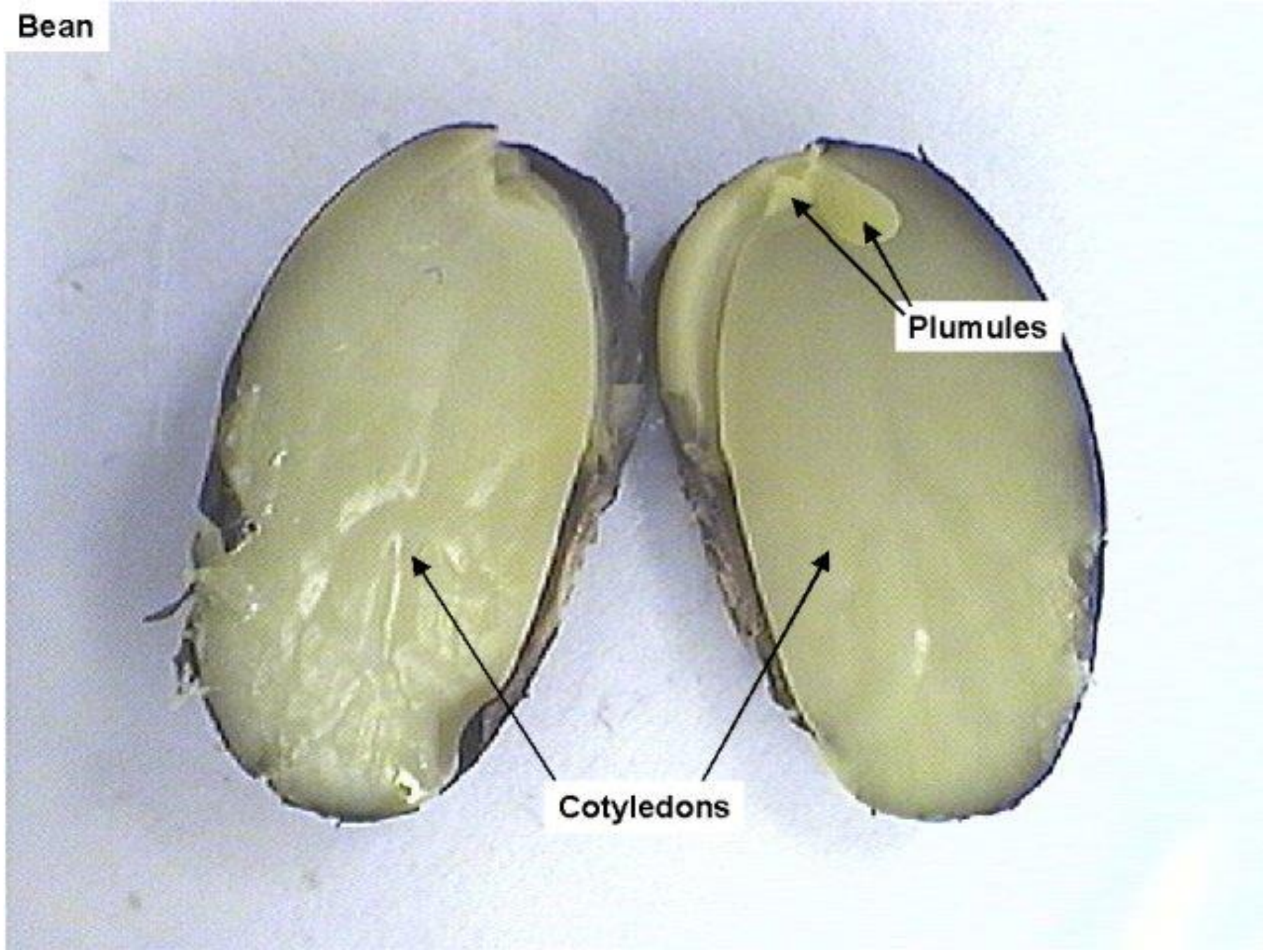
What parts remain?

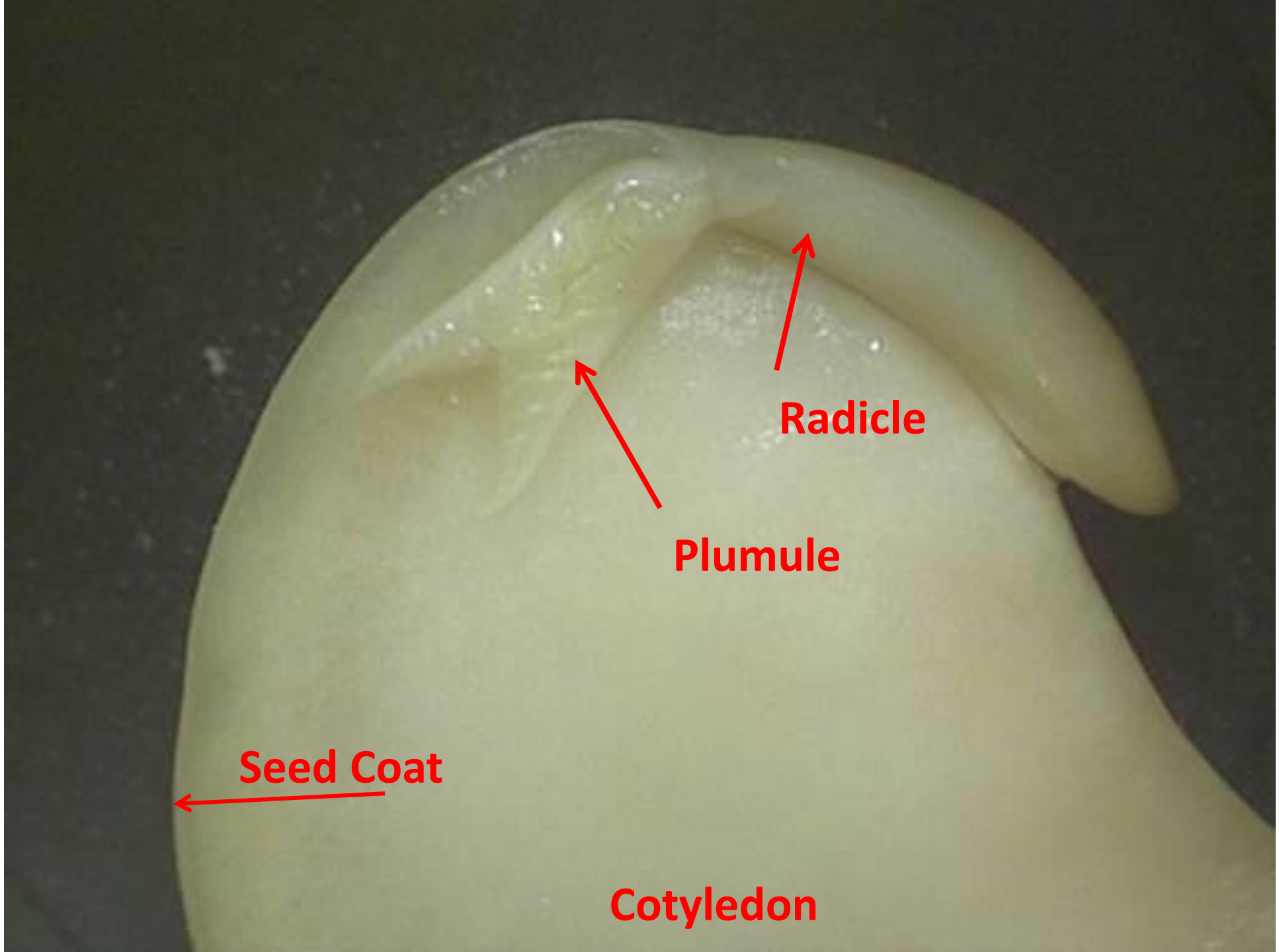
Opening the ovary



- Dicot Seed Dissection Images follow…

Identify the parts of a seed


Bean
Plumules
Cotyledons


Radicle
Plumule
Seed Coat
Cotyledon

Germination of Seeds monocot vs dicot

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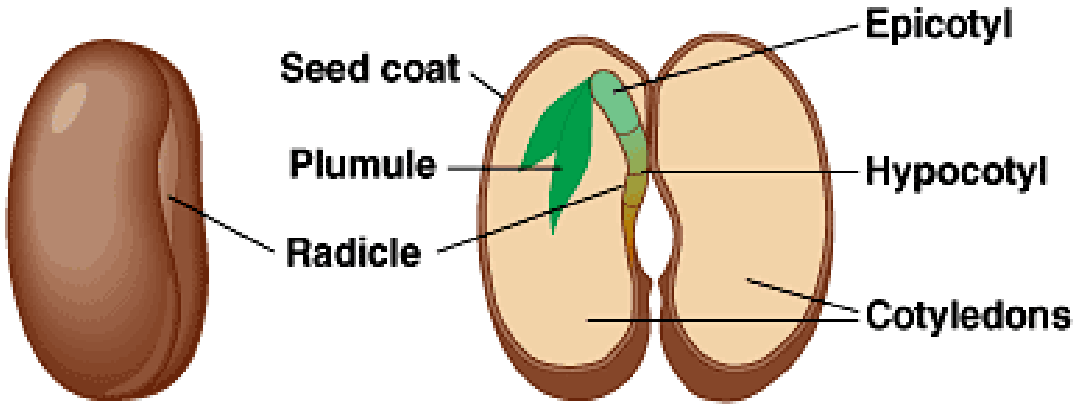
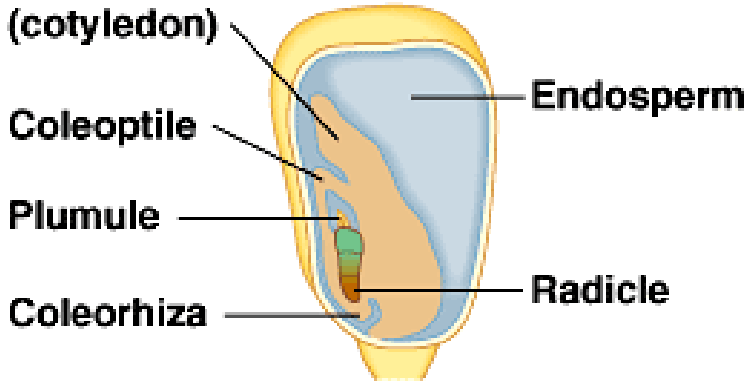


Dicotyledon

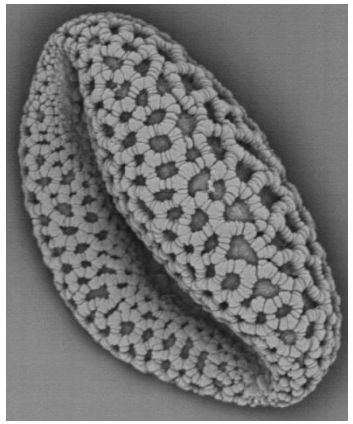


Monocotyledon

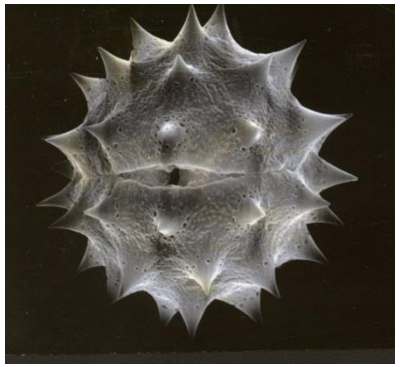
Pollen examples

- Gymnosperm Pollen

- Lily Pollen



- Cedar pollen



Seeds we eat - examples

- Corn
- Wheat
- Oats
- Barley
- Rye
- Rice
- Poppy
- Sunflower & other nuts

Stems, flowers and leaves we eat - examples

- Asparagus
- Lettuce
- Broccoli
- Cauliflower
- Herbs
- Cabbage
- Celery

Roots we eat - examples

- Carrots
- Radish
- Parsnips
- Turnip
- Beats
- Ginger

Fruit we eat - examples

- Zucchini
- Pumpkin
- Tomato
- Peach
- Watermelon
- Mango
- Papaya

Rice cultivation becomes well established in southern China, southeast Asia, and northern India. Rice farming spreads widely from these regions, and rice later becomes a major Chinese export.

4500 BC

5000 BC

People in central Mexico domesticate corn, also called maize. Early corncobs are only about an inch long and have a few dozen kernels. The ancestor of corn was probably a wild grass called teosinte.

3500 BC

The potato is domesticated in the Andes Mountains of South America. Early Andean farmers eventually produce 700 varieties of potatoes by cultivating them on irrigated terraces built on mountain slopes.

- Compare corn today with maize grown in 5000 BC. How is it similar? How is it different?
- How did it become what it is today?