Plant Biology

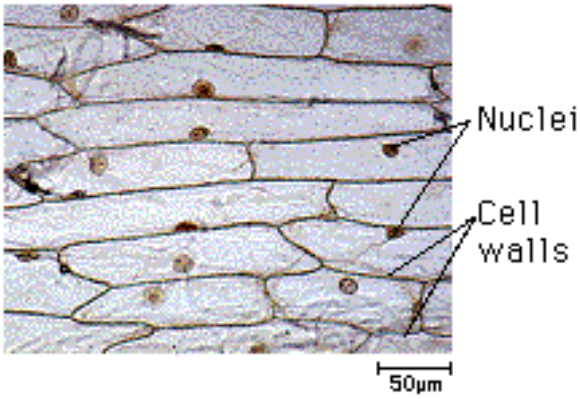
Practical part

Prepared by
Shorouq S. Jaradat
2010-2011

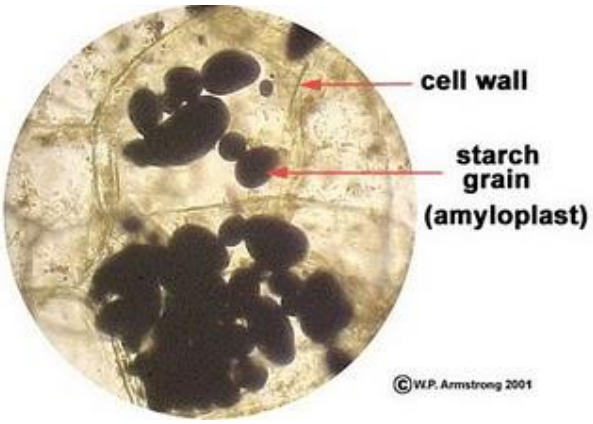
Lab 1
Wet- mount Preparation

Tomato cells

Onion epidermal cells

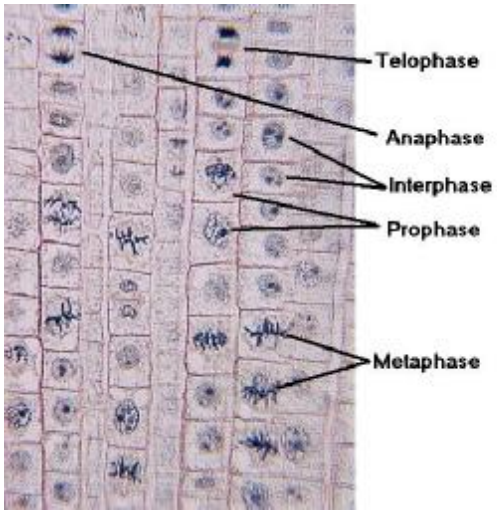


Potato cells

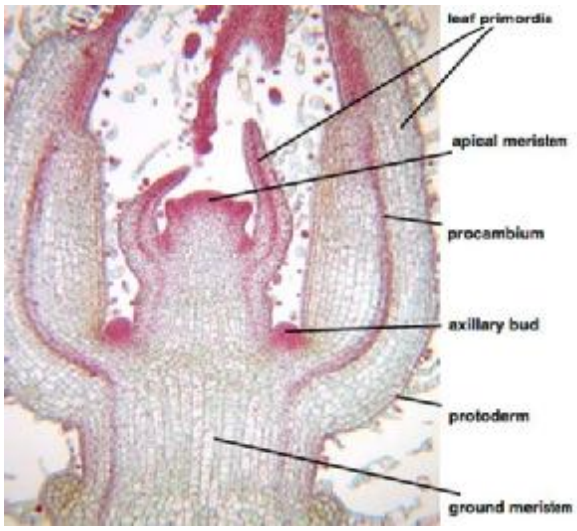


Lab 2
Simple Tissues

Meristematic tissue

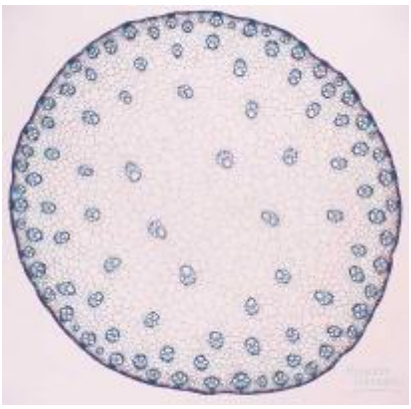


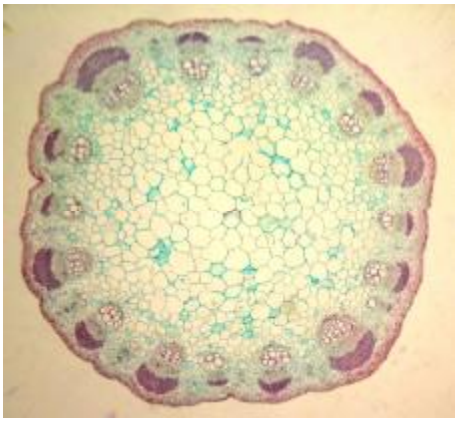
Allium root tip

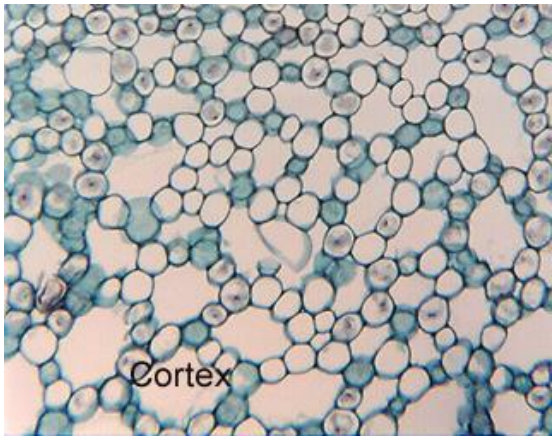


Shoot apex

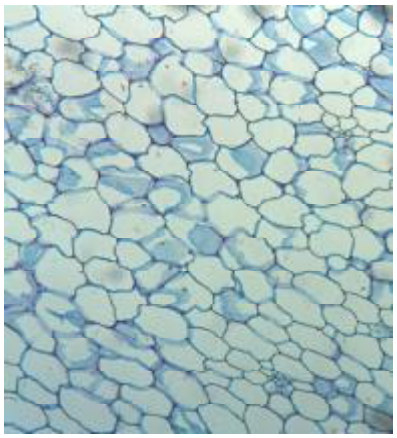
Parenchyma



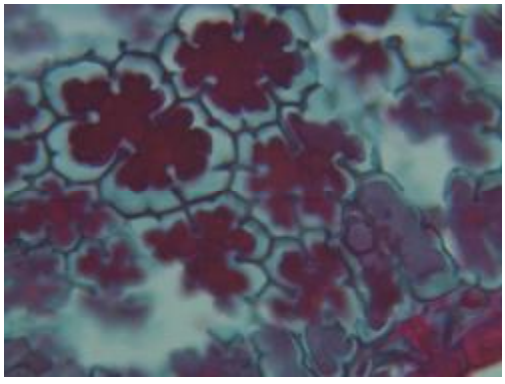




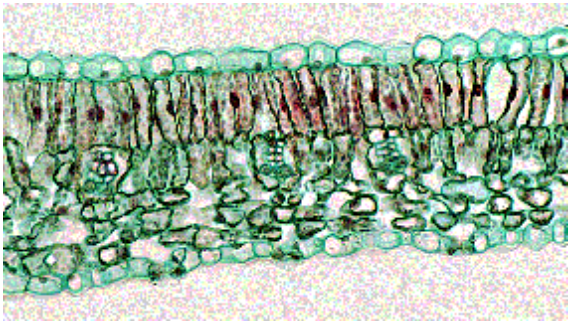
Aerenchyma



Polyhedral parenchyma

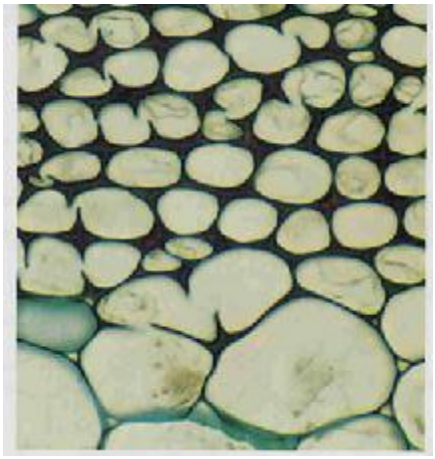


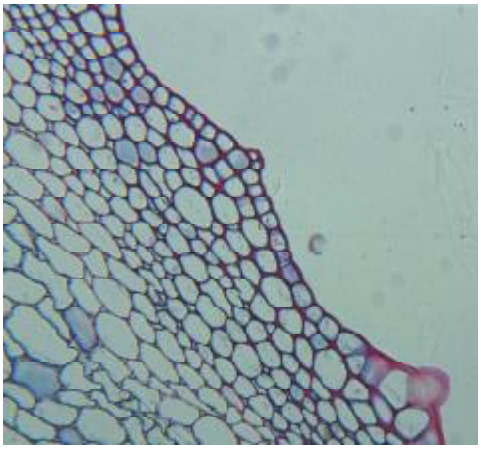
Folded parenchyma



Elongated parenchyma

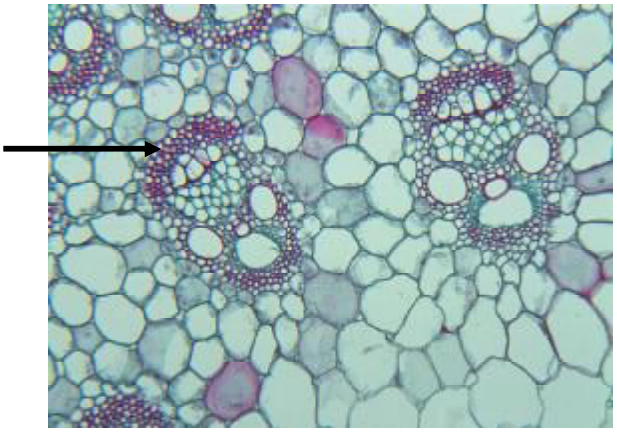
Collenchyma



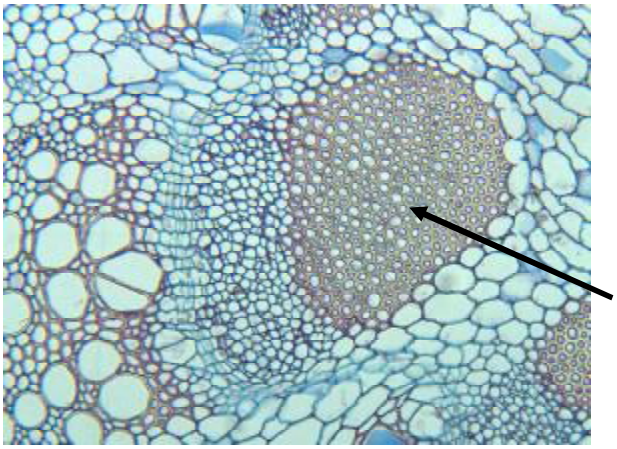


Celery Collenchyma (l.S)

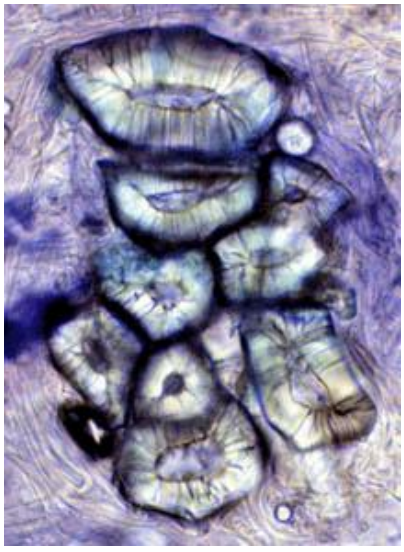
Sclerenchyma



Sclerenchyma (fiber) as a bumdle sheath

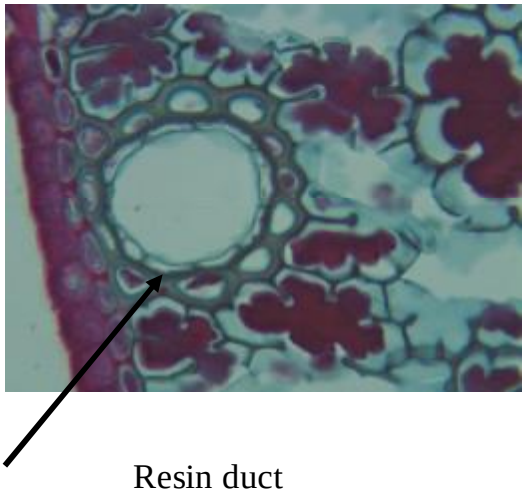


Sclerenchyma (fiber) as a bundle cap



Scleride in pear

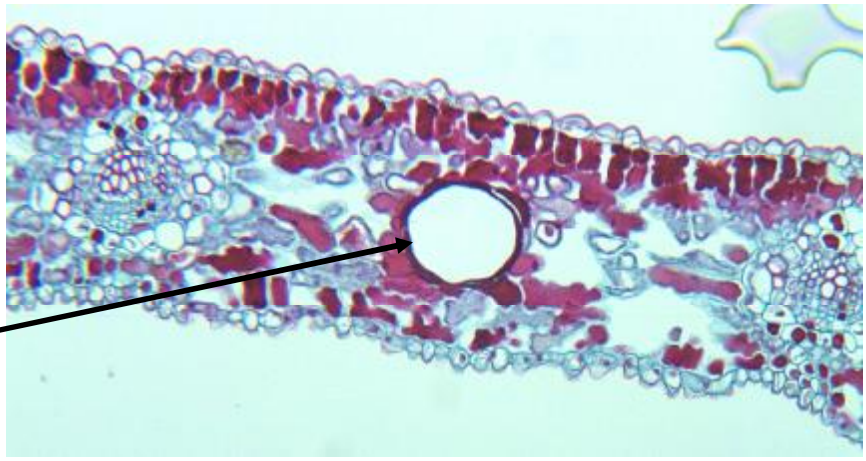
Secretory Tissues



Resin duct

Pinus leaf

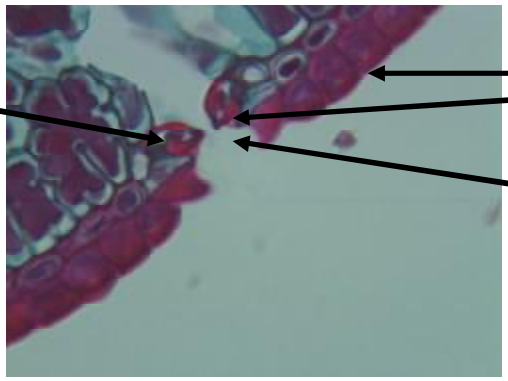
Mucilage duct

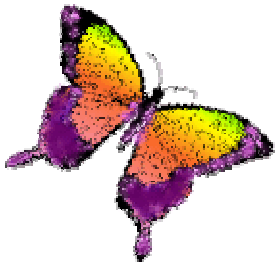


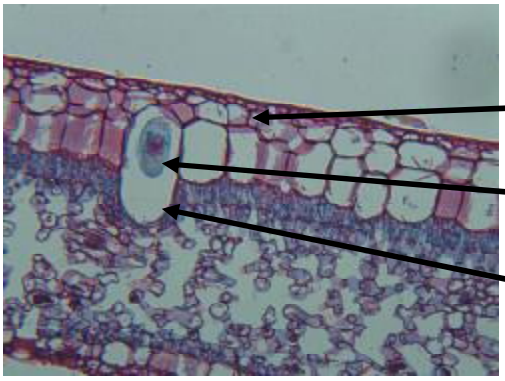
Ginkgo leaf

Lab 3
Compound Tissues

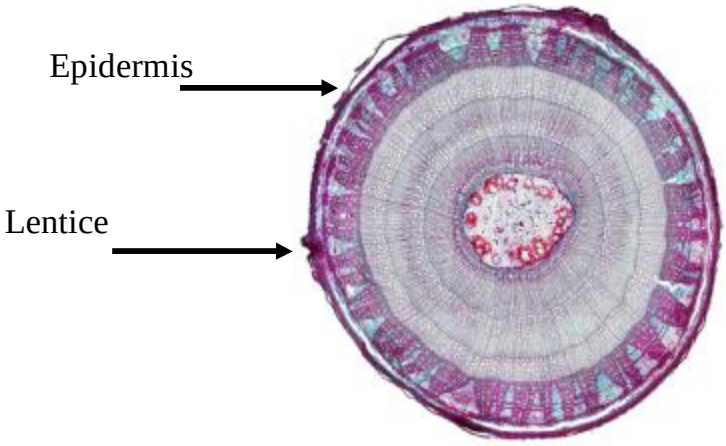
Epidermis

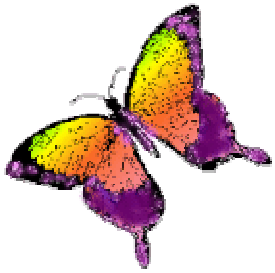


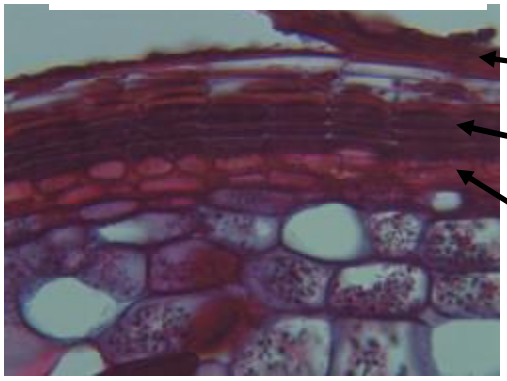




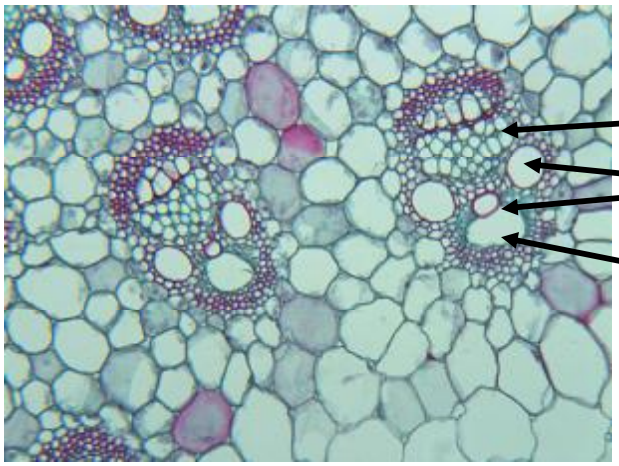
Periderm

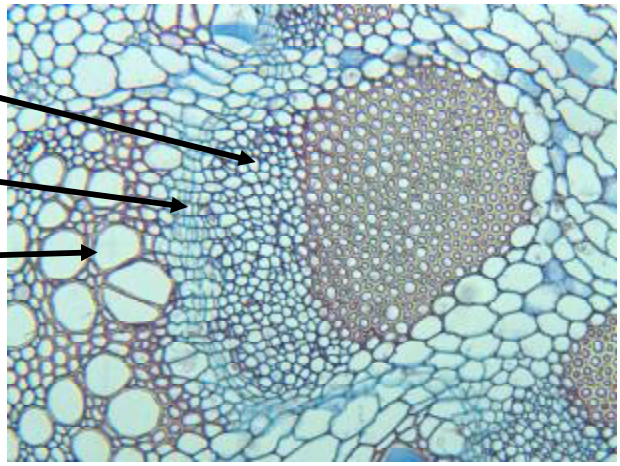


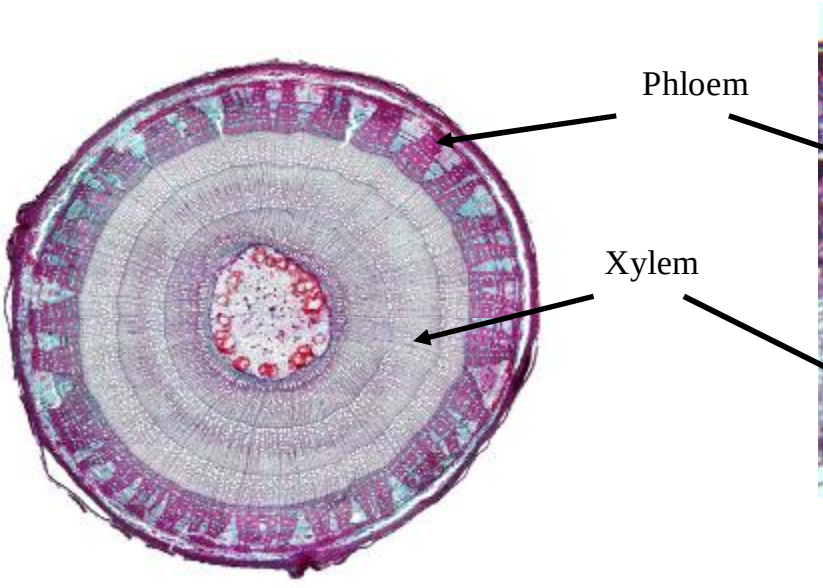


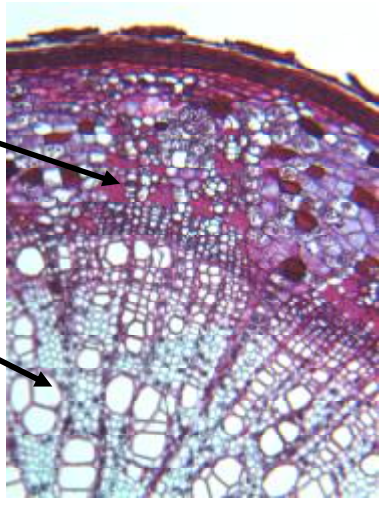


Xylem & Phloem



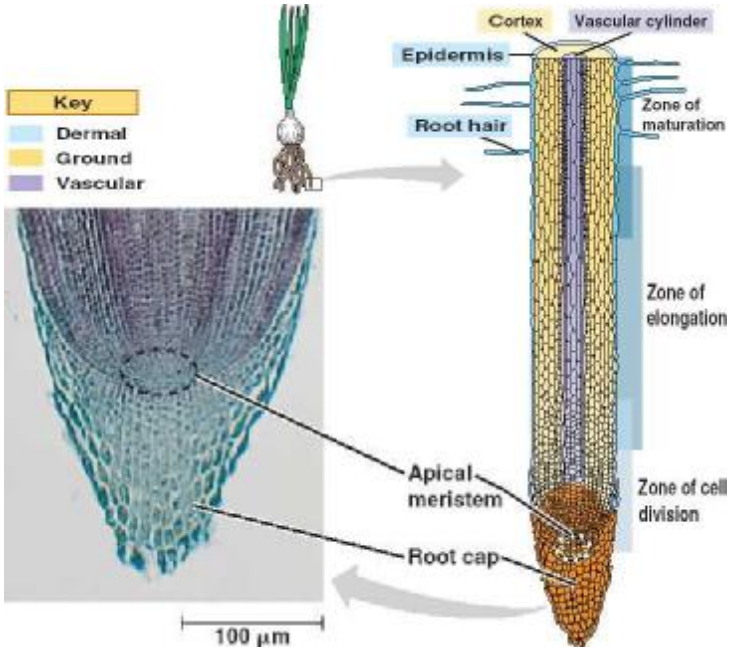


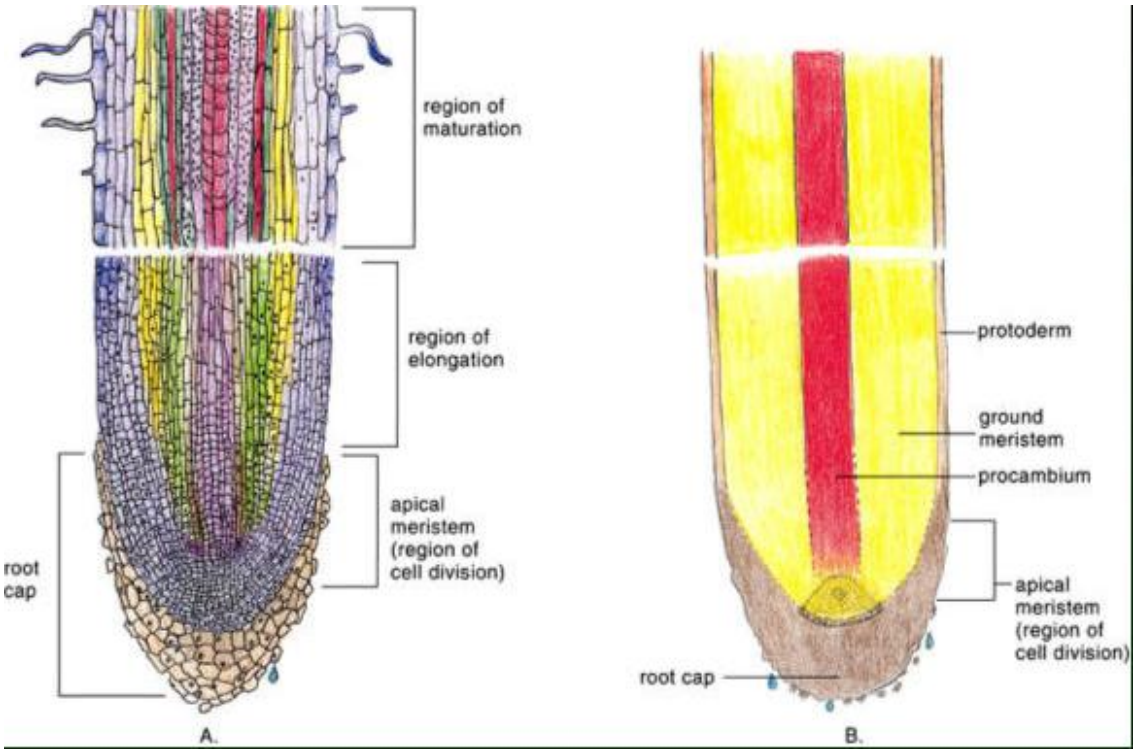




Lab 4
Stem & Root

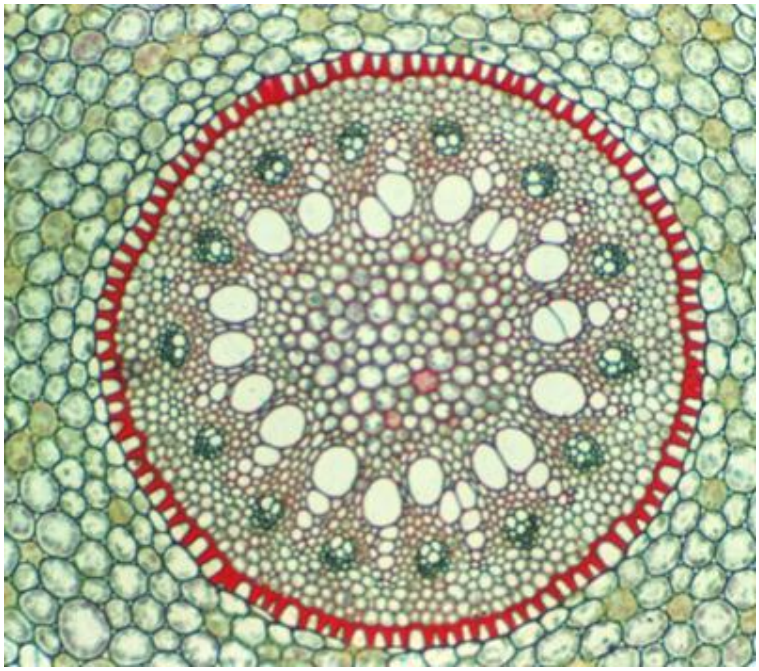
Root Zones

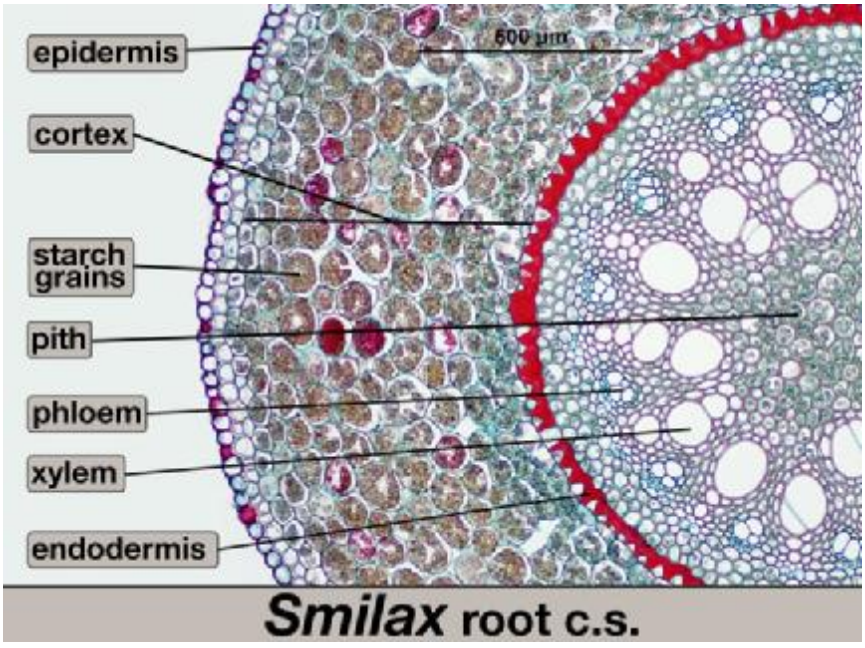




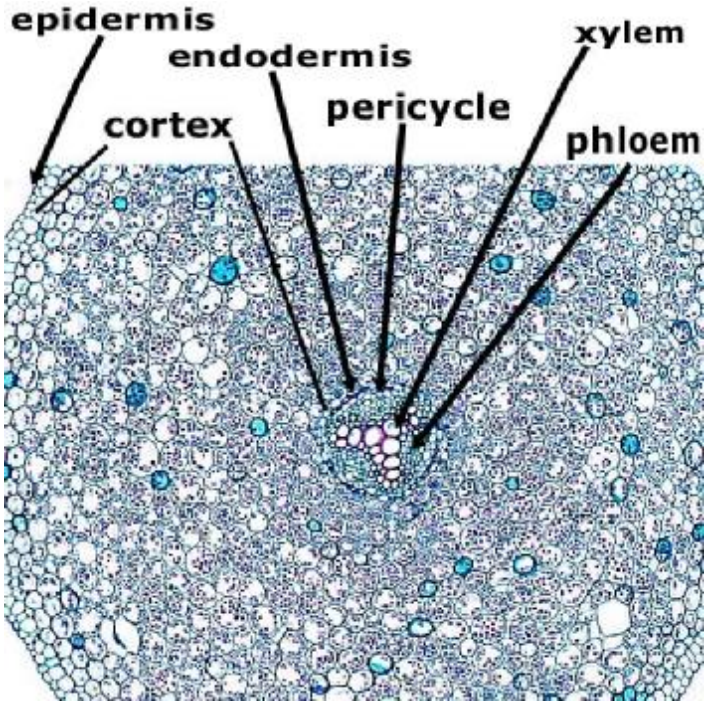
***Allium* root tip**

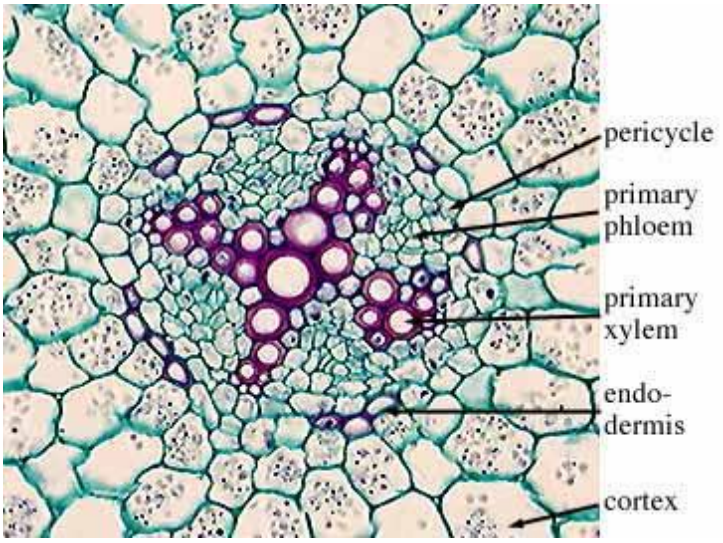
Monocot Root





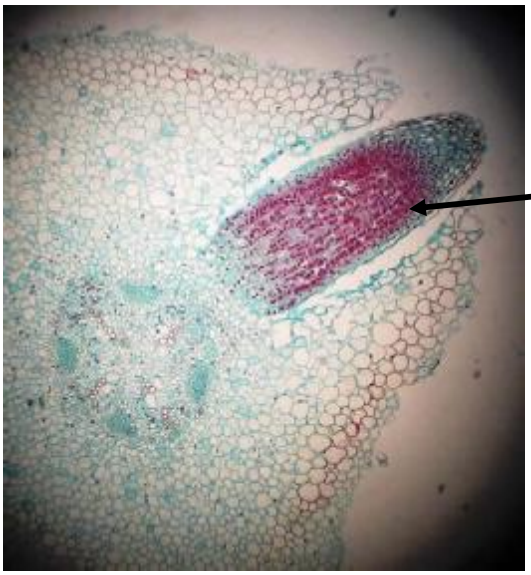
Dicot Root

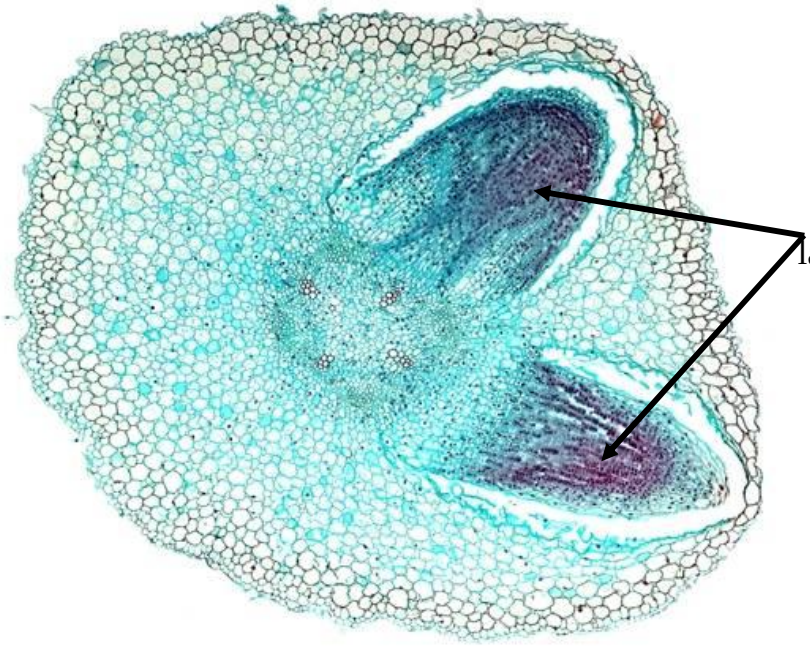




***Ranunculus* root**

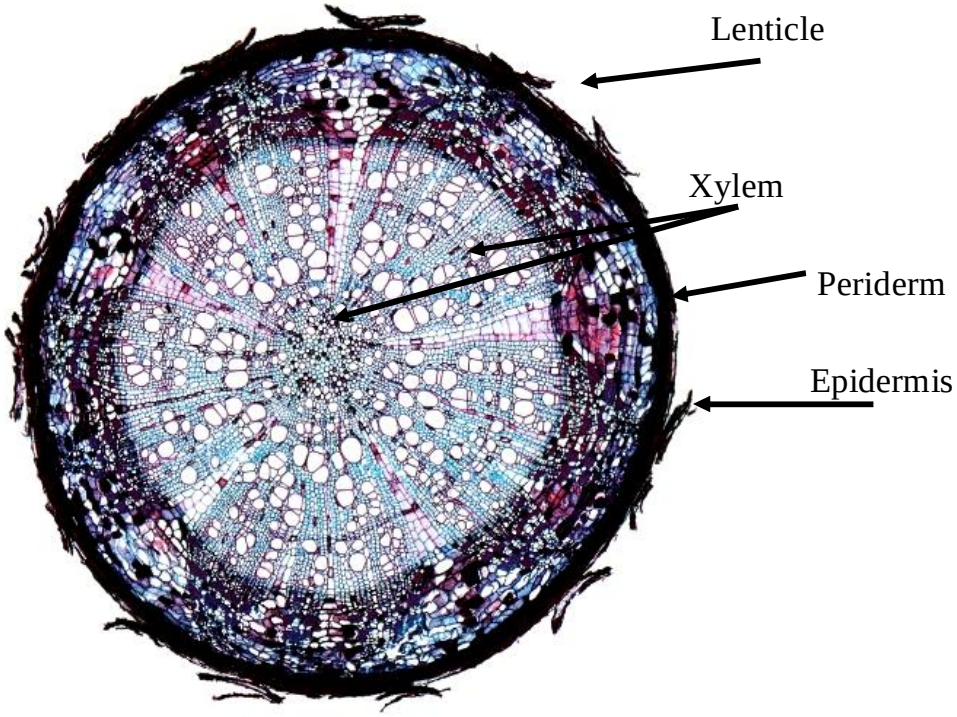
Dicot Root

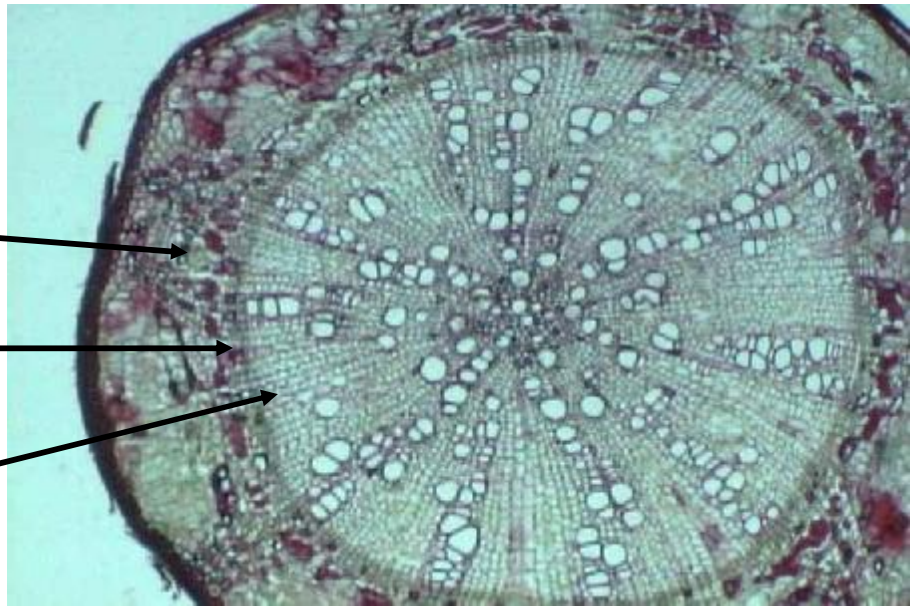




***Vicia* root**

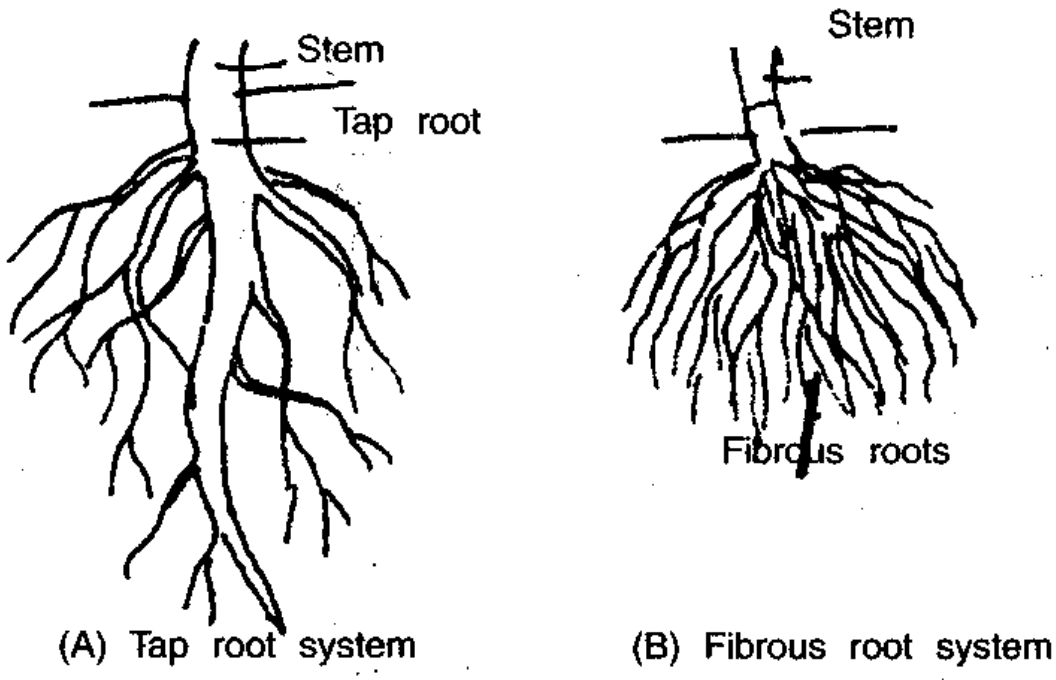
Dicot Woody Root





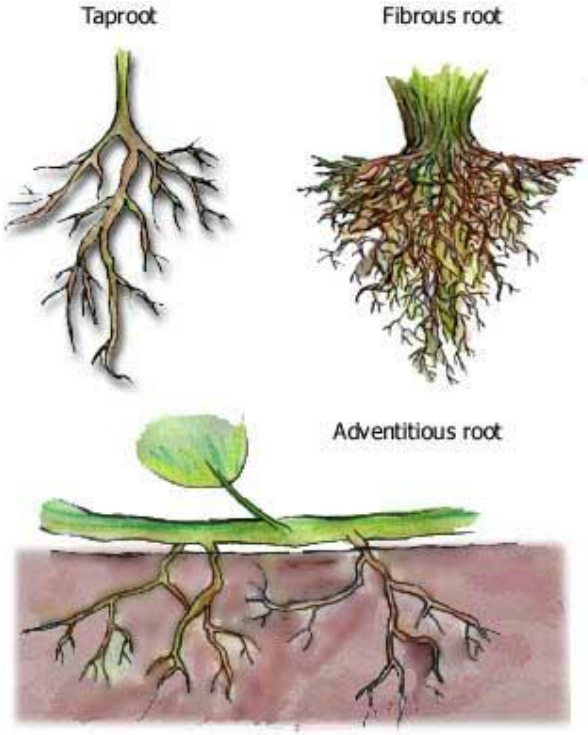
***Tilia* root**

Root System

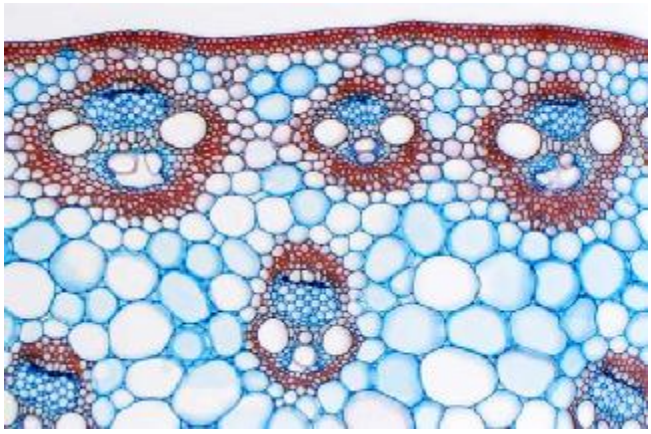


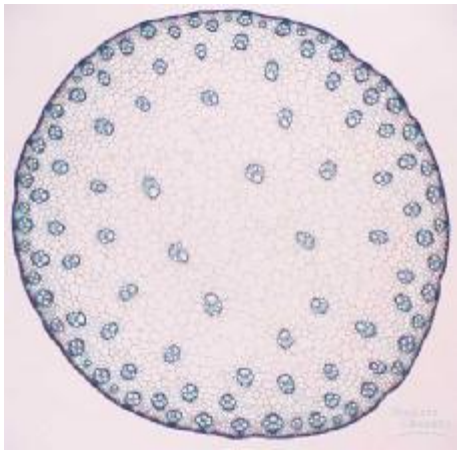
(A) Tap root system

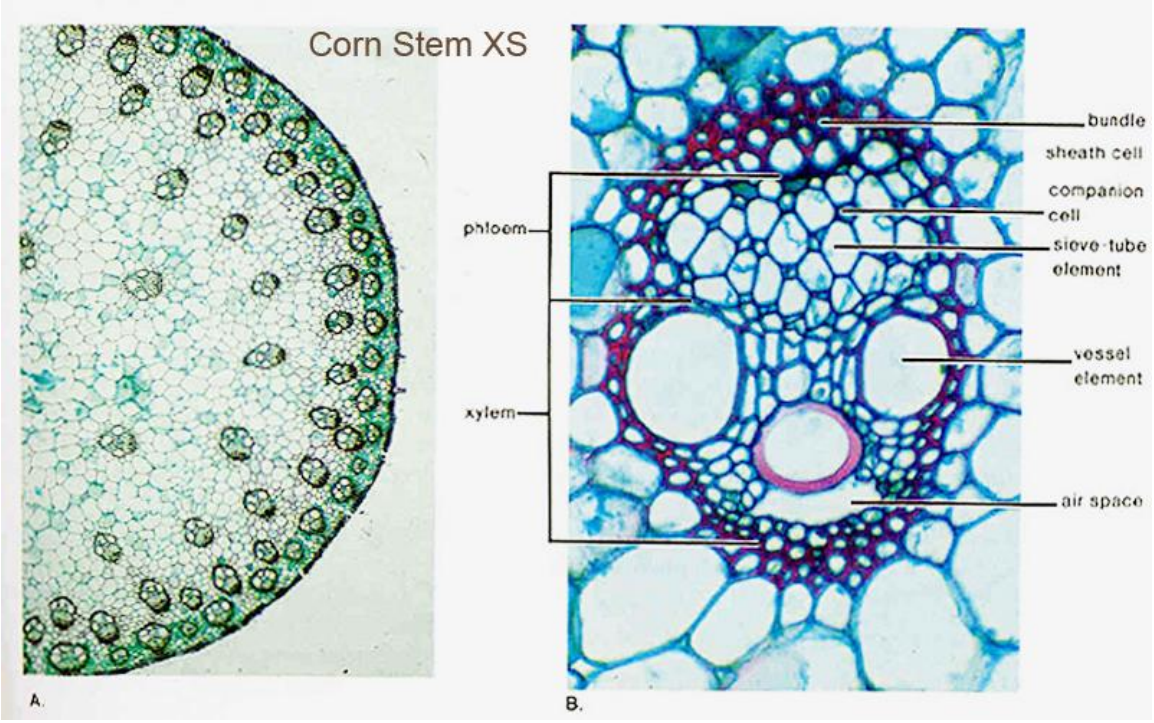
(B) Fibrous root system



Monocot Stem

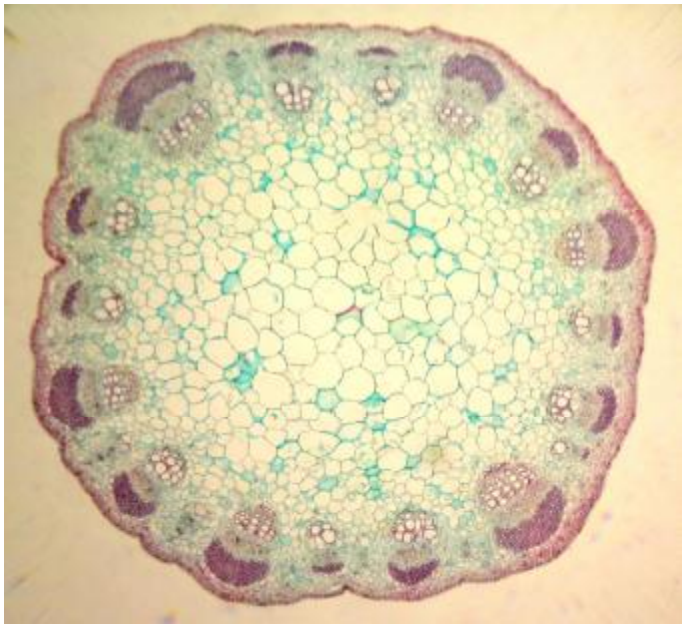






***Zea* root**

Dicot Stem

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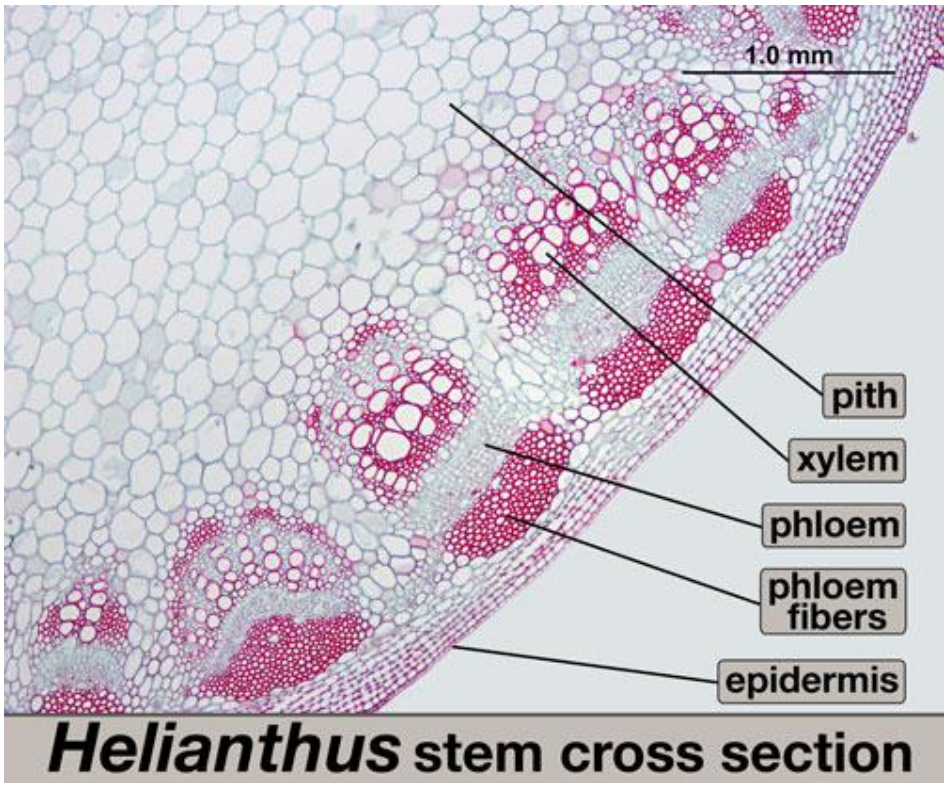
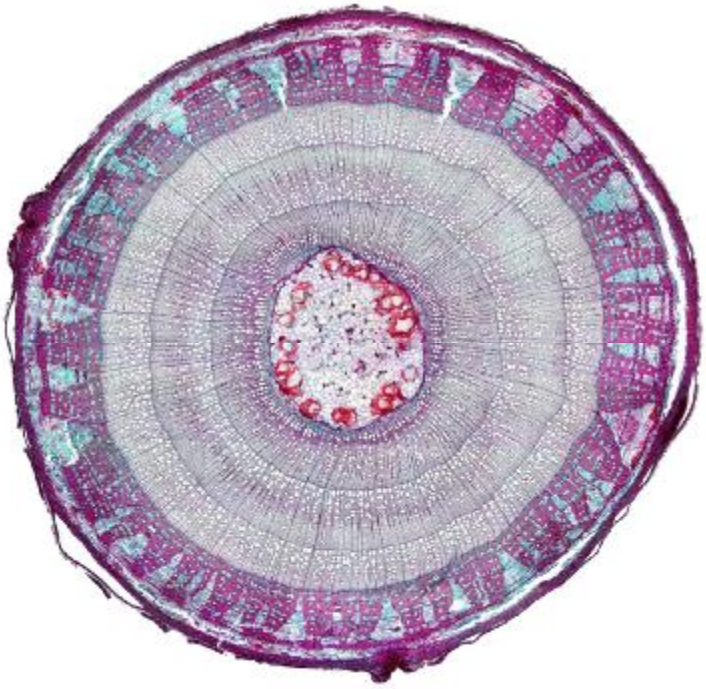
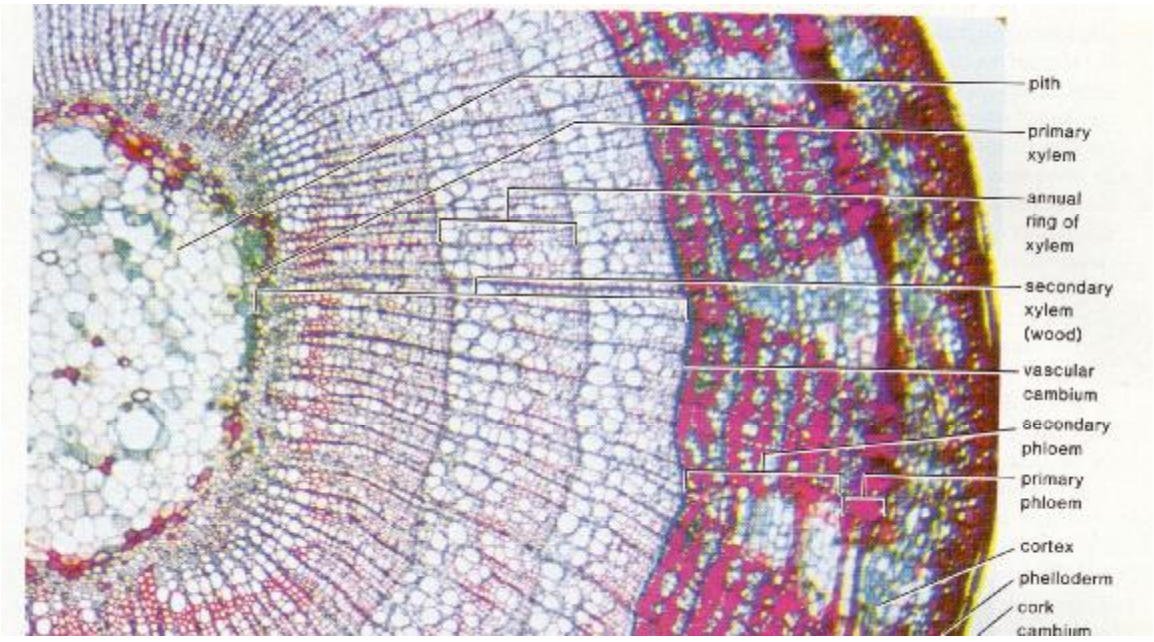

1.0 mm
pith
xylem
phloem
phloem fibers
epidermis
Helianthus stem cross section

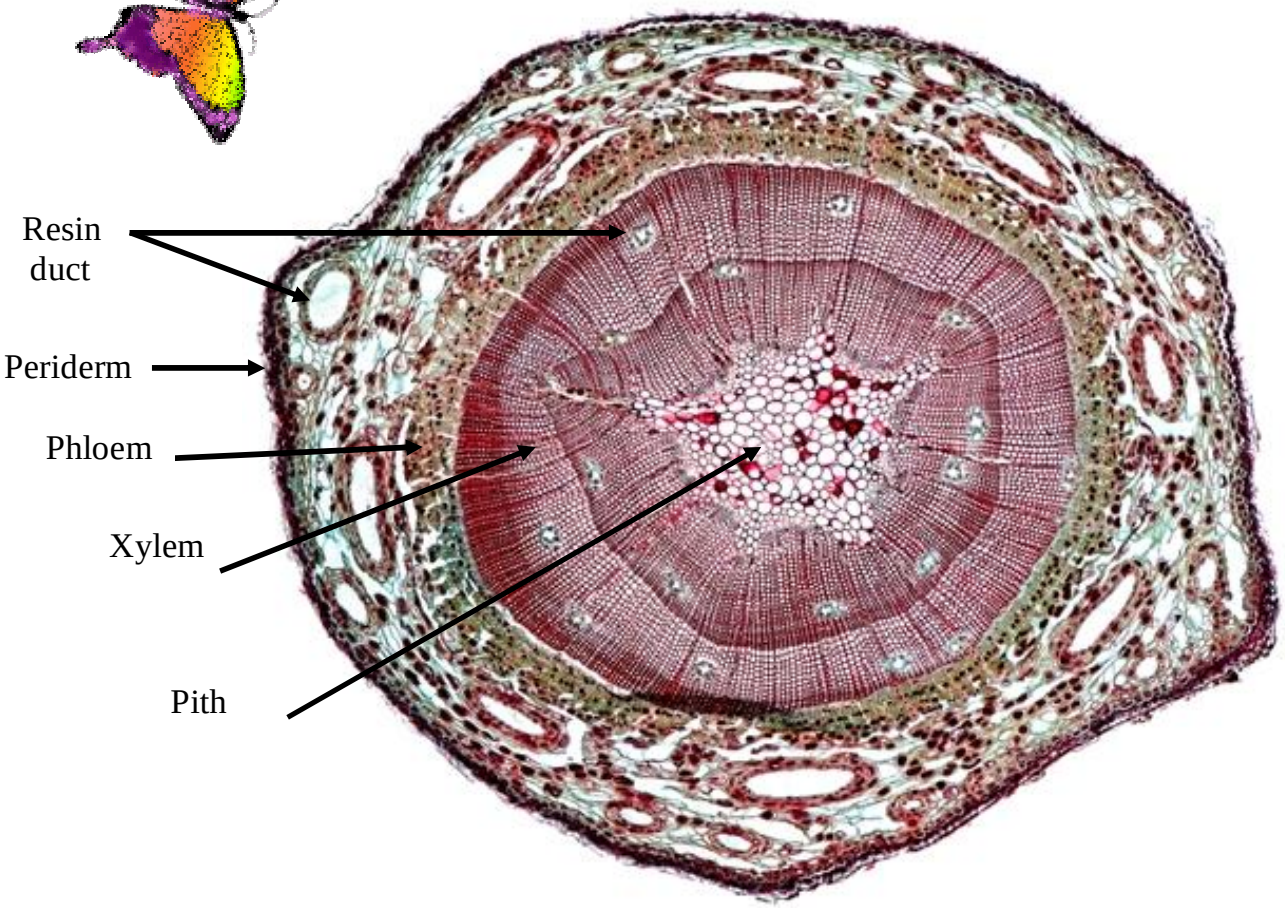
Dicot Woody Stem

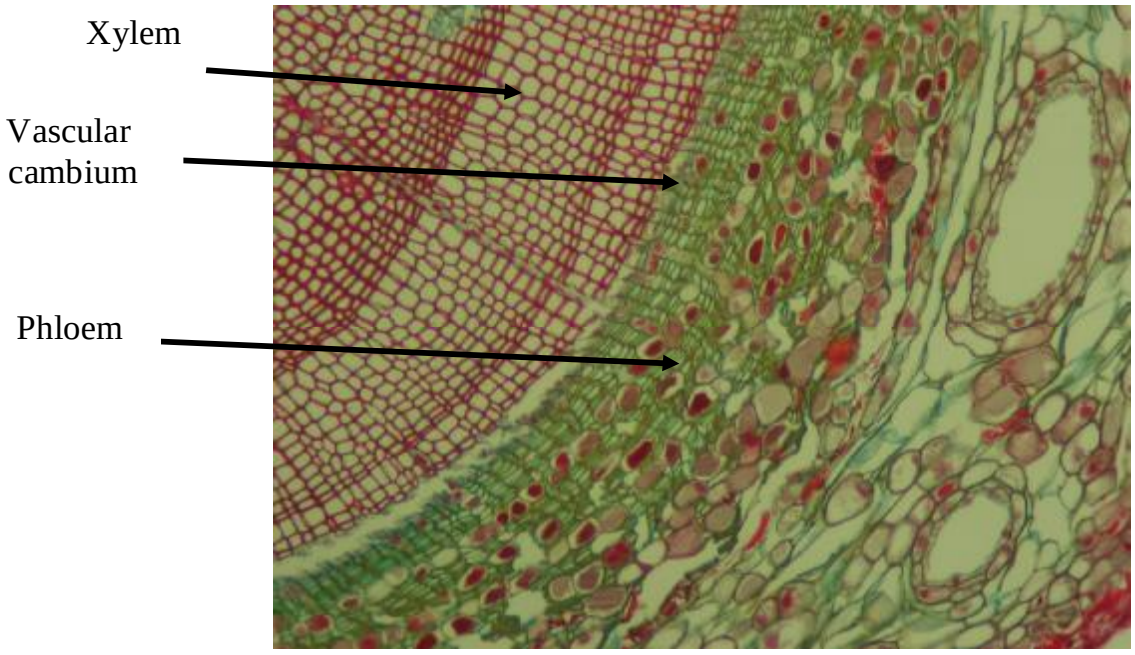




Tilia Stem

Gymnosperm Woody Stem

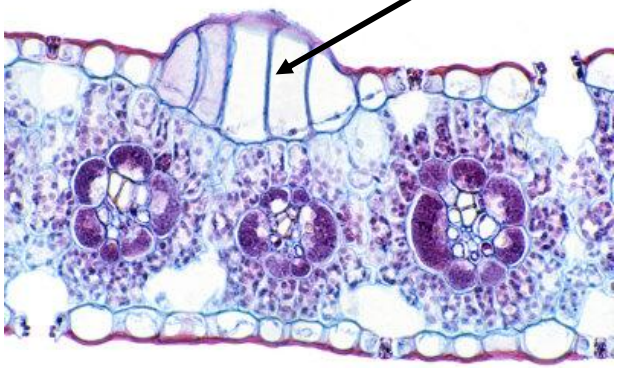


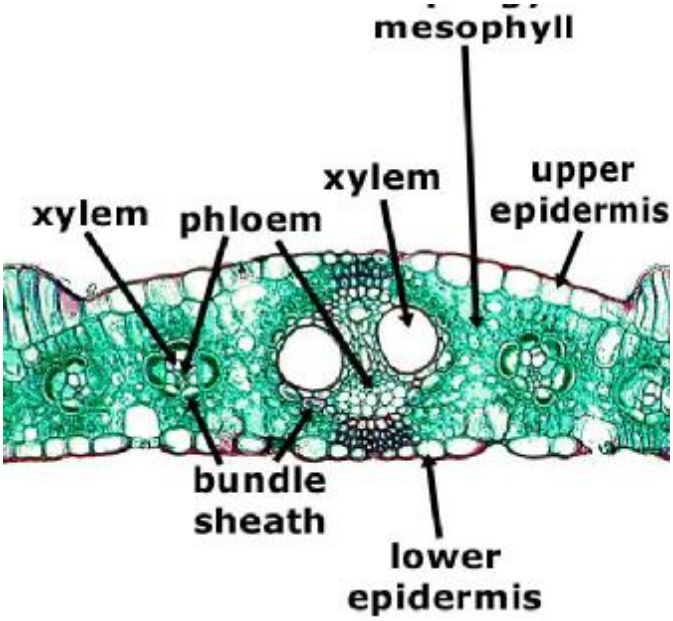


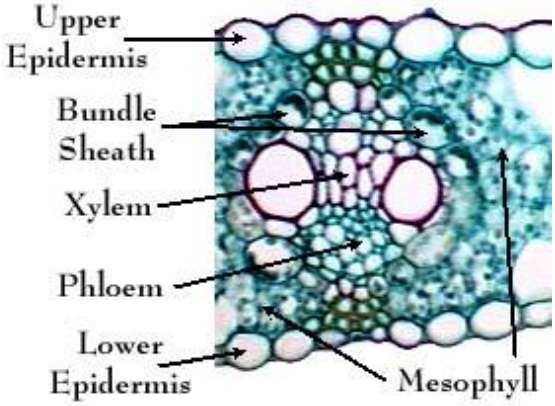
***Pinus* stem**

Lab 5
Leaves

Monocot leaf

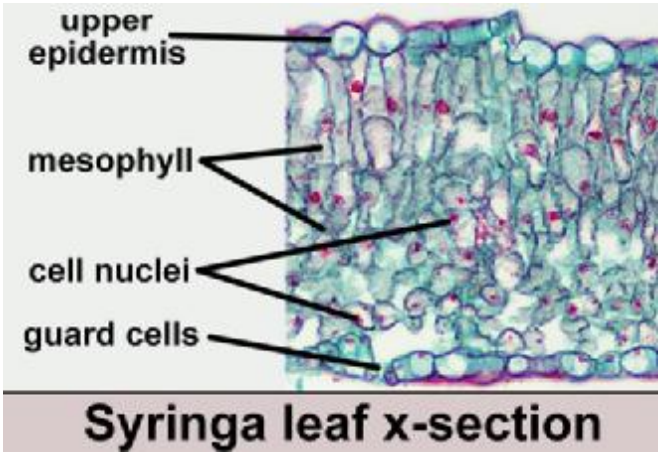


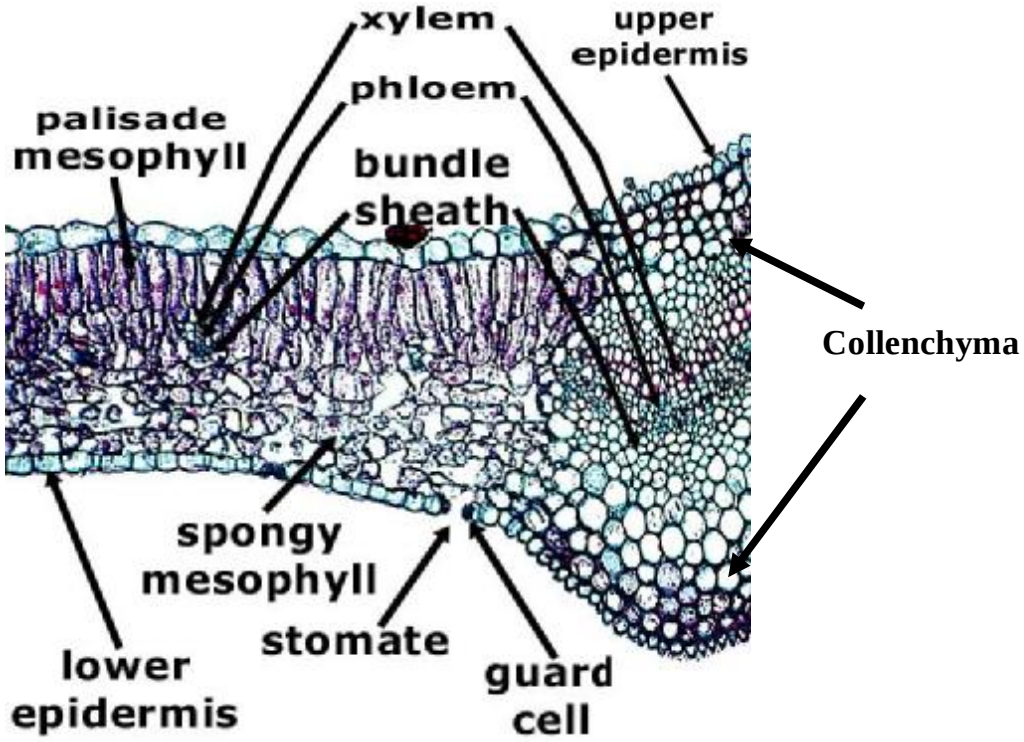




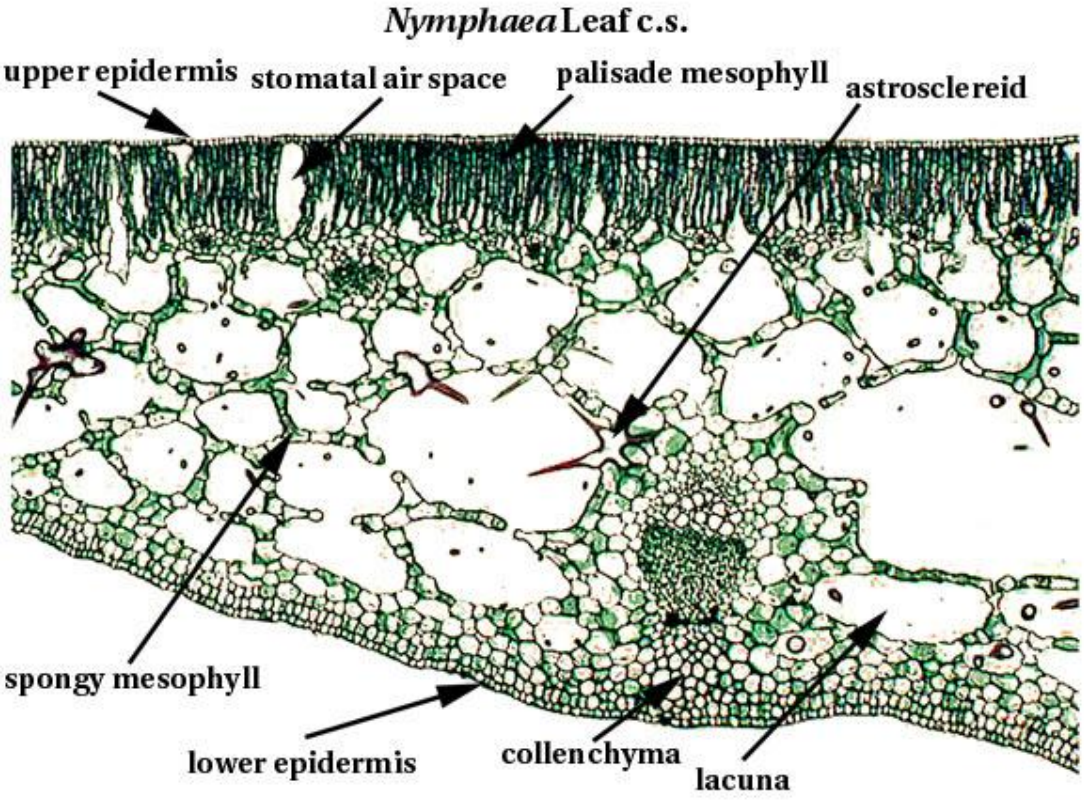
***Zea* leaf**

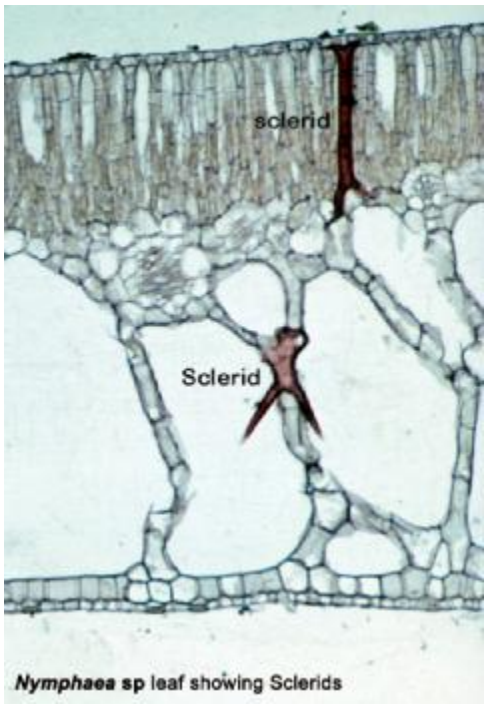
Dicot leaf


upper epidermis
mesophyll
cell nuclei
guard cells
Syringa leaf x-section


xylem
upper epidermis
phloem
palisade mesophyll
bundle sheath
Collenchyma
spongy mesophyll
stomate
lower epidermis
guard cell

Dicot aquatic Leaf

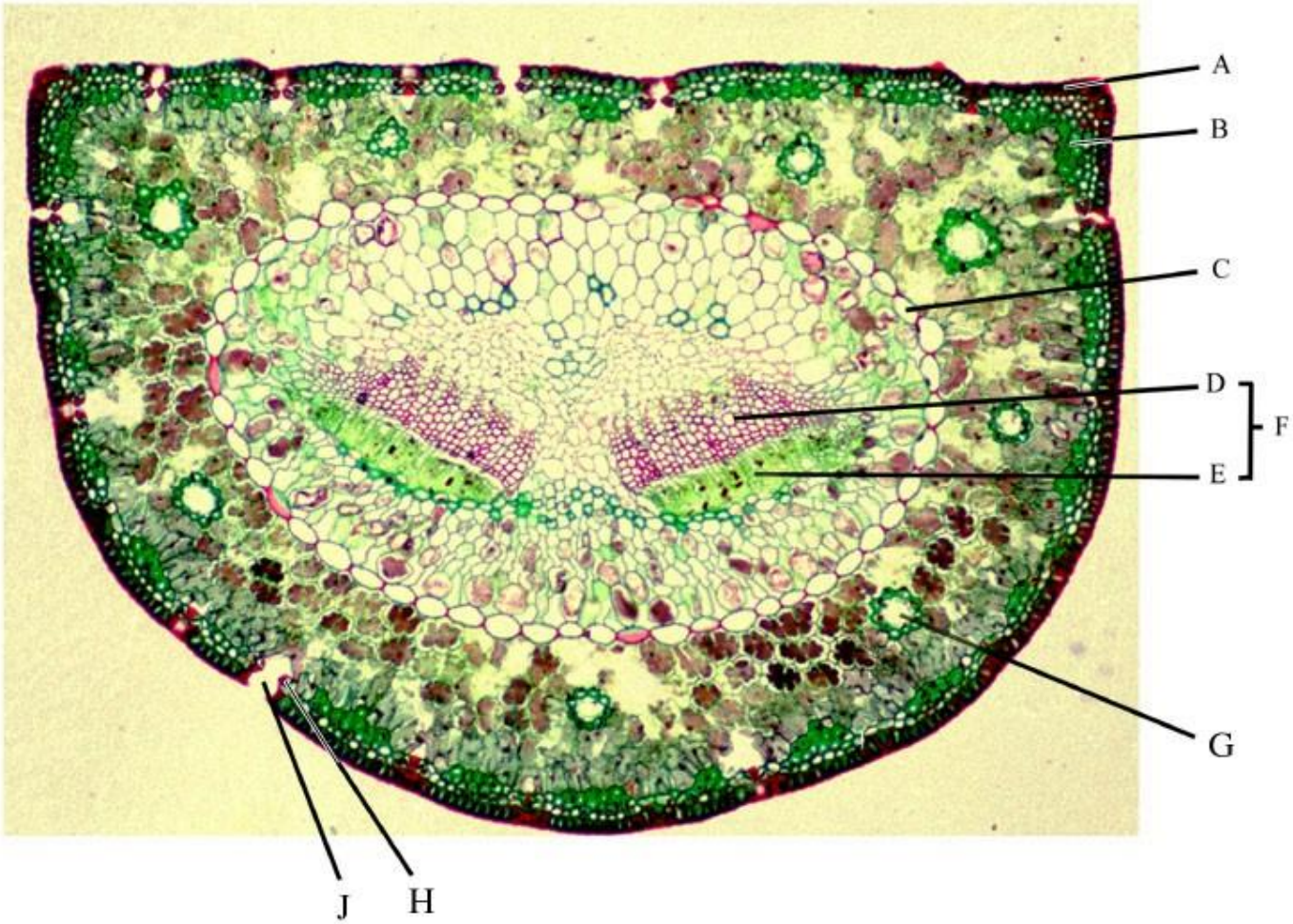




***Nymphaea* sp** leaf showing Sclerids

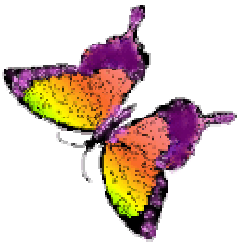
Gymnosperm leaves
Pinus leaf

Pinus leaf TS

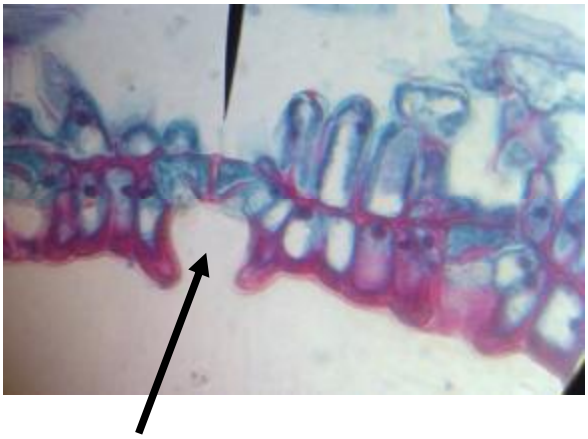


A - epidermis
B - sclerenchyma (hypodermis)
C - endodermis
D - xylem
E - phloem
F -vascular bundle
G - resin duct
H - guard cell
J - sunken stoma

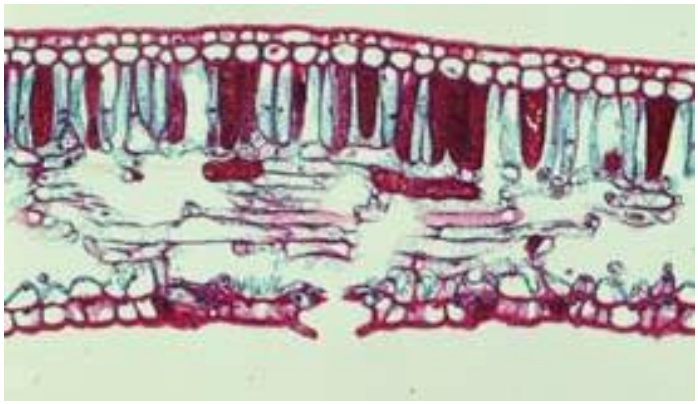
Cycad leaflet



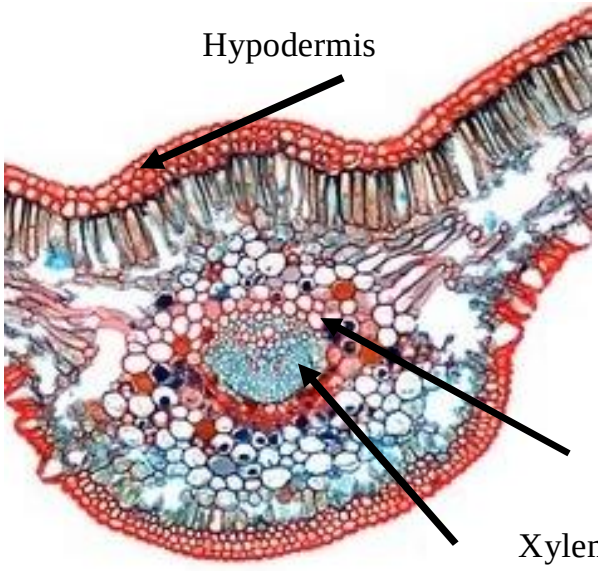
Guard cells



Sunken stoma

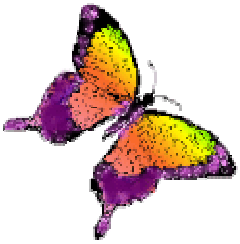


Hypodermis

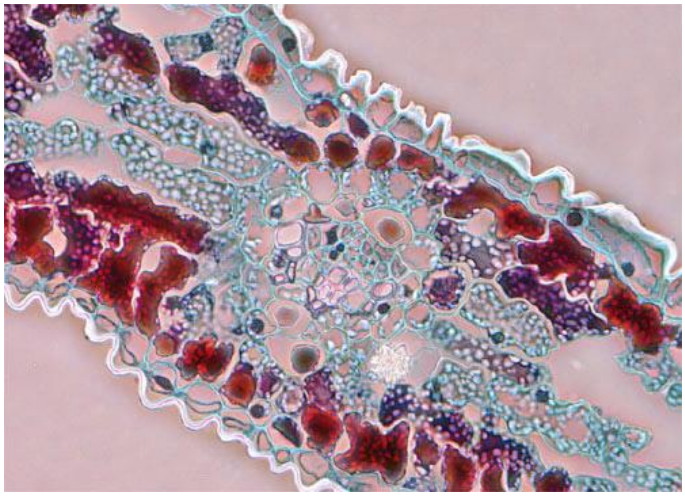


Xylem

Phloem

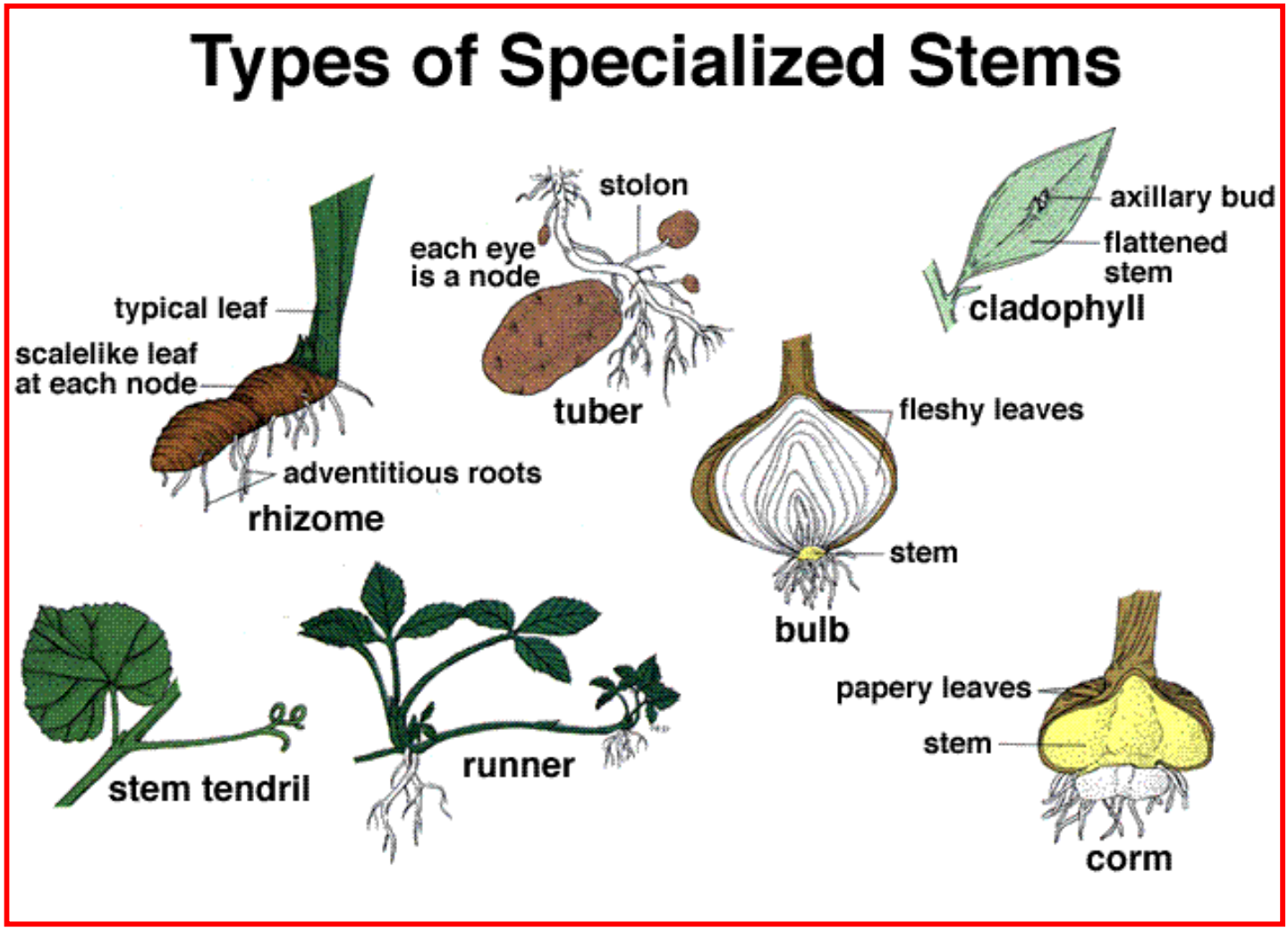


Gingko leaf



Lab 6
Modified Stems,
Leaf Morphology
&
Inflorescence

Specialized stems



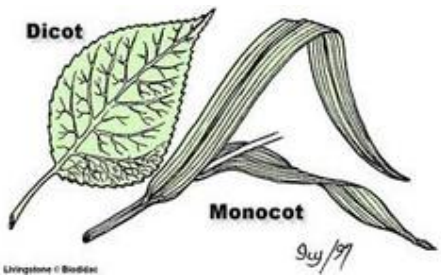
Patterns of leaf veins

LEAF VENATION

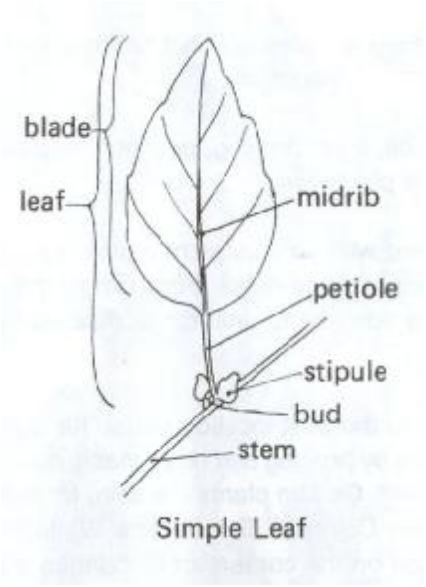
Parallel Venation

Pinnately Netted

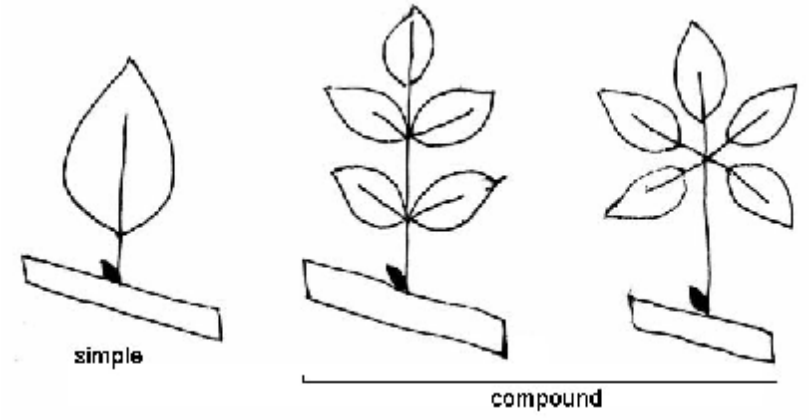
Palmately Netted



Parts of leaf



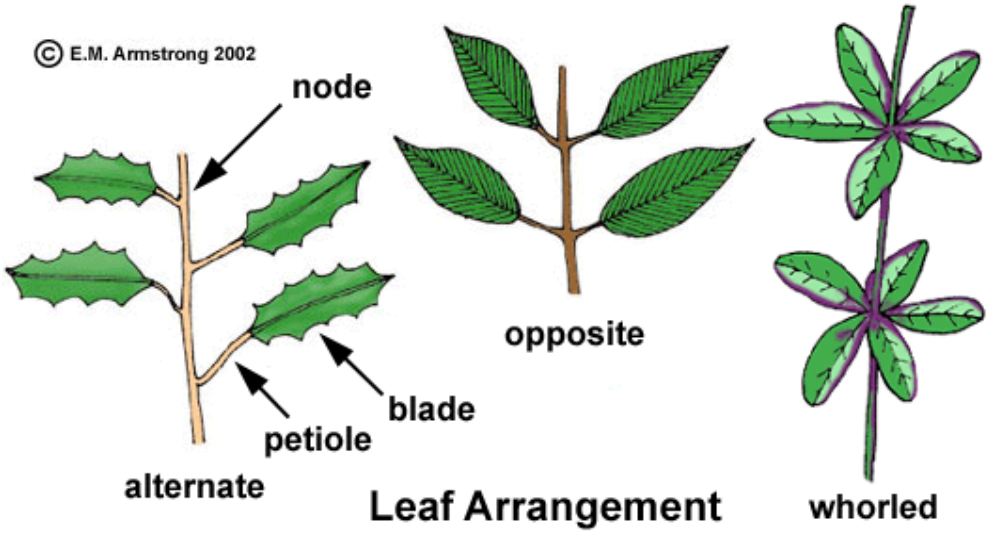
Simple & Compound leaves



Pinnately compound

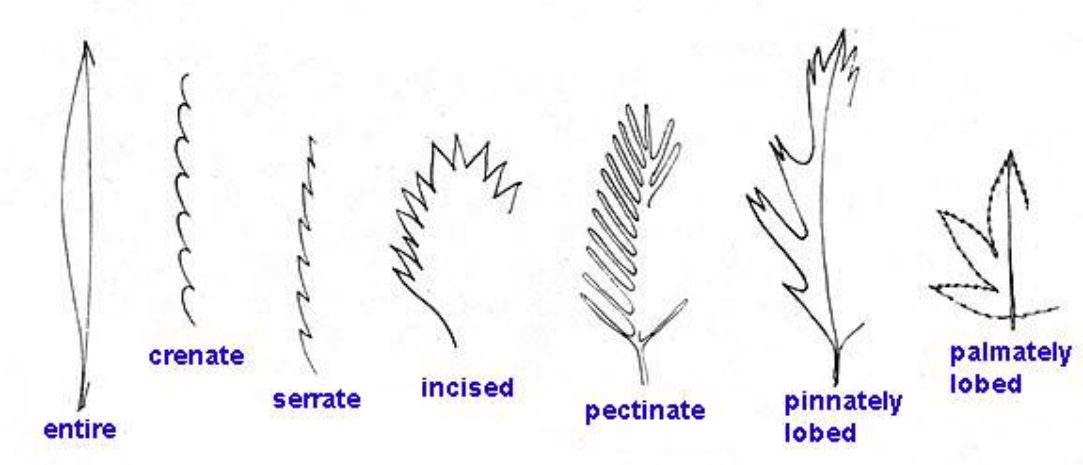
Palmately compound

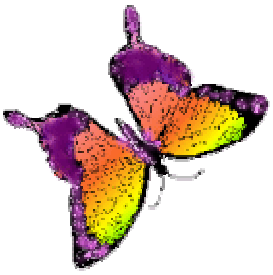
Leaf Phyllotaxy



Leaf arrangements on stem

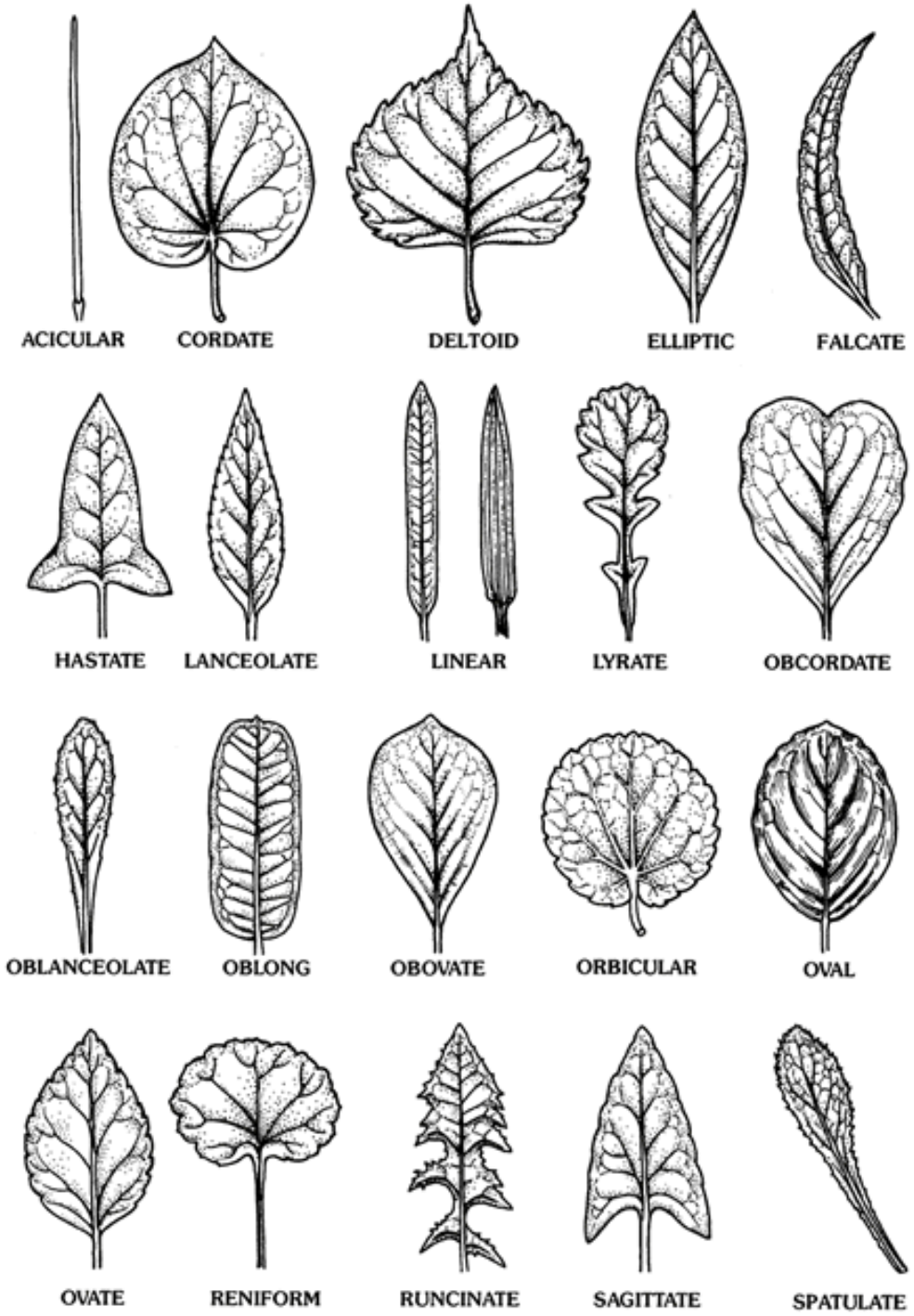
Leaf Margins





Leaf Shapes

PLATE 3. LEAF SHAPES



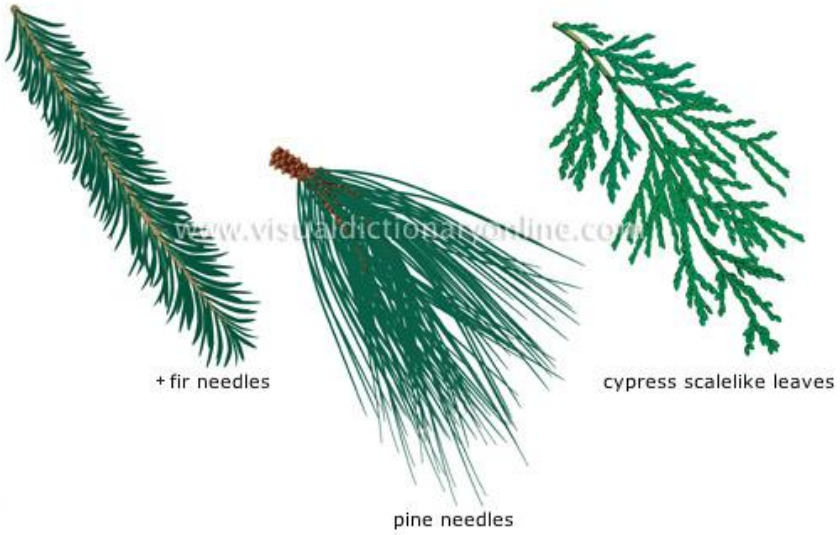
as published in Swink, F. and G. Wilhelm. 1994. *Plants of the Chicago region*. 4th ed. Indianapolis: Indiana Academy of Science.

Leaf shapes

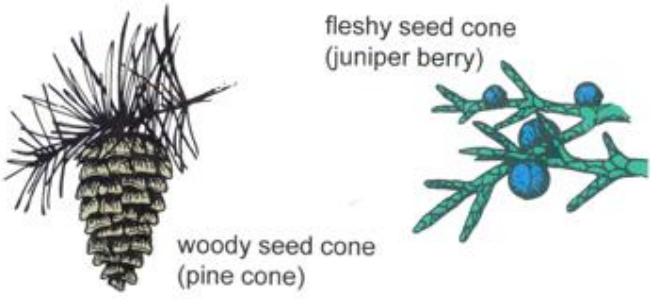
Image src: http://www.vplants.org/plants/glossary/plate03.html

Terms related to conifers

Leaf shape in conifers either Needle shaped leaves or Scale shaped leaves



Cones in conifers either woody or fleshy

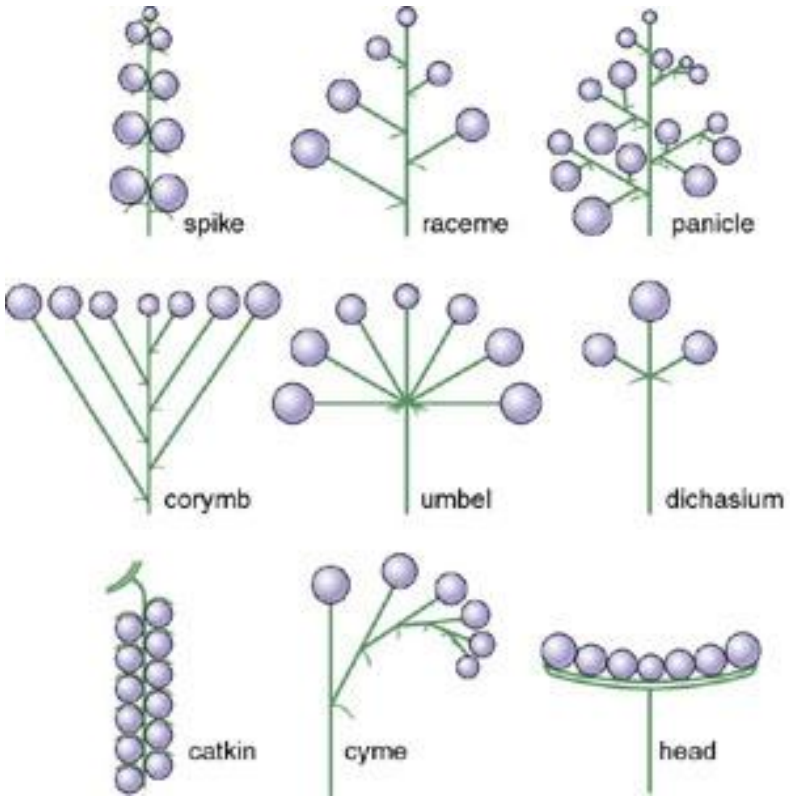


Ovary location in flower

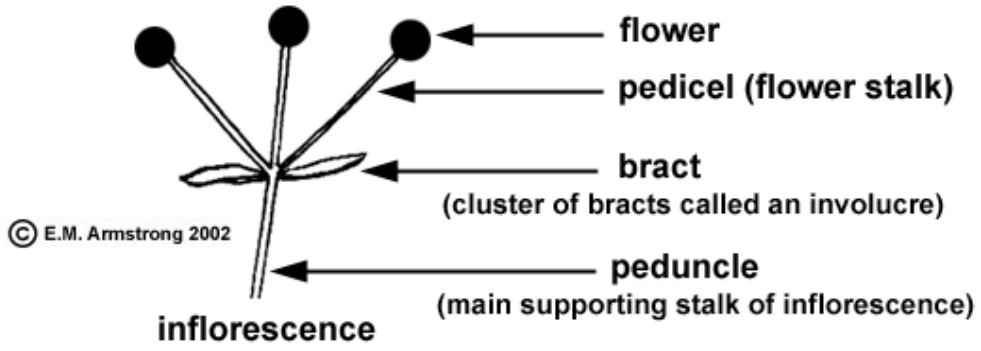
Superior ovary

Inferior ovary

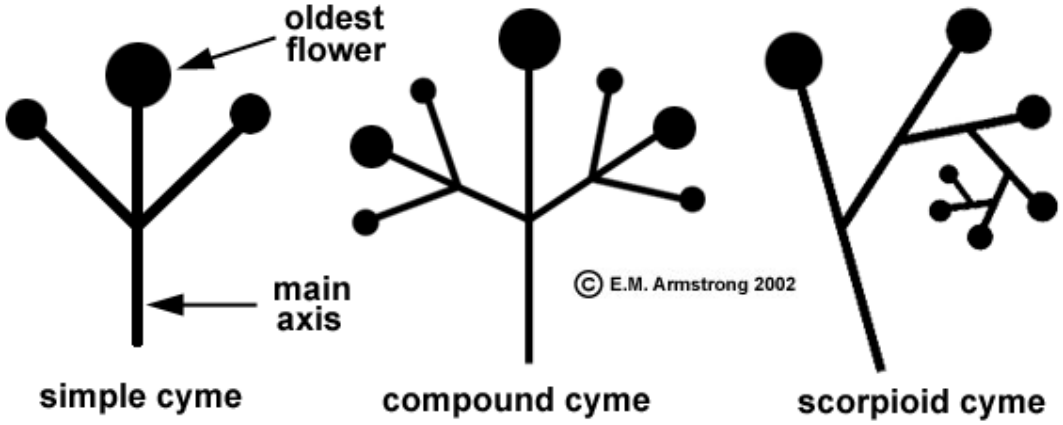
Types of Inflorescence



An inflorescence may be defined as a cluster of flowers, all flowers arising from the main stem axis or peduncle:

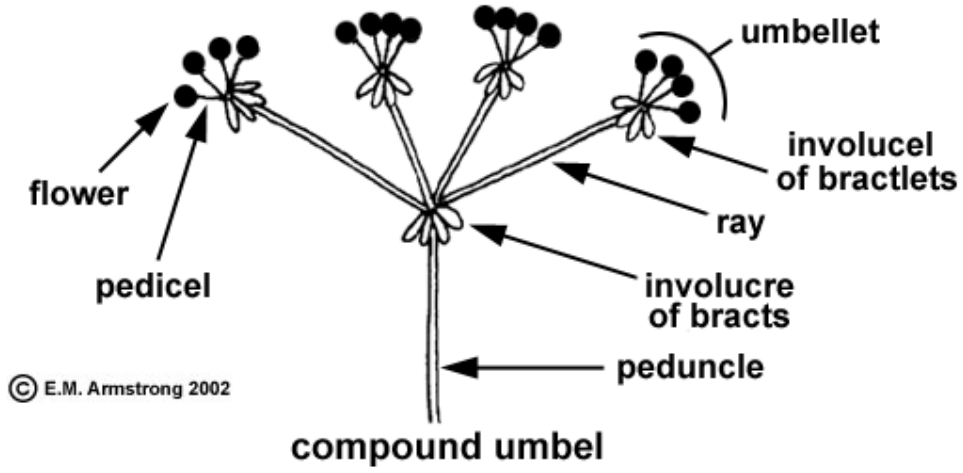


1. Cyme



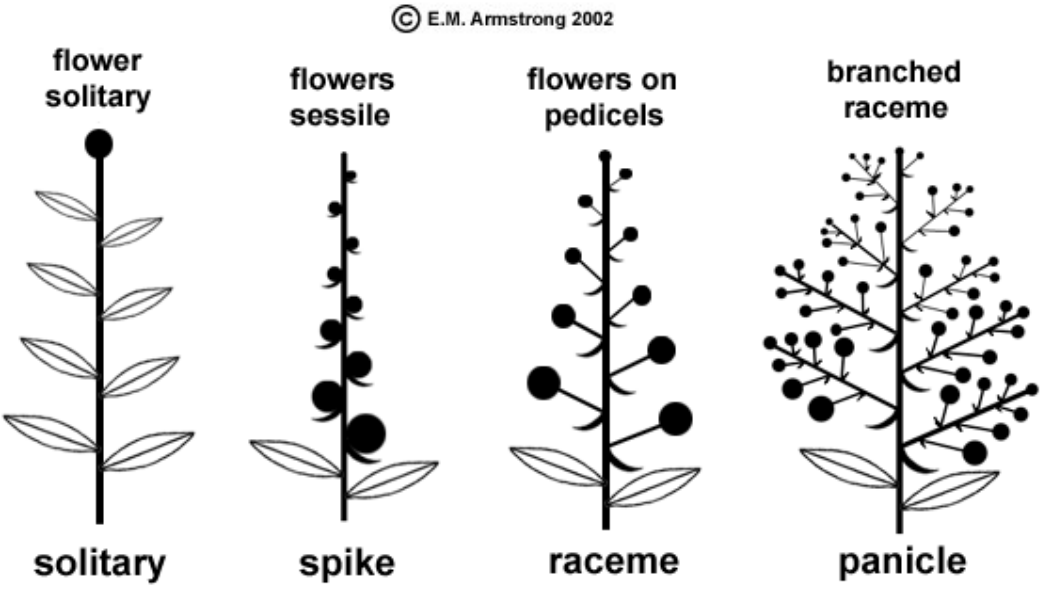
In a cyme, the oldest flower terminates the main axis. Scorpioid cymes have one-sided branching, forming a coiled inflorescence typical of the families Boraginaceae and Hydrophyllaceae.

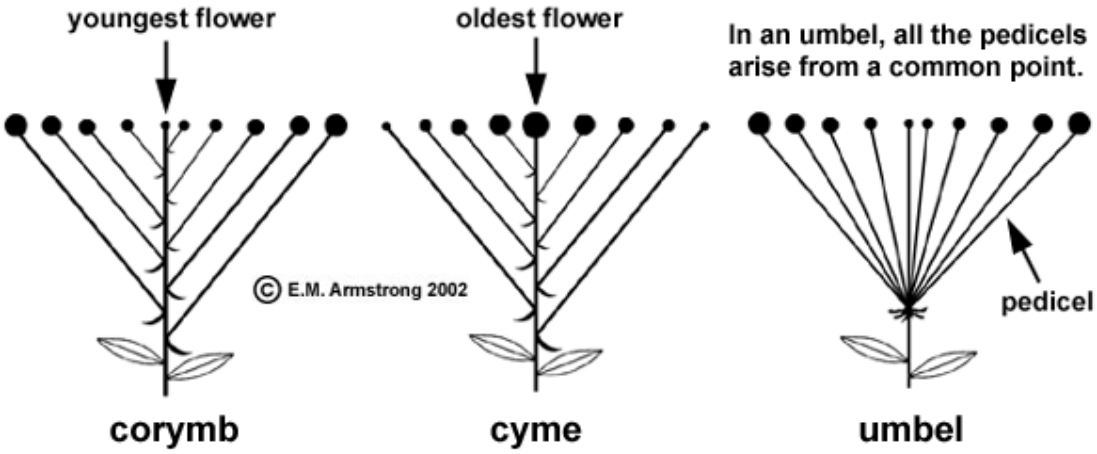
2. Umbel



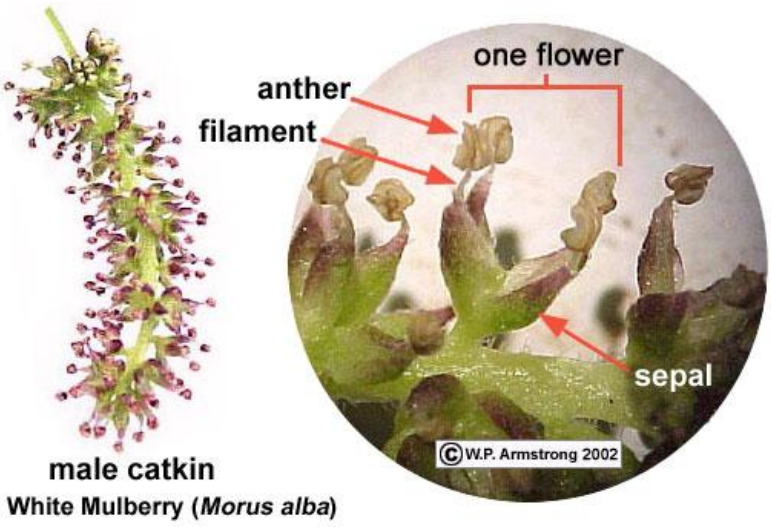
Typical inflorescence of the carrot family (Apiaceae = Umbelliferae)

3. Inflorescence Types

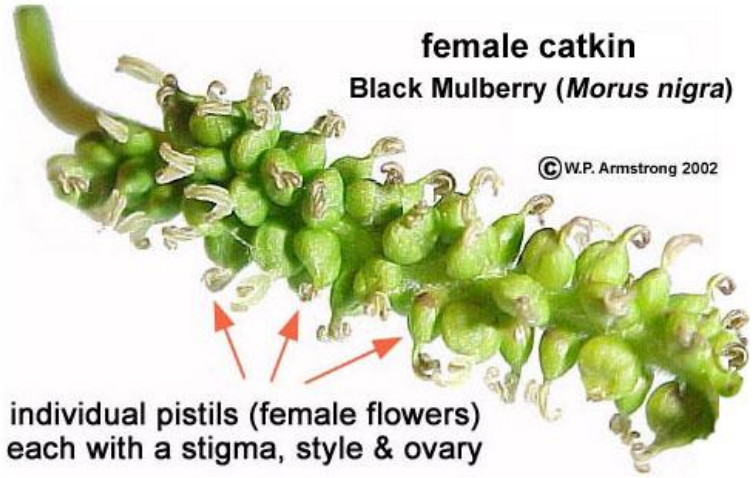




4. Catkin: Inflorescence With Unisexual Flowers



Left: Male (staminate) catkin from the white mulberry (**Morus alba**), a fruitless variety commonly planted as a shade tree in southern California. Right: An individual male flower containing four stamens, each with an anther and a filament. At the base of each filament is a fleshy green sepal. Male trees are known as "fruitless mulberry" because they do not produce messy fruits that stain clothing and walkways. Since mulberries are wind-pollinated, male trees produce copious pollen which can raise havoc with hay-fever sufferers.



Female catkin from a variety of black mulberry (**Morus nigra**). Mulberry flowers are produced in a catkin, with male and female catkins on different trees. Male flowers have four stamens while female flowers consist of single pistil tightly enveloped by four inconspicuous sepals. Each carpel or pistil (also referred as a gynoecium) consists of a forked stigma, a short style and a spherical ovary. Each ovary (carpel) becomes a drupelet and the ripened cluster of drupelets (syncarp) is called a multiple fruit. In the aggregate fruit of a blackberry, all the drupelets of the cluster (syncarp) come from a single flower. Seedless, parthenocarpic fruits may be produced without pollination by male trees.

Inflorescence Definitions

Note: Inflorescences with youngest flower at the end of the main axis (rachis) are called "indeterminate" (i.e. terminal bud continues to produce new flowers). Inflorescences with oldest flower at the end of the main axis are called "determinate" (i.e. terminal bud stops growing and lateral flowers are produced from axillary buds.)

- Solitary: A single flower on a caulescent or acaulescent stem.

- Spike: Unbranched inflorescence with sessile flowers (no pedicels).

- Raceme: Unbranched inflorescence with flowers on pedicels.

- Panicle: A branched or compound raceme (i.e. main rachis with branches bearing flowers on pedicels).

- Corymb: Flat-topped inflorescence with youngest flowers at the end of main axis or rachis.

- Cyme: Flat-topped inflorescence with oldest flowers at the end of main axis. [Includes simple, compound and scorpioid cymes.]

- Umbel: Flat-topped inflorescence with all the pedicels arising from a common point. [Includes simple and compound umbels.]

- Catkin or Ament: A spike-like inflorescence of unisexual, apetalous flowers, often pendent and falling as a unit. This is the typical inflorescence of willow (**Salix**), cottonwood (**Populus**), oak (**Quercus**), alder (**Alnus**) and birch (**Betula**). All these species belong to a polyphyletic group of angiosperm families known as the Amentiferae.

Lab 7
Fruits
&
Vegetables

Kinds of fruits

- **Fleshy (fruits whose mesocarp is at least partly fleshy at maturity) or dry (mesocarp is definitely dry at maturity).**
- **Simple (develops from a flower with a single pistil and could be with one carpel or compound with many carpels); aggregate (a single flower with several pistils) or multiple (derived from several to many individual flowers).**
- **Fruits could be developed from the ovary alone or in addition to other floral parts.**

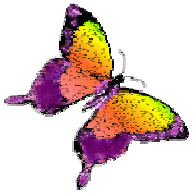
- **A- Fleshy fruits (1) simple:**

a- Drupes: with a single seed (develops from a single ovule) and a stony endocarp e.g. almonds, apricot, cherries, peaches, plums, olives and coconut. In the later the mesocarp is not fleshy and with the exocarp represent the husk (fibrous tissue) while the endocarp is the stony thick brown shell and the watery (milk) substance is the endosperm for seeds.

Almond

Olive

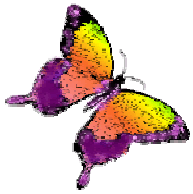
Simple fleshy fruits: Drupe

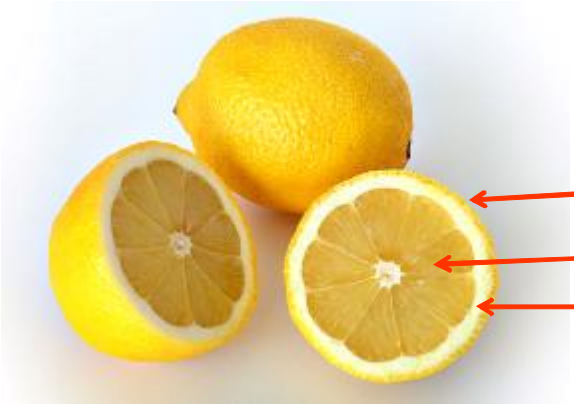


Peach

- **b- Berries:** usually develop from a compound ovary so commonly contain several seeds. The entire pericarp is fleshy:

(1) **A true berry**: thin exocarp and soft pericarp at maturity, contain several seeds except in date and avocado which have one seed, e.g. tomato, peppers, grapes, eggplant, persimmons. When the fruits are derived from **inferior ovary**, other floral parts contribute to the flesh. E.g. blueberries, cranberries, pomegranates and bananas.
When the fruit develop without fertilization (parthenocarpy) it produces no seeds.
(2) The pepo: with a thick rind (pumpkins family), e.g. pumpkin, watermelon, cantalope, squashes, cucumber.
(3) The hespridium: with a leathery skin containing oil. Numerous outgrowths from the inner lining of the ovary wall become scale like and swollen with juices as the fruit develop. E.g. family Rutaceae: lime, lemon, orange, tangerine, grapefruit..etc



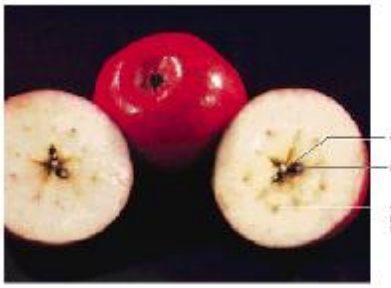


Hespridium fruits

(4) Pome: the bulk of the flesh comes from enlarged floral tube that grows up around the ovary with papary or leathery endocarp. E.g. apples, pears.
Pepo and pome are fruits having accessory tissues so sometimes they name it as accessory fruits.

- **A- Fleshy fruits (2) aggregate**: derived from a single flower with several to many pistils. Each pistil develops into a tiny fruitlet but they mature as a clustered unit on a single receptacle. E.g. raspberries, blackberries and strawberries (also contain accessory tissues).
- **A- Fleshy fruits (3) Multiple**: several to many flowers on a single inflorescence, each flower has its own receptacle but all fused into a fleshy part. E.g. mulberries, osage orange, figs and pineapple.

Tomato and grape are true berries



Pomes of apple

Aggregate fruits

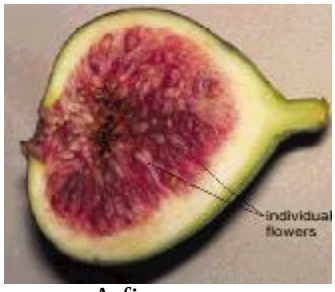
Blackberry flower and fruits

Several pistils in a single flower

A strawberry

Raspberries

Multiple fruits

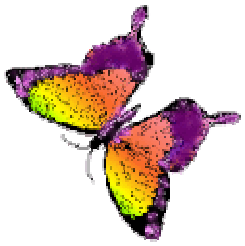


A fig

Osage orange

a pineapple

B- Dry Fruits



- Fruits whose mesocarp is definitely dry at maturity

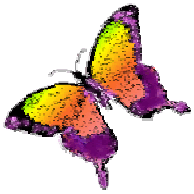
(1) Dry fruits that split at maturity:

a. Follicle: splits along one side or seam only. E.g. milkweed.

b. Legume: splits along two sides. **Fabaceae** family, e.g. peas, beans, lentil, chickpeas, soybean, peanuts (develop underground and microorganisms are responsible of splitting the fruits.

c. Silique: splits along two sides but the seeds are borne on a central partition. **Mustard family** e.g. cabbage, broccoly, radish and mustard.

d. Capsules: consists of at least of two carpels and split in a variety of ways. Some split along the partitions and others through the cavities (locules) in the carpels while others by popping off the caps.



Follicles

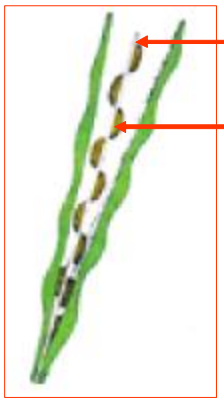
Magnolia

Legumes

Peas

Milkweed

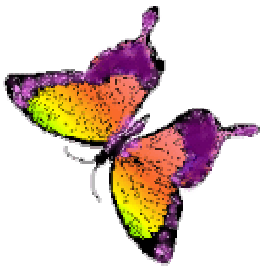
Coral tree



Siliques

Mustard

Dollar plant



Capsules

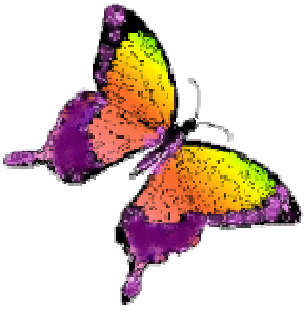
Butterfly iris

Okra

Unicorn plant

Autograph tree

***Bletilla* orchid**

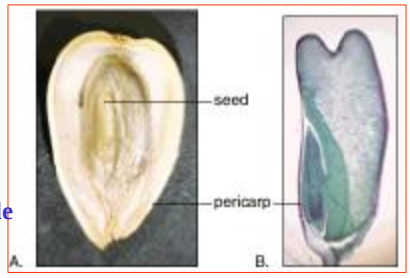


(2) Dry fruits that do not split at maturity

- <u>The single seed is united with the pericarp in different degrees:</u>

a. Achene: The seed is only attached from the base with the pericarp (husk). E.g. buckwheat and sunflower.
b. Nut: the seed is generally larger than achene and the pericarp is much harder and thicker, they develop with a cluster of bracts at their base. E.g. hazelnut, acorns, chestnut.
Most of the known nuts are botanically not nuts: peanut is a legume, coconuts, almonds, walnuts, pecans and cashew nut are drupes.
c. Caryopsis (grain): The pericarp is tightly united with the seeds and cannt be separated from it. All members of grass family Poaceae including: wheat, barley, corn, oat, rice.
d. Samaras: The pericarp extends out in the form of a wing or membrane which aids in dispersal and could be produced in pairs like Maple or in a single seed like Ashes, Elm and the tree of heaven.
e. Schizocarp: The twin fruit is unique to parsley family (Apiaceae), when matured it breaks into two mericarps (one seeded) e.g. parsley, carrots, anise, caraway and dill.

Samaras of Maple

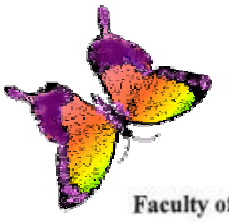


Achene of sunflower

Caryopsis of corn

Schizocarp of carrot

Nuts of acorn oak



Faculty of Agricultural and Environmental Sciences, McGill University
Principles of Plant Science PLNT 211

VEGETABLE CROPS LABORATORY

Student Name: _____ Student Number: _____

PART A: Fill in the following table.

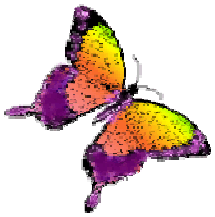
Vegetable	Latin Name	Family	Plant Part(s) Consumed (if a fruit, name the type)
Asparagus			
Beans			
Beet			
Bok choy			
Brussels sprouts			
Cabbage			
Carrot			
Cauliflower			
Celeriac			
Celery			
Cucumber			
Eggplant			
Fennel			
Garlic			
Globe Artichoke			
Kohlrabi			
Leek			
Lettuce			
Okra			
Onion			

Parsley			
Parsnip			
Peas			
Pepper			
Potato			
Radish			
Rutabaga			
Spinach			
Squash			
Sweet Corn			
Sweet Potato			
Tomato			
White Radish			
Zucchini			

PART B: Give an example for and draw the following vegetable parts. Label each drawing appropriately.

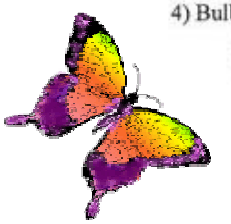
1). Berry in cross section
Label placenta, ovule, pericarp
Example _____

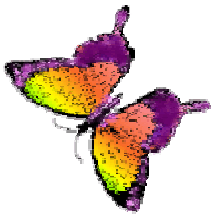
2) Pod (open and then draw)
Label pericarp, funiculus, ovule
Example _____



3) Compare a <u>stem tuber</u> and <u>root tuber</u> (draw whole)
Label bud (eye), terminal bud, scar of attachment.
Examples _____

4) Bulb - in longitudinal section
Label membranous scales, fleshy scales, main bud, lateral bud
Example _____





PART C: Testing processing quality of stored potatoes

Some vegetable such as squash, carrots, rutabagas, and potatoes can be stored for a number of months before they are used. However, in order to reduce the rate of respiration and maintain vegetable quality, storage conditions must be carefully controlled. Good air circulation and low humidity are important to prevent disease development. Reducing the ambient temperature in storage is a good way to reduce enzyme activity in the stored produce, thus decreasing respiration. There is an optimum temperature for storage for different vegetable species. End use will also determine the correct storage temperature. For example, table potatoes are best stored at 5°C. Potatoes used in manufacturing potato chips and french fries should not be held at temperatures lower than 7-8°C. At lower temperatures, enzymes will convert starch into sugar, giving the potato tuber flesh a sweet taste. When these potatoes are used for making chips and fries, the end product browns very easily due to the high sugar content of the potatoes. This is not desirable in the potato chip and french fry industry since there is consumer demand for a light golden, even coloured product.

In this part of the laboratory, you will observe potato flesh stored at 1°C and at 10°C.

1. Cut 5 small disks from each of potato samples A and B
2. Place the disks in the iodine solution in petri dishes A and B for 5 minutes
3. After 5 minutes, rinse the potato disks and observe the coloration of disks from sample A vs. sample B.

Are there any differences? If so, describe them and comment on the potential quality of each sample for the potato chip industry.

SAMPLE A (1°C) **SAMPLE B (10°C)**

PART D. Enjoy a sample of a mixed vegetable dish from the Philippines. It is called "pinakbet". Can you recognize all of the vegetables?

Faculty of Agricultural and Environmental Sciences, McGill University
Principles of Plant Science PLNT 211

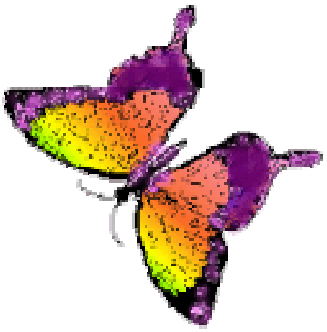
FRUIT CROP STRUCTURES LABORATORY

Student Name: _____ Student Number:_____

The various fruit types have been described in the Class Notes (pp. 123-125) including berry, drupe, hesperidium, pepo, pome, aggregate achene, aggregate drupe, and mutiple drupe.

PART A Examine the fruits on display and complete the following table.

FRUIT (Common Name)	SCIENTIFIC NAME	TYPE
Apple		
Avocado		
Banana		
Blueberry		
Cantaloupe		
Cherry		
Grape		
Grapefruit		
Kiwi		
Lemon		
Lime		
Mango		
Nectarine		
Orange		
Papaya		
Peach		
Pear		
Pineapple		
Plum		
Raspberry		



Shorouq Jaradat

Strawberry		
Watermelon		

PART B

Draw and name an example of each fruit type in the space provided for it below. Label all parts (i.e. receptacle, carpel, seed, endocarp, mesocarp, exocarp, drupe, achene).

Pome (e.g. _____)

Drupe (e.g. _____)

True berry (e.g. _____)

Hesperidium (e.g. _____)

Pepo (e.g. _____)

Multiple fruit (drupe) (e.g. _____)

Aggregate fruit:

a) aggregate drupe (e.g. _____)

b) aggregate achene (e.g. _____)

PART C

Observe apple varieties A, B, C, D, and E.

1). Observe the pressure test demonstration (used to assess flesh firmness; indicates handling ability, loss of firmness in storage). Record the results for each of the varieties.

2) Eat a sample of each variety.

3) Rank varieties A B C D E in order of your personal preference (most preferred to least preferred) and briefly state reasons for your choices (e.g. taste, texture, appearance, etc.)

Lab (8)
Non- vascular plants

&
Spore- bearer plants

Non-vascular plants

(Moss)

Division: Bryophyta

Mnium

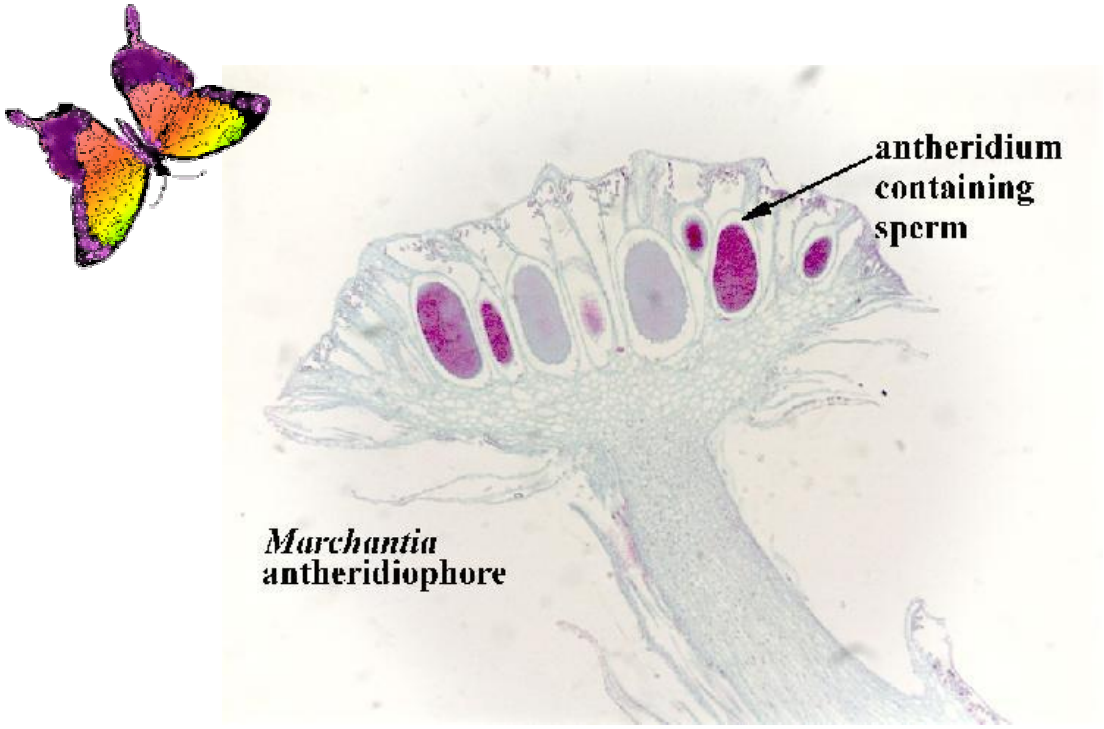
Polytrichum

Liverworts
Division: Hepatophyta

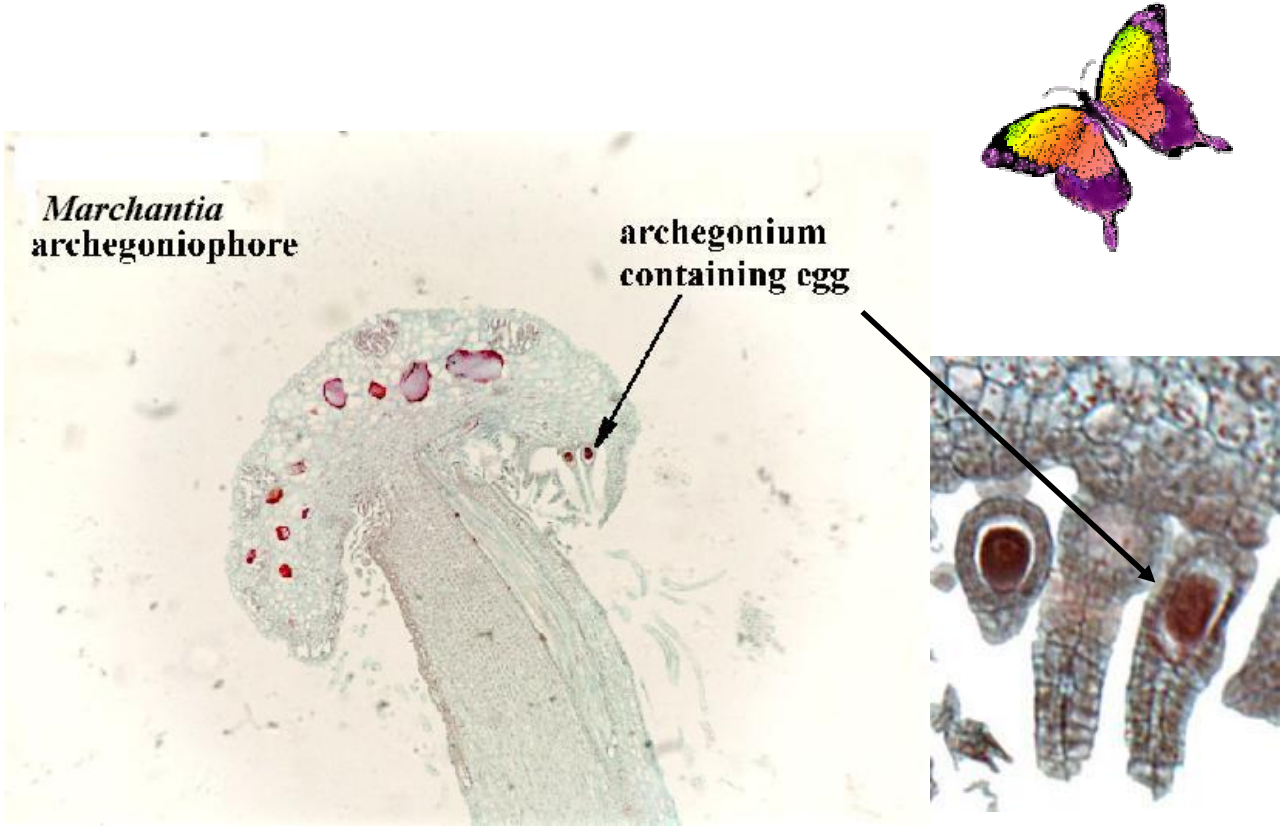
Marchantia antheridiophore

Marchantia archegoniophore

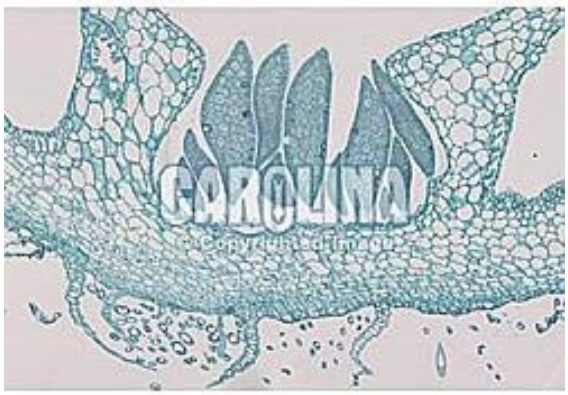
Marchantia polymorpha showing gemmae cups



Marchantia antheridiophore



Marchantia archegoniophore

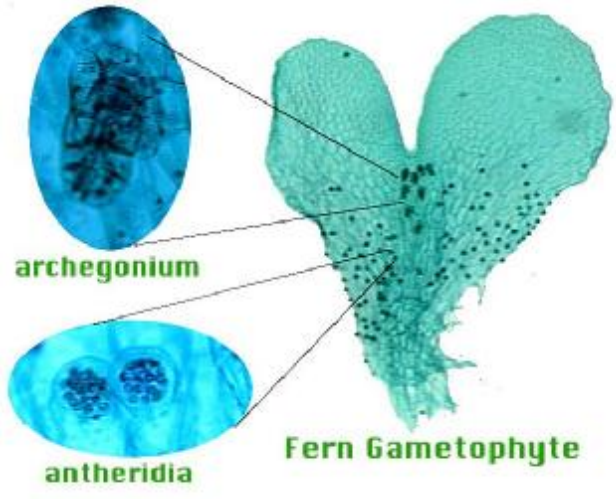


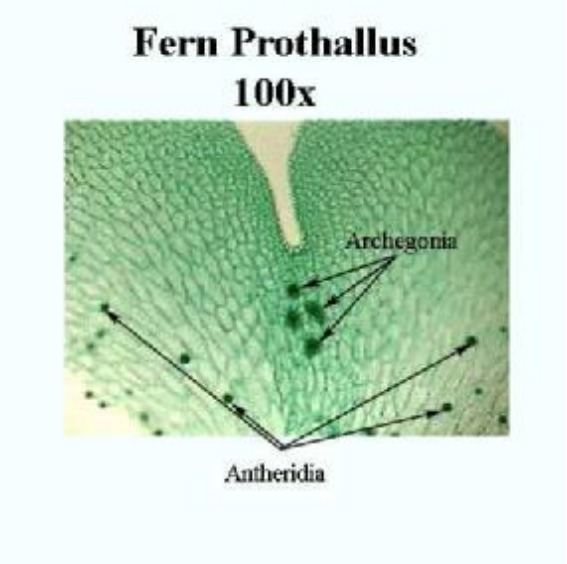
Marchantia thallus with gemmae cup

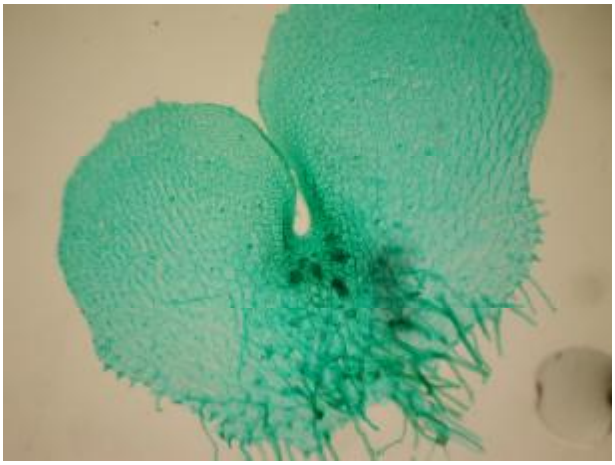
Spore- bearer plants

Ferns

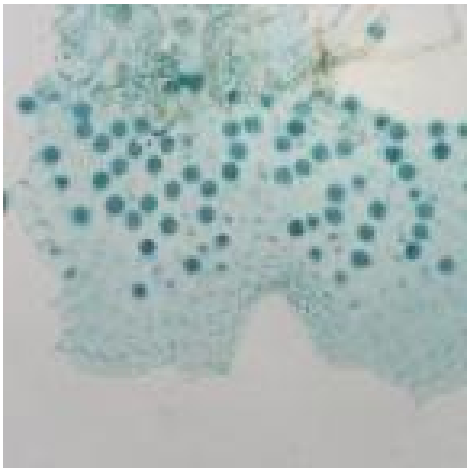
Division: Polypodiophyta



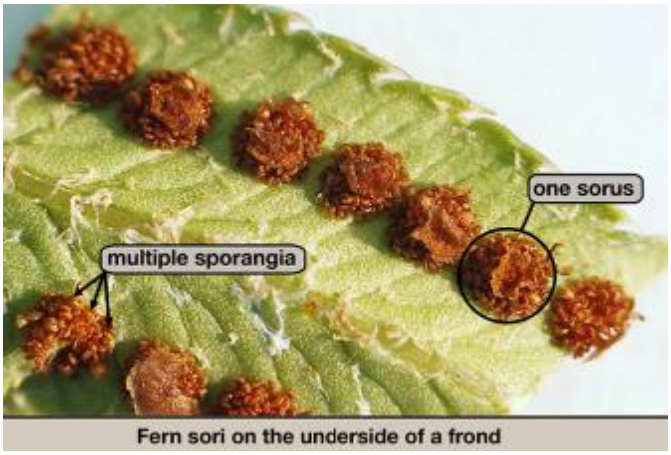




Fern female gametophyte



Fern male gametophyte

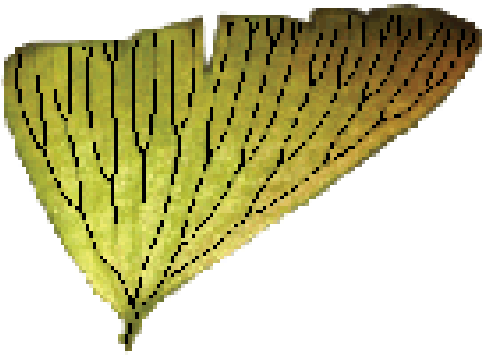


Fern sori on the underside of a frond

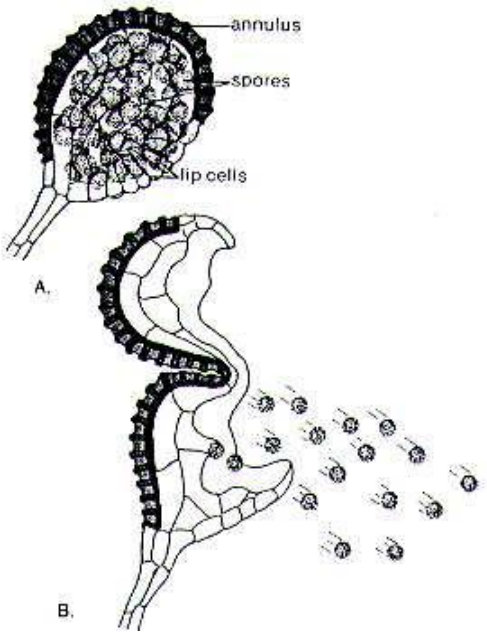
Polypodium Frond with sori at lower surface

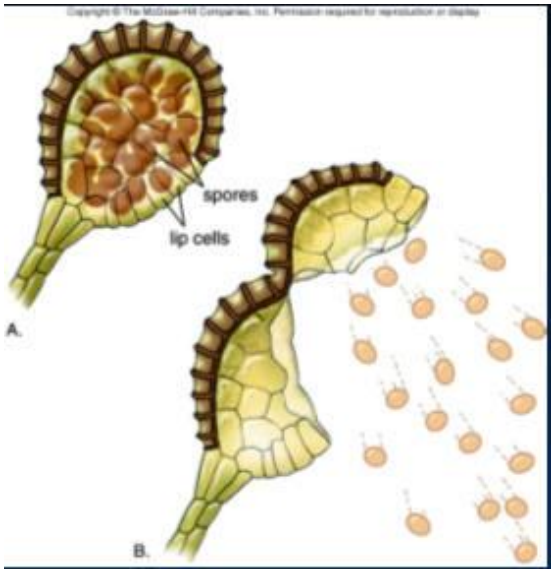
Fern fiddle head

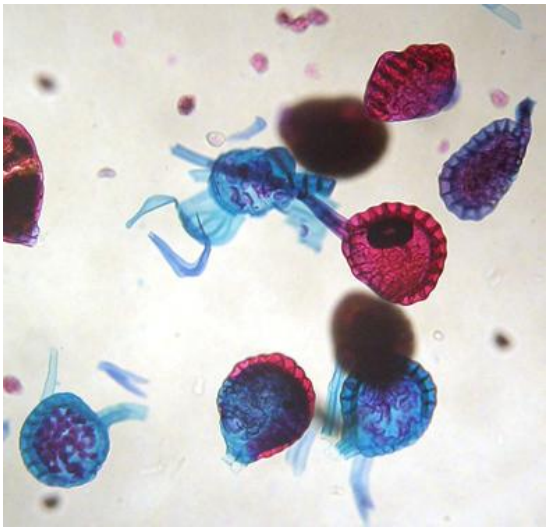
Adiantum compond leaf with sori on the margins of leaflets



Dichotomous branches of *Adiantum* leaflets







Fern sporangia

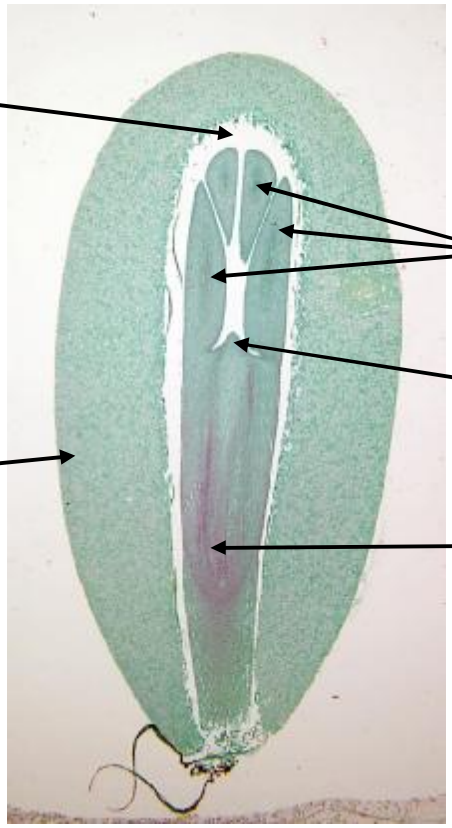
Lab (9)
Gymnosperms

Vascular seed bearing plants

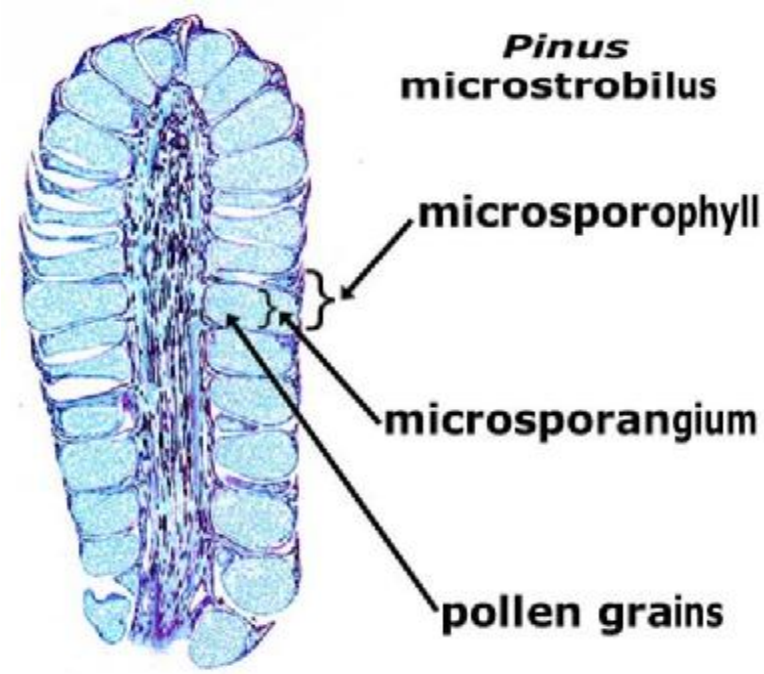
Division: Ginkgophyta

***Ginkgo* ovule**

Division: Coniferophyta

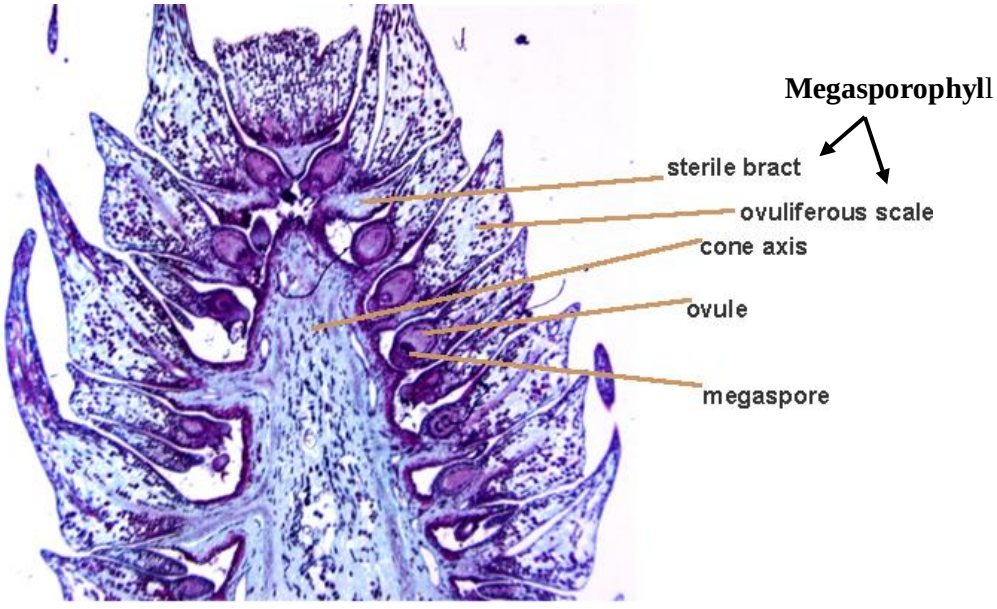


Pine mature embryo



(microspores)

Pine staminate cone



Pine young ovulate cone

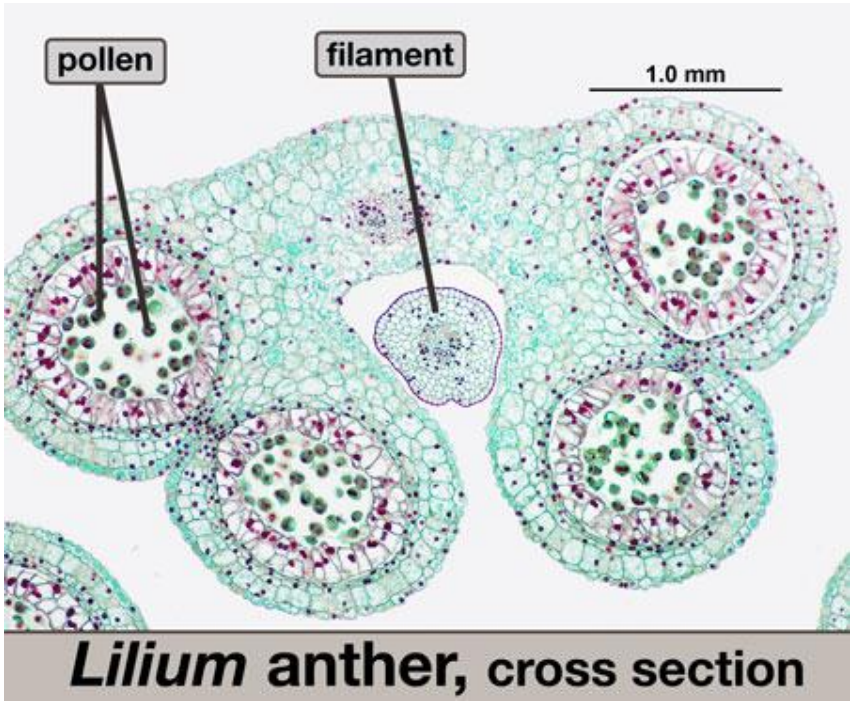
Cluster of antheridia

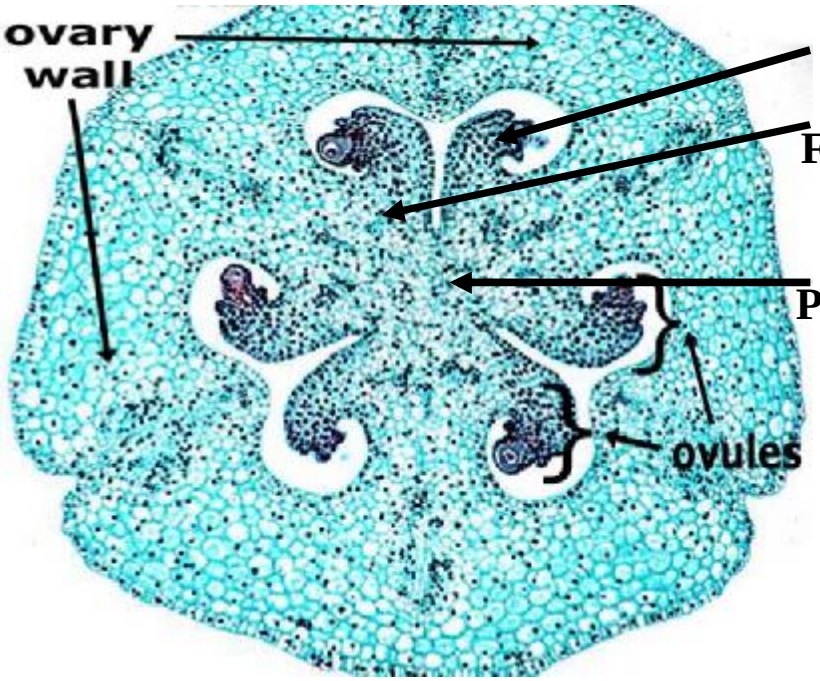
Female pine cone

Needle leaves of pine

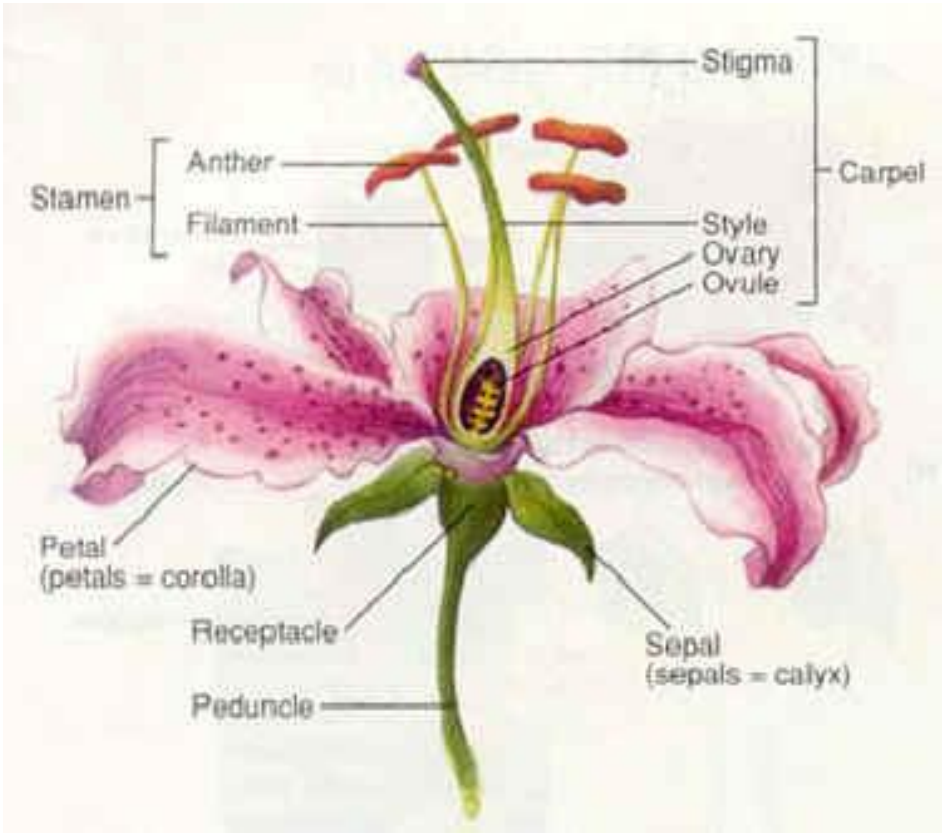
Lab (10)
Angiosperms

Flowering plants

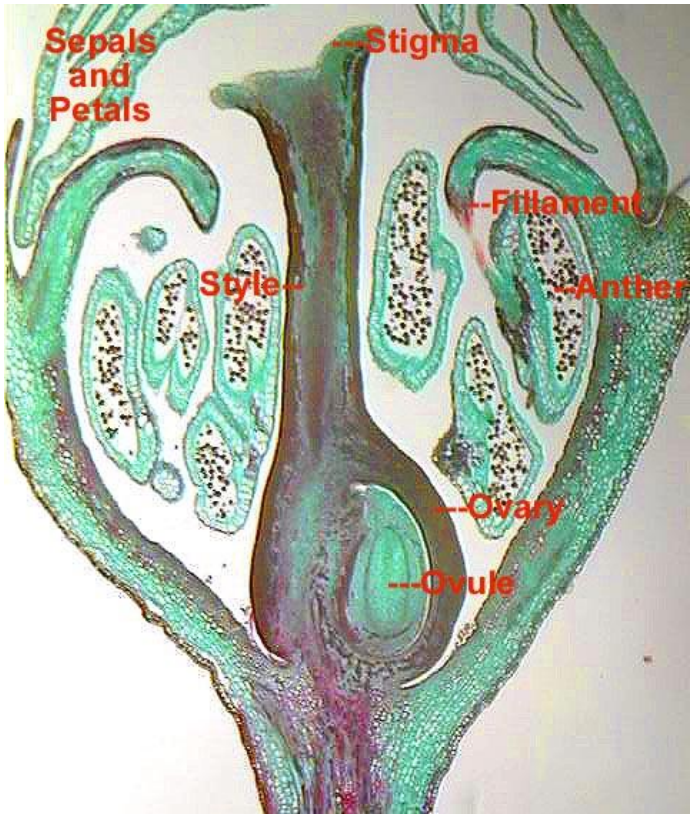




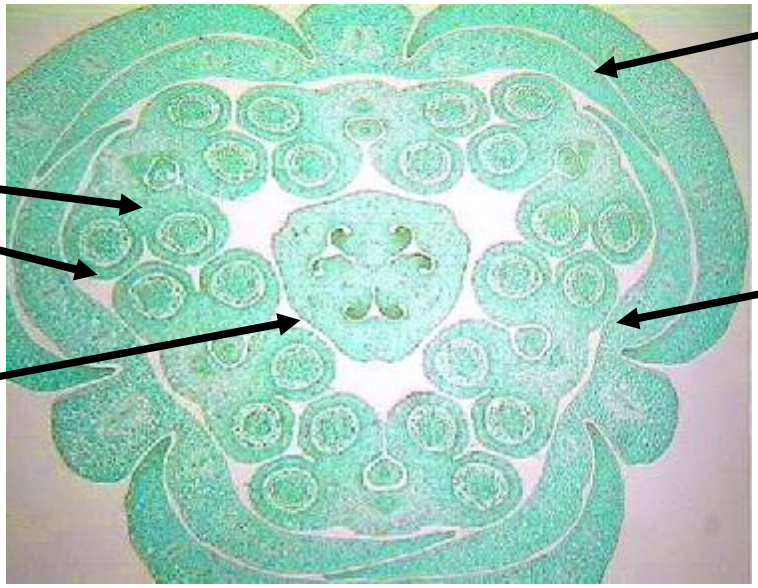
Lilium ovary C.S



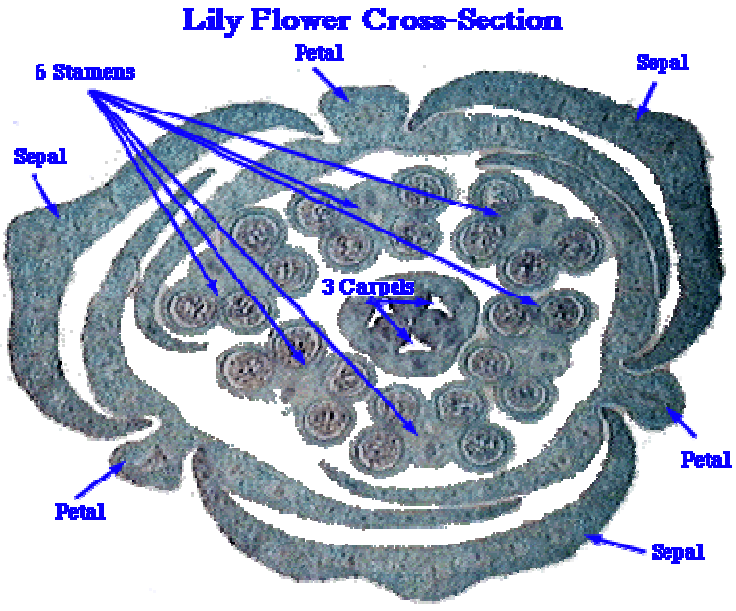
Dicot flower



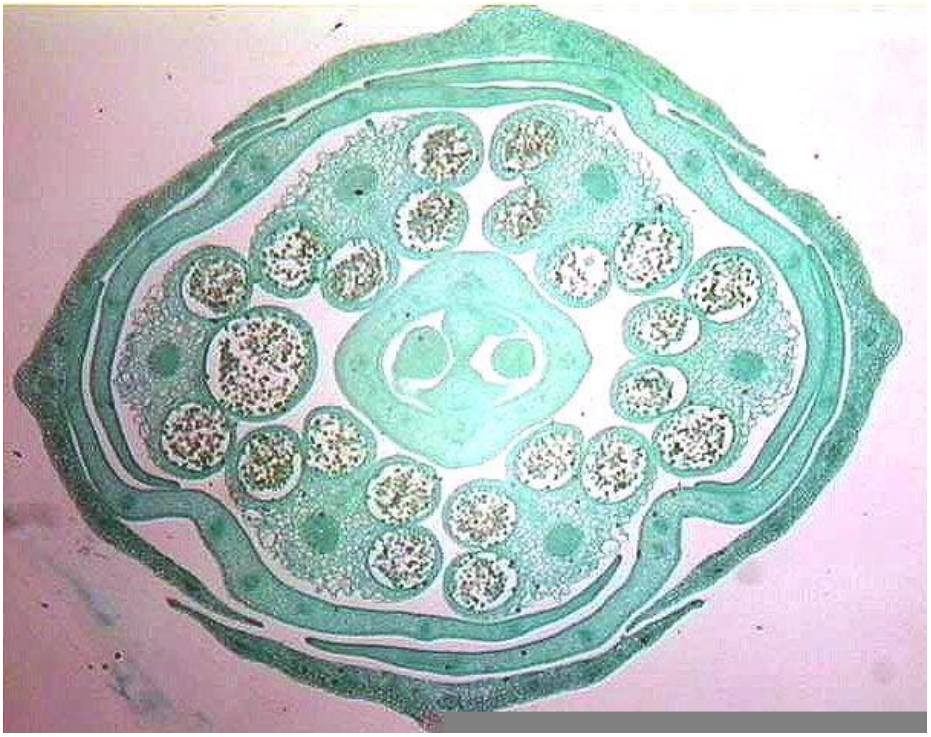
Dicot flower bud L.S



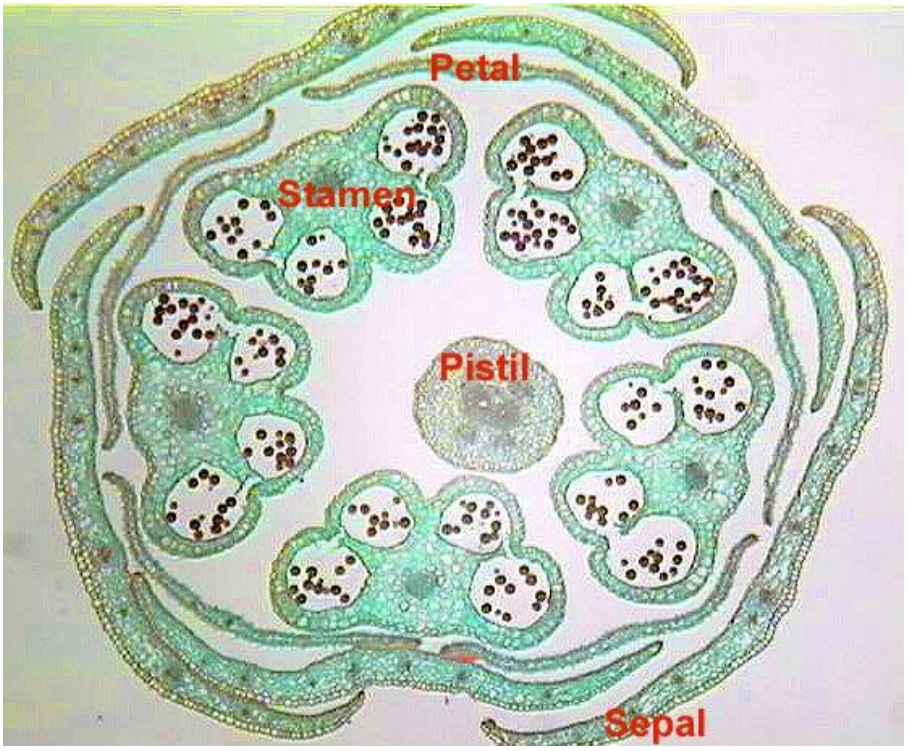
Monocot flower bud C.S



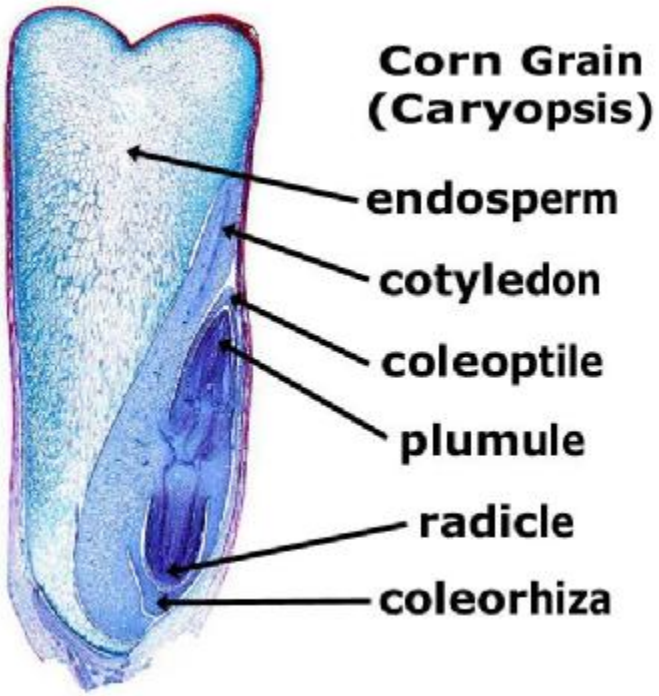
Monocot flower bud C.S



Dicot flower bud C.S

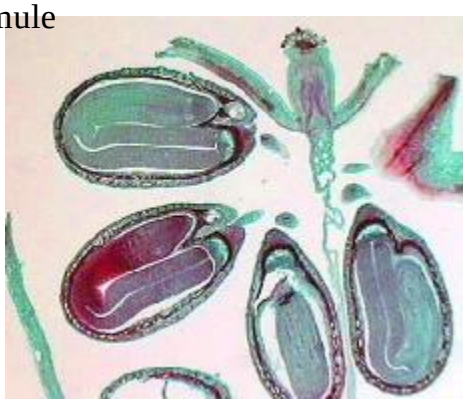


Dicot flower bud C.S



Corn grain

Plumule

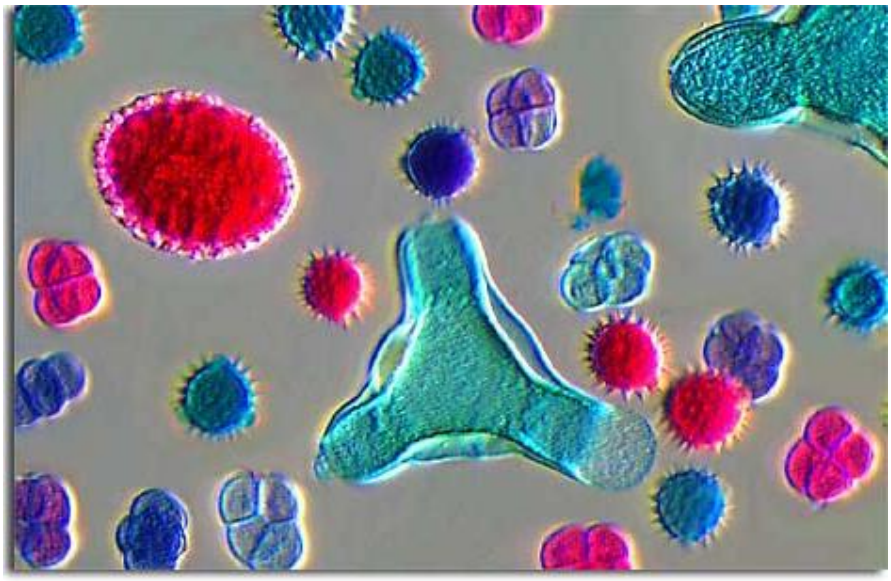


***Capsella* fruit**

Seed coat Radicle

2 cotyledons

***Capsella* seed**



Mixed pollen grains

- **Microspores become later the pollen grains.**
- **The outer layer of the pollen grain wall is called the exine.**
- **Exine contains chemicals that may later react with other chemicals in the stigma of a flower.**
- **As a result of these reactions, the pollen grain may germinate or its further development may be blocked, depending on whether or not it originated from the same plant, another plant of the same species, or a plant of a different species.**

Lab (11)
Plant families

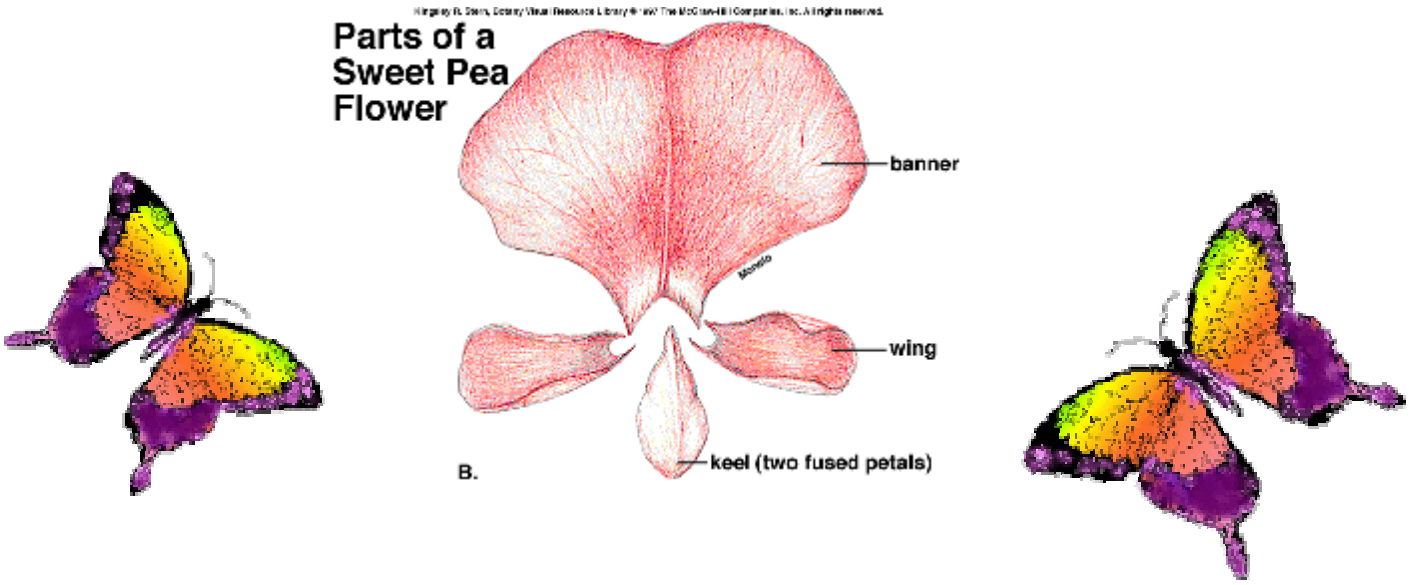
Identification of Common Plant Families:

Prepared by M. H. Abu-Dieyeh

Reference: Stern K R (2003) Introductory plant Biology. Wm.C. Brown Publisher

The Rose family (Rosaceae): comprises a large number of trees, shrubs and herbs. The flowers have the basal parts fused into a cup, with petals, sepals, and numerous stamens being attached to the cup's rim. Include plants with pome fruits (apples and pears), with aggregate fruits (strawberries, raspberries), with stone fruits (cherries, apricots, peaches, plums) and with follicle fruits (rose).

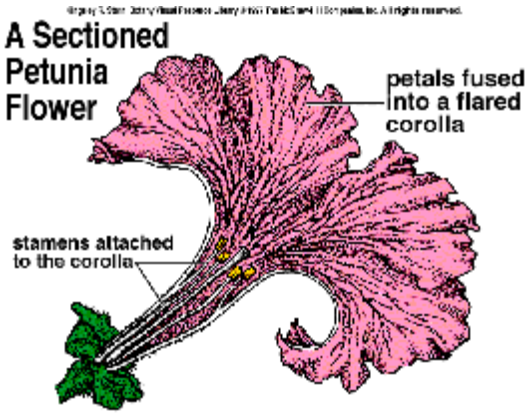
The Legume family (Fabaceae): The third largest of the flowering plants (about 300 families). The flowers are mostly bilaterally symmetrical with 5 petals: two fused petals (boat shaped) enclosing the pistil and named a keel, two wing petals and a larger banner petal. All members of this family produce the same fruit type, the pod or legume. Include: peas, beans, lentils, peanuts, chickpeas, alfalfa and clover.



The Mustard family (Brassicaceae): The flower usually has four petals in the form of a cross, four sepals, and six stamens, two of which are shorter than the other four. All members produce silique fruits. Include: cabbage, cauliflower, brussels sprouts, broccoli, radish, turnip, and mustard.

The Mint family (Lamiaceae): have square stems in cross sections, with opposite leaves and bilaterally symmetrical flowers. Generally, they produce aromatic oils in the leaves and stems. Include: rosemary, thyme, sage, mint, oregano, basil.

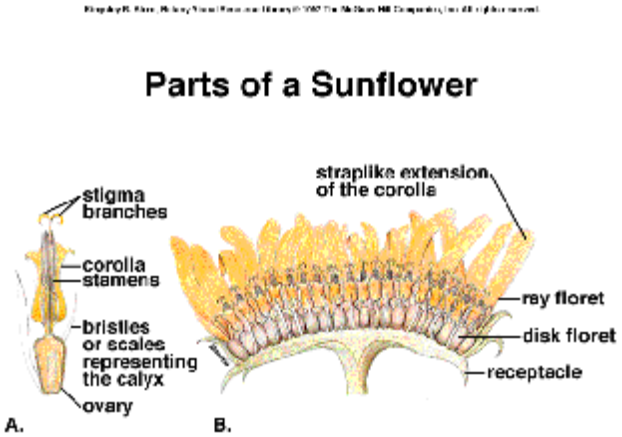
The Nightshade family (Solanaceae): Petals are fused togother, at least at the base, and the filaments of the stamens are fused to the corolla so that they appear to be arising from it. The superior ovary develops into a berry or capsule. Have alternate leaves and occur as herbs, shrubs, trees, or vines. Include: tomato, potato, eggplant, pepper, tobacco and petunia (ornamental).

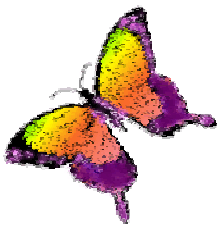


The Carrot family (Apiaceae): The flowers are small and numerous and are arranged in umpels. The ovary is inferior and the stigma is two-lobed. The petiols of the leaves (are generally dissected) usually form sheaths around the stem at their bases. Include: dill, celery, carrot, parsley, fennel, and anise.

The Pumpkin family (Cucurbitaceae): Plants are prostrate or climbing herbaceous vines with tendrils. The flowers have fused petals and an inferior ovary with three carples. All flowers are unisexual but in some plant both male and female flowers are present on the same plant. Produce pepo fruits. Include: pumpkin, squashes, cucumber, cantaloupes, and watermelons.

The Sunflower family (Asteraceae): The second largest family of the flowering plants in terms of number of species. The individual flowers are called florets. They are usually tiny and numerous but are arranged in a compact inflorescence, so that they resemble a single flower. Marginal florets having greatly developed corollas that extend out like straps, forming what appear to be petals of the inflorescence and called ray florets, other florets are called disc florets. In certain species like dandelion all florets of the inflorescence have narrow straplike extensions. Include: lettuce, chicory, dandelion, sunflower, dahlia, marigold, thistle, and Jerusalem artichoke.



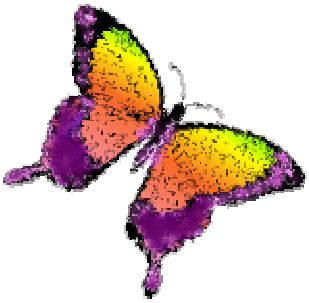


The Cactus family (Cactaceae): The flowers are usually showy, with numerous stamens, petals, and sepals. The sepals are often colored like the petals, and the inferior ovary develops into a berry. The leaves are mostly reduced in size (spines) or missing, with fleshy flattened or cylindrical often fluted stems carrying on the photosynthesis of the plants. Include prickly pear cacti, barrel cactus, and organ-pipe cactus.

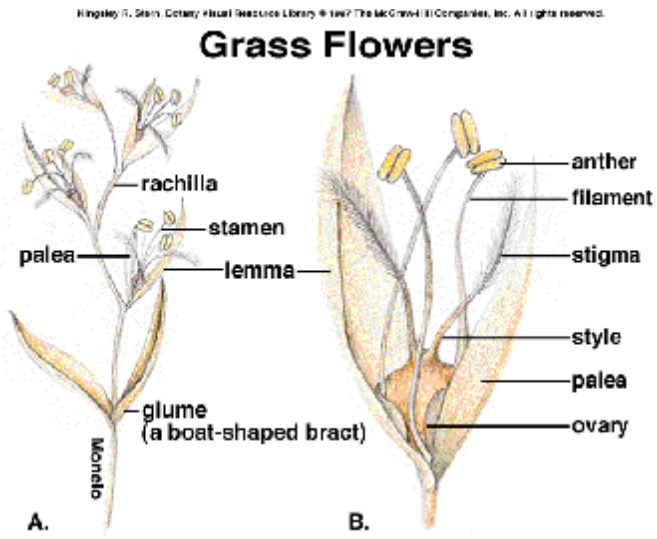
Prickly pear

Organ pipe

Barrel



The Grass family (Poaceae): The most widely distributed flowering plant. The flowers are highly specialized in structure and have a terminology all their own. The calyx and corolla are represented tiny, inconspicuous scales and the flowers are protected by boat-shaped bracts. The stigmas when they are exposed are feathery and the leaves sheathe the stem at their bases. Include all cereals: wheat, barley, rye, oats, rice, and corn and include also sugarcane and wild grasses.

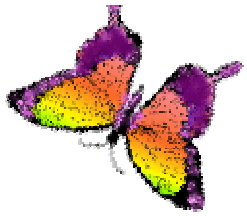


The Lily family (Liliaceae): With large flowers and multiple of three parts. The sepals are frequently colored the same as and resembling the petals. Generally have superior family. Include: lilies, asparagus, meadow saffron, and Aloe Vera.

A generalized key for common plant families

1. Flowers with parts in fours or fives or multiples thereof; seeds with two cotyledons (DICOTS).
   2. Petals separate from one another, or lacking.
      3. Petals present.
         4. Stamens more than twice as many as the petals.
            5. Stamens, petals, and sepals attached to the rim of a cup surrounding the one to many pistils ..... Rose Family (Rosaceae)
            5. Stamens, petals, and sepals not attached to the rim of a cup.
               6. Pistils several to many in each flower ..... Buttercup Family (Ranunculaceae)
               6. Pistil one.
                  7. Ovary superior ..... Poppy Family (Papaveraceae)
                  7. Ovary inferior ..... Cactus Family (Cactaceae)
         4. Stamens not more than twice as many as the petals.
            8. Herbaceous vines; fruit a pepo ..... Pumpkin Family (Cucurbitaceae)
            8. Primarily herbs, shrubs, and trees; fruit not a pepo.
               9. Fruit a legume ..... Legume Family (Fabaceae)
               9. Fruit not a legume.
                  10. Fruit a silique or silicle ..... Mustard Family (Brassicaceae)
                  10. Fruit not a silique or silicle.
                     11. Ovary superior; stems square in cross section; leaves opposite; fruit of four nutlets ..... Mint Family (Lamiaceae)
                     11. Ovary inferior; stems rounded in cross section; leaves alternate; fruit a schizocarp ..... Carrot Family (Apiaceae)
      3. Petals lacking; calyx sometimes petal-like.
         12. Ovary of three carpels and usually elevated on a gynophore; anthers splitting lengthwise ..... Spurge Family (Euphorbiaceae)
         12. Ovary of one carpel; gynophore lacking; anthers splitting by raised flaps ..... Laurel Family (Lauraceae)
   2. Petals fused together.
      13. Flowers with a single pistil; ovary superior ..... Nightshade Family (Solanaceae)
      13. "Flowers" are inflorescences composed of several to numerous florets with inferior ovaries on a common receptacle ..... Sunflower Family (Asteraceae)
1. Flowers with parts in threes or multiples thereof; seed with one cotyledon (MONOCOTS).
   14. Flowers inconspicuous; without petals or sepals ..... Grass Family (Poaceae)
   14. Flowers conspicuous, the petals and sepals mostly similar in coloration.
      15. Ovary superior; petals all alike ..... Lily Family (Liliaceae)
      15. Ovary inferior; one petal different in form from the other two ..... Orchid Family (Orchidaceae)

A list of garden vegetables and horticulture plants



Prepared By Mohammed H. Abu-Dieyeh

1. APIACEAE(UMPELLIFERAE)

Common name English	French	Scientific (Latin) name
Carrot	Carotte	*Daucus carota*
Celeriac	Céleri-rave	*Apium graveolens*
Celery	Céleri	*Apium graveolens Var. rapaceum*
Coriander	Coriande	*Coriandrum sativum*
Dill	Aneth	*Anethum graveolens*
Parsley	Persil	*Petroselinum crispum*
Fennel	Fenouil	*Foeniculum vulgare*

2. ASTERACEAE (=COMPOSITAE)

Jerusalem artichoke	Topinambour	*Helianthus tuberosus*
Artichoke	Artichaut	*Cynara scolymus*
Marigold (Ornamental)	Oeillet d'inde	*Tagetes erecta*
Safflower	Carthame	*Carthanus tinctorius*
Sunflower	Tournesol	*Helianthus annus*
Lettuce	Laitue	*Lactuca sativa*

3. BALSAMINACEAE

Impatiens	Impatiente	*Impatiens balsamina*

4. BRASSICACEAE (=CRUCIFERAE)

Cabbage	Chou	*Brassica oleraceae var. capitata*
Cauliflower	Chou-fleur	*Brassica oleraceae var. cauliflora*
Broccoli	Brocoli	*Brassica oleraceae var. botrytis*
Brussels sprouts	Choux de Bruxelle	*Brassica oleraceae Var. germifera*
Kale	Chou Kale	*Brassica oleraceae Var. acephala*
Oriental/ Brown mustard	Moutarde brune	*Brassica juncea*
Radish	Radis	*Raphanus sativus*
White radish	Radis blanc	*Raphanus sativus Var.longipinnatus*
Mustard	Moutarde	*Brassica hirt = Sinapsis alba*
Canola (rapeseed)	Colza	*Brassica napus*
Forage rape	Colza fourrager	*Brassica napus Var. oleifera*

5. CANNACEAE

Canna (Ornamental)	Canna	*Canna x generalis*

6. CHENOPODIACEAE

Sugar beet	Betterave sucré	*Beta vulgaris*
Swiss chard	Bette-à-carde	*Beta vulgaris var. cicla*
Spinach	ةpinard	*Spinacia oleracea*

7. CONVOLVULACEAE

Sorrel	Oseille	*Rumex acetosa*
Morning glory	Ipomée	*Ipomoea imperialis*

8. CUCURBITACEAE

Cucumber	Concombre	*Cucumis sativus*
Cantaloupe	Cantaloup	*Cucumis melo*
Squash/ Hubbard squash	Courge	*Cucurbita maxima*
Zucchini/ Pumpkin Acorn squash/ Spaghetti squash/ Delicata/	Zucchini/ citrouille/ courge giraumont/ spaghetti/delicata/	*Cucurbita pepo*
Watermelon	Melon d'eau	*Citrulus lanatus*
Gourd	Courge-calebasse	*Lagenaria siceraria*
Rhubarb	Rhubarbe	*Rheum rhaponticum*

9. FABACEA (=LEGUMINOSAE)

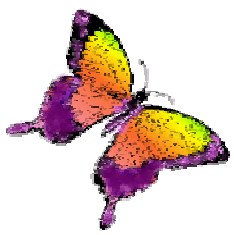
Faba bean /Broad bean	Gourgane	*Vicia faba*
Scarlet runner	Haricot d'Espagne	*Phaseolus coccineus*
Common bean/ Kidney bean/ Wax bean/ Green bean	Haricot	*Phaseolus vulgaris*
Lentil	Lentille	*Lens culinaris*
Chickpea	Garbanzo/ Pois chiche	*Cicer arietinum*
Garden pea	Pois vert	*Pisum sativum*
Alfalfa	Luzerne	*Medicago sativa*
Soybean	Soya	*Glycine max*
Bird's foot trefoil	Lotier	*Lotus corniculatus*
Red clover	Trèfle rouge	*Trifolium pratense*
Kura clover	Trèfle kura	*Trifolium ambiguum*
White clover	Trèfle blanc	*Trifolium repens*

10. GERANEACEAE

Geranium	Géranium	*Pelargonium hortorum*

11. MALVACEAE

Cotton	Coton	*Gossypium hirsutum*
Lavatera	Lavatère	*Lavatera grandiflora*
Malva	Mauve musquée	*Malva moschata*
Okra	Gumbo	*Abelmoschus esculentus*



12. LAMIACEAE

Basil (Herb)	Basilic	*Ocium basilicum*
Oregano (Herb)	Origan	*Origanum vulgare*
Pepermint (Herb)	Menthe poivrée	*Mentha piperita*
Rosemary (Herb)	Romarin	*Rosmarinus officinalis*
Sage (Herb)	Sauge	*Salvia officinalis*
Thyme (Herb)	Thym	*Thymus vulgaris*
Savory (Herb)	Sariette	*Satureja hortensis*

13. LILIACEAE (=AMARYLLIDACEAE)

Garlic	Ail	*Allium sativum*
Leek	Poireau	*Allium ampeloprasum*
Onion	Oignon	*Allium cepa*
Asparagus	Asperge	*Asparagus officinalis*

14. LINACEAE

Flax	Lin	*Linum usitatissimum*

15. POACEAE (=GRAMINAE)

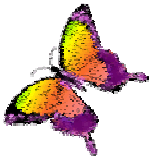
Corn, Maize	Mais	*Zea mays*
Wheat	Blé	*Triticum aestivum*
Timothy	Fléole des prés	*Phleum pratense*
Barley	Orge	*Hordeum vulgare*
Oat	Avoine	*Avena sativa*
Rye	Seigle	*Secale cereale*
Sorghum	Sorgho	*Sorghum bicolor*
Japanese millet	Millet japonais	*Echinochloa frumentacea*
Annual ryegrass	Ivraie multiflore	*Lolium multiflorum*
Perennial ryegrass	Ivraie vivace	*Lolium perenne*
Bromegrass	Brome inerme	*Bromus inermis*
Kentucky bluegrass	Pâturin des prés	*Poa pratensis*
Orchardgrass	Dactyle	*Dactylis glomerata*
Redtop grass	Agrostide blanche	*Agrostis alba*
Sudan grass	Sudan grass	*Sorghum vulgare Var. Sudanese*
Triticale	Triticale	*Tritico secale*
Reed canarygrass	Alpiste roseau	*Phalaris arundinacea*
Tall fescue	Fétuque élevée	*Festuca arundinacea*

16. POLYGONACEAE

Common buckwheat (grain)	Sarrasin	*Fagopyrum esculentum*
Wild buckwheat (weed)	Renouée liseron	*Polygonum convolvulus*

17. ROSACEAE

Strawberry	Fraise	*Fragaria xananassa*
Raspberry	Framboise	*Rubus idaeus*



18. SOLANACEAE

Eggplant	Aubergine	*Solanum melongena*
Potato	Pomme de terre	*Solanum tuberosum*
Pepper (Sweet)	Piment	*Capsicum annuum*
Tomatillo	Tomatillo	*Physalis ixocarpa*
Tobacco	Tabac	*Nicotinia tabacum*
Petunia	Pétunia	*Petunia hybrida*
Tomato	Tomate	*Lycopersicon esculentum*