

Flowers and Flowering

From various internet sources

October 2019

REPRODUCTIVE ORGANS

❖ Primitive Reproductive Organs

- Archegonia
- Antheridia
- Sporangia

❖ Complex Reproductive Organs of the Higher Plants

- Cones
- Flowers of Angiosperms

Structure of Flowers

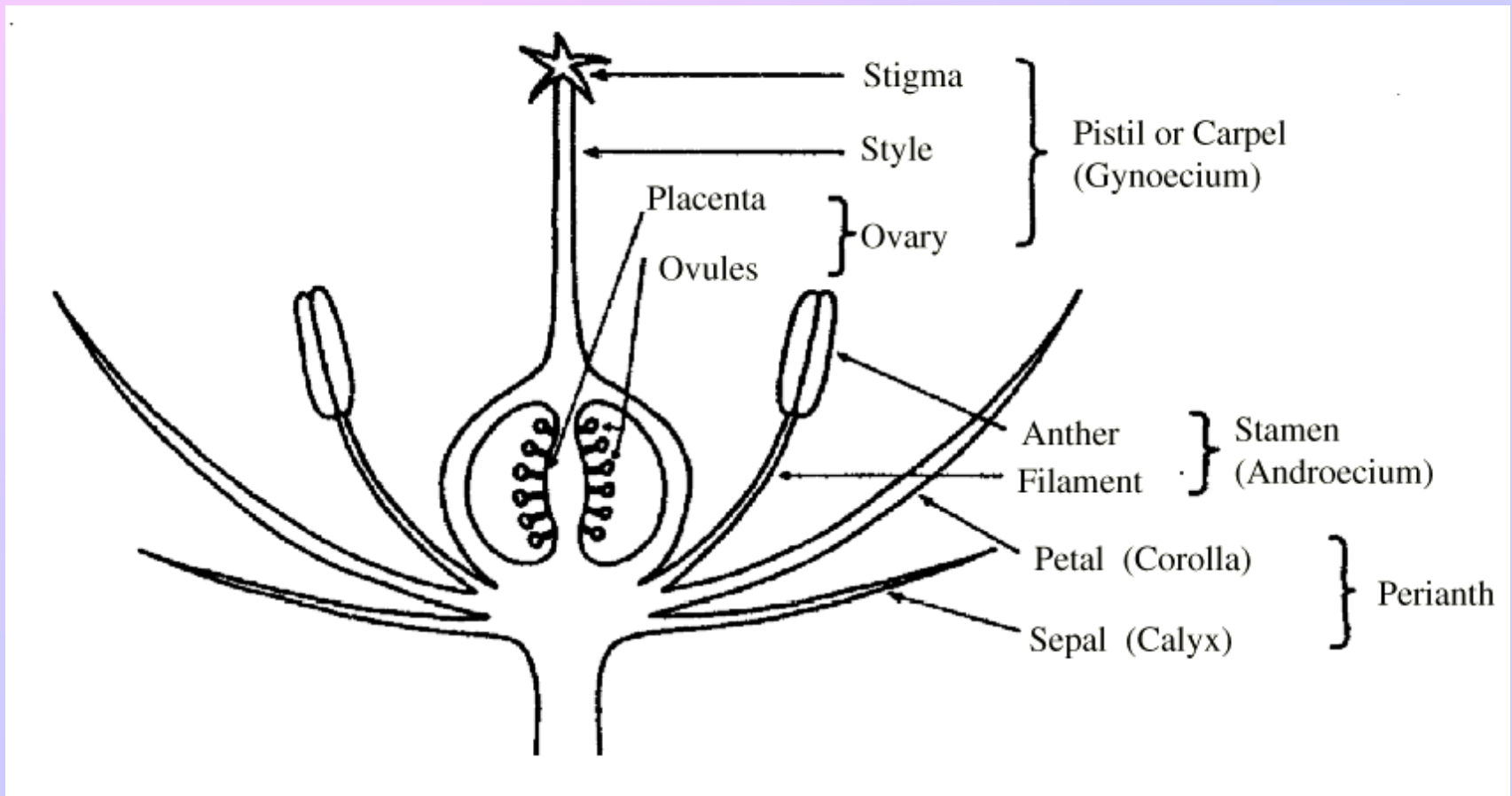
- ❖ **Flowers begin as embryonic primordium**

PARTS

- ❖ **Peduncles.**
 - **pedicels**
- ❖ **Receptacle - Swollen end of peduncle or pedicel**

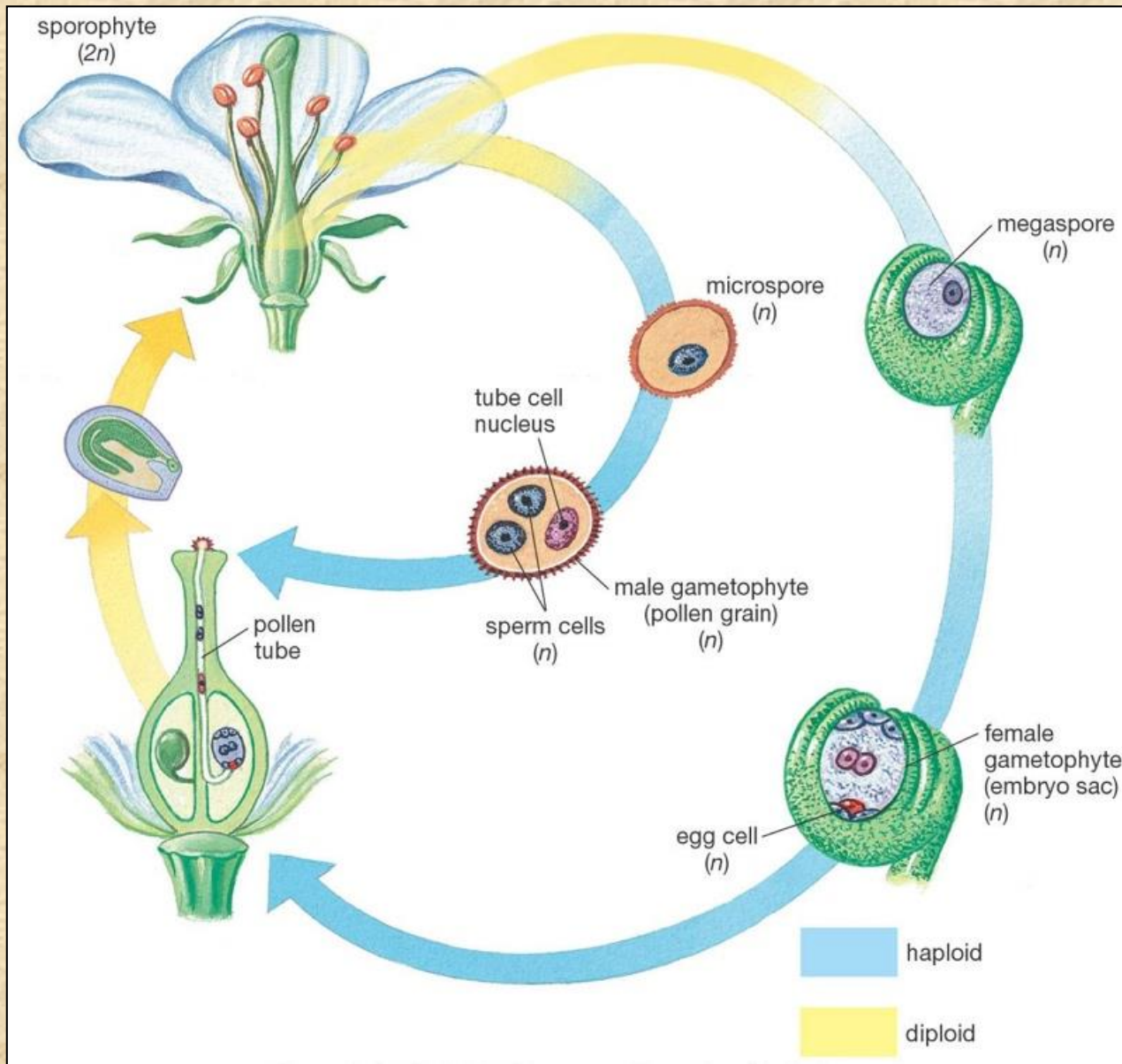
Other parts of flower attached to receptacle in whorls: sepals, petals, stamens, and pistil.

The Reproductive Parts



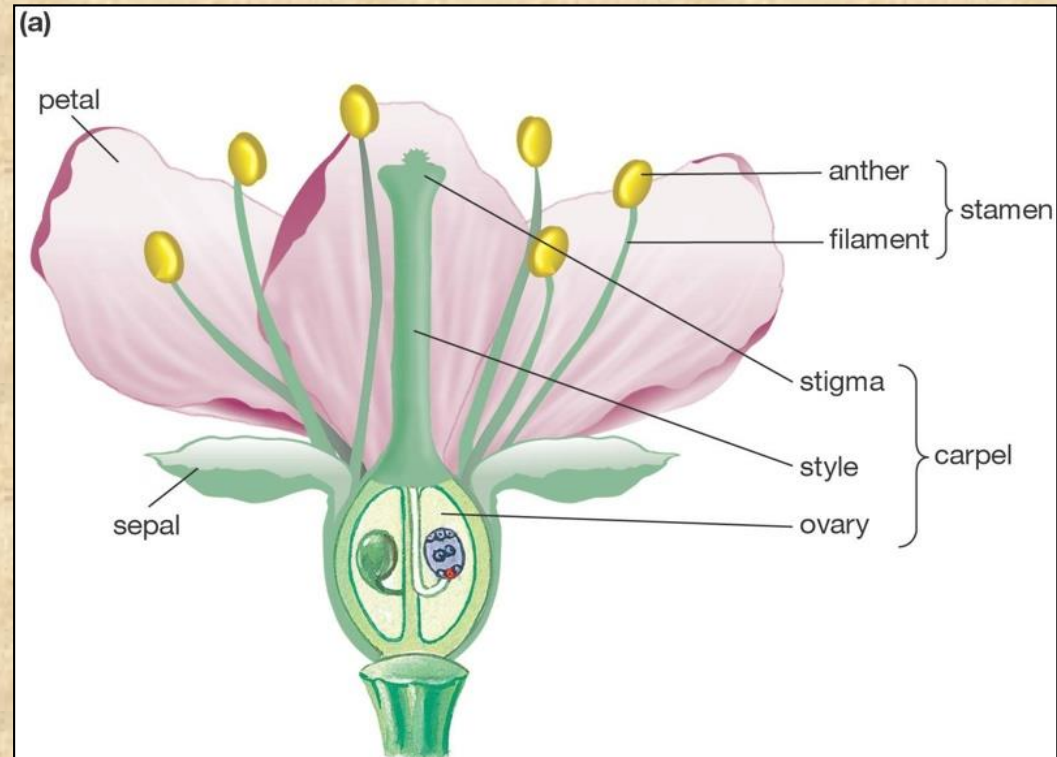
- **43.3 What Is the Function and Structure of the Flower?**
 - **Most Flowers Lure Animals that Pollinate Them.**
 - **Flowers Are the Reproductive Structures of Angiosperms.**
 - **Complete Flowers Have Four Major Parts.**
 - **Pollen Contains the Male Gametophyte.**
 - **The Female Gametophyte Forms within the Ovule of the Ovary.**
 - **Pollination of the Flower Leads to Fertilization.**

Angiosperm Life Cycle



Flower Parts

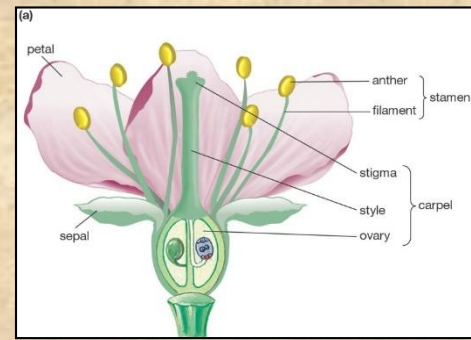
- **Flowers** are the reproductive structures of angiosperms, produced by the sporophyte generation.



Flower Parts

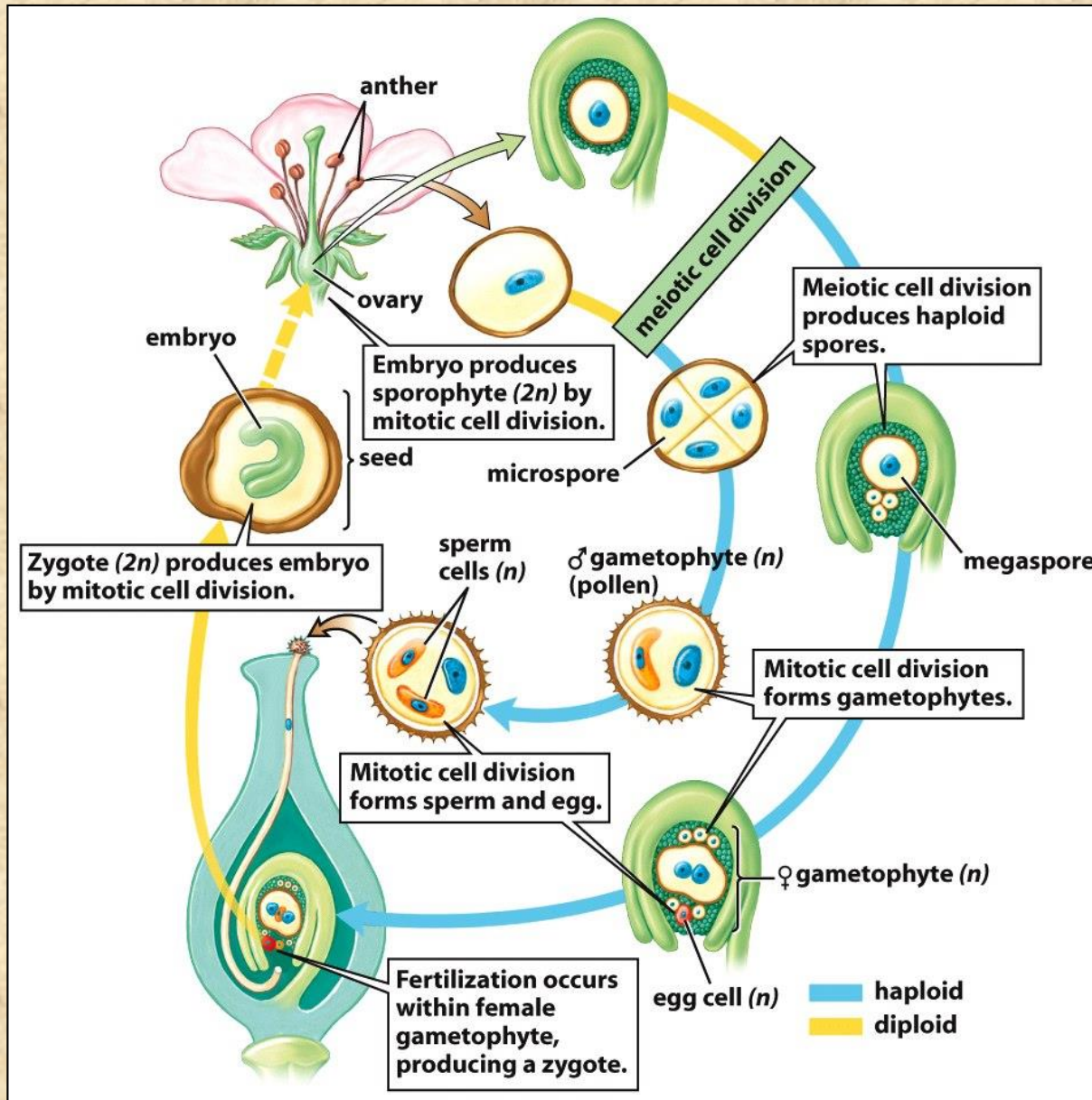
- Angiosperms bear male and female gametophytes on flowers.
- Within each flower, meiosis gives rise to two types of haploid spores.
 - Megaspore divides by mitosis to form female gametophyte (embryo sac) that is retained within flower.
 - Microspore divides by mitosis to form male gametophyte (pollen grain).

Flower Parts



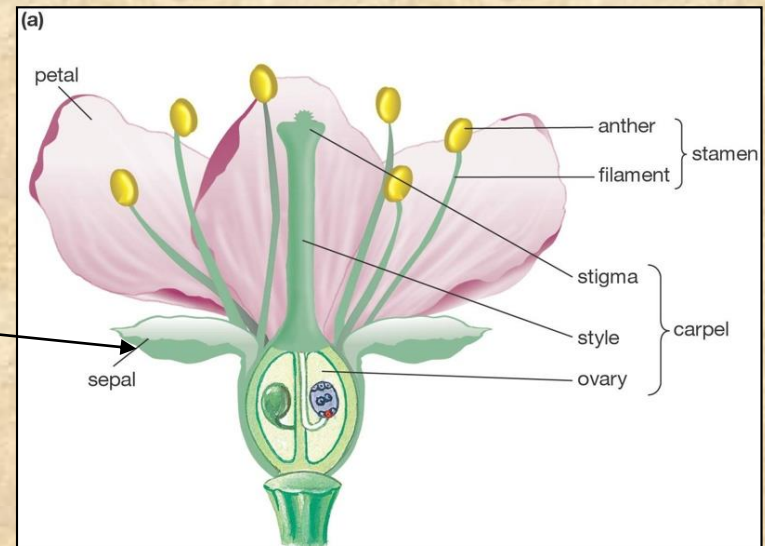
- Gametophytes form haploid gametes (n) by mitosis.
- Sperm are liberated from pollen grain when it lands on female structure of another plant.
- Sperm burrow to egg and fuse to form a diploid zygote that becomes encased in a seed.
- Seed germinates to form a new sporophyte.

Flowers



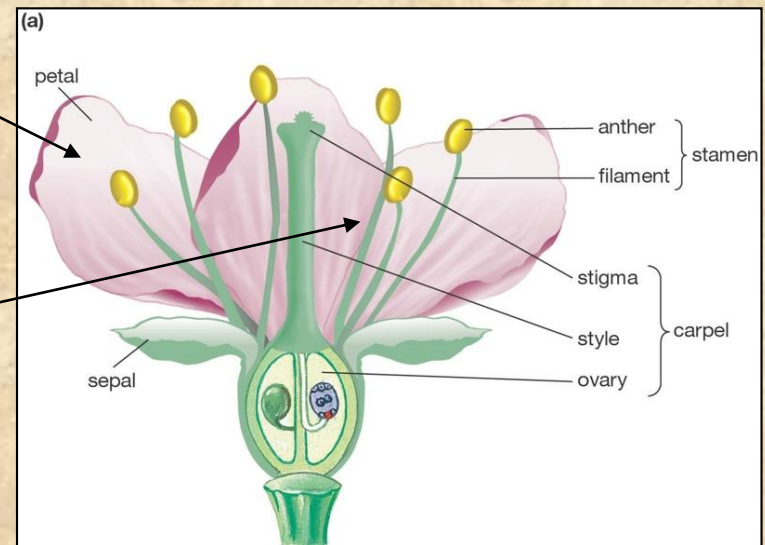
Flower Parts

- Complete flowers have four major parts.
- Sepals – located at base of flower; surround and protect the bud.
 - Dicot sepals are green and leaf-like.
 - Monocot sepals resemble petals.



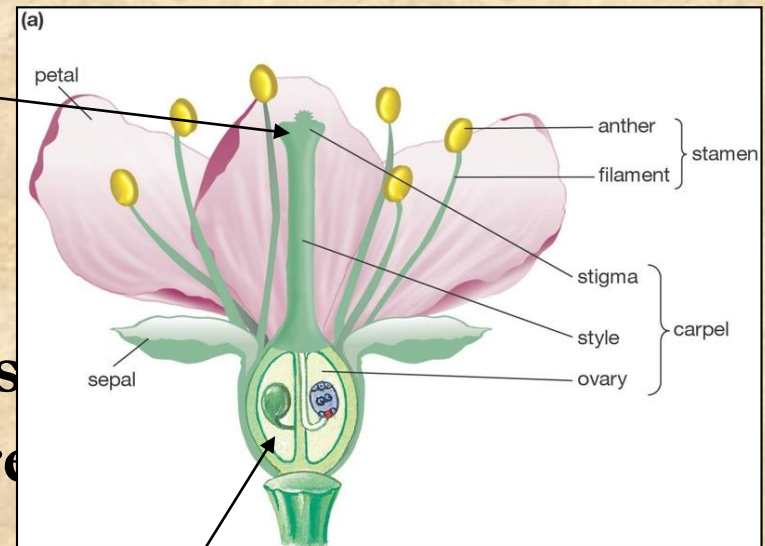
Flower Parts

- **Petals** – located above sepals; usually brightly colored and fragrant (attract pollinators).
- **Stamens** (male reproductive structures) – attached above petals.
 - Each consists of a filament (stalk) and anther (produces pollen).



Flower Parts

- Carpel (female reproductive structure) – centrally located
 - Each consists of a sticky stigma (catches pollen), an elongate style, and a bulbous ovary containing one or more ovules.
 - Ovules develop into seeds.
 - Ovary develops into a fruit.



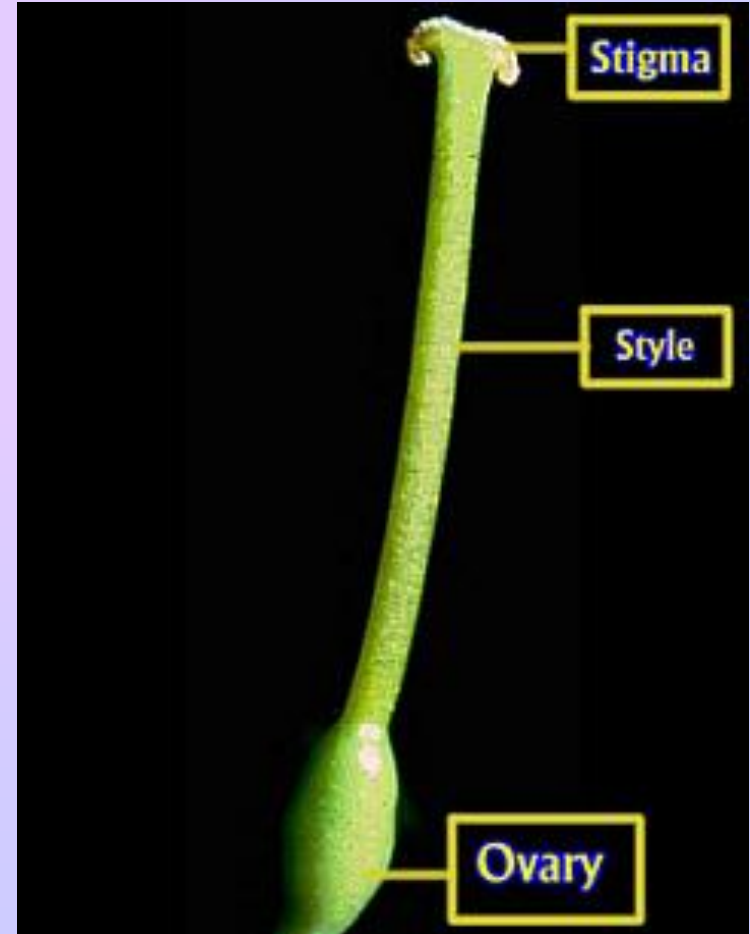
The Stigma



- The *stigma* is the top of the female part of the flower.
- Pollen from another flower collects on the stigma's sticky surface.
- Found at the end of the pistil

Style

- The neck of the pistil



Ovule

- The part of the flower in which the eggs are produced and seeds develop

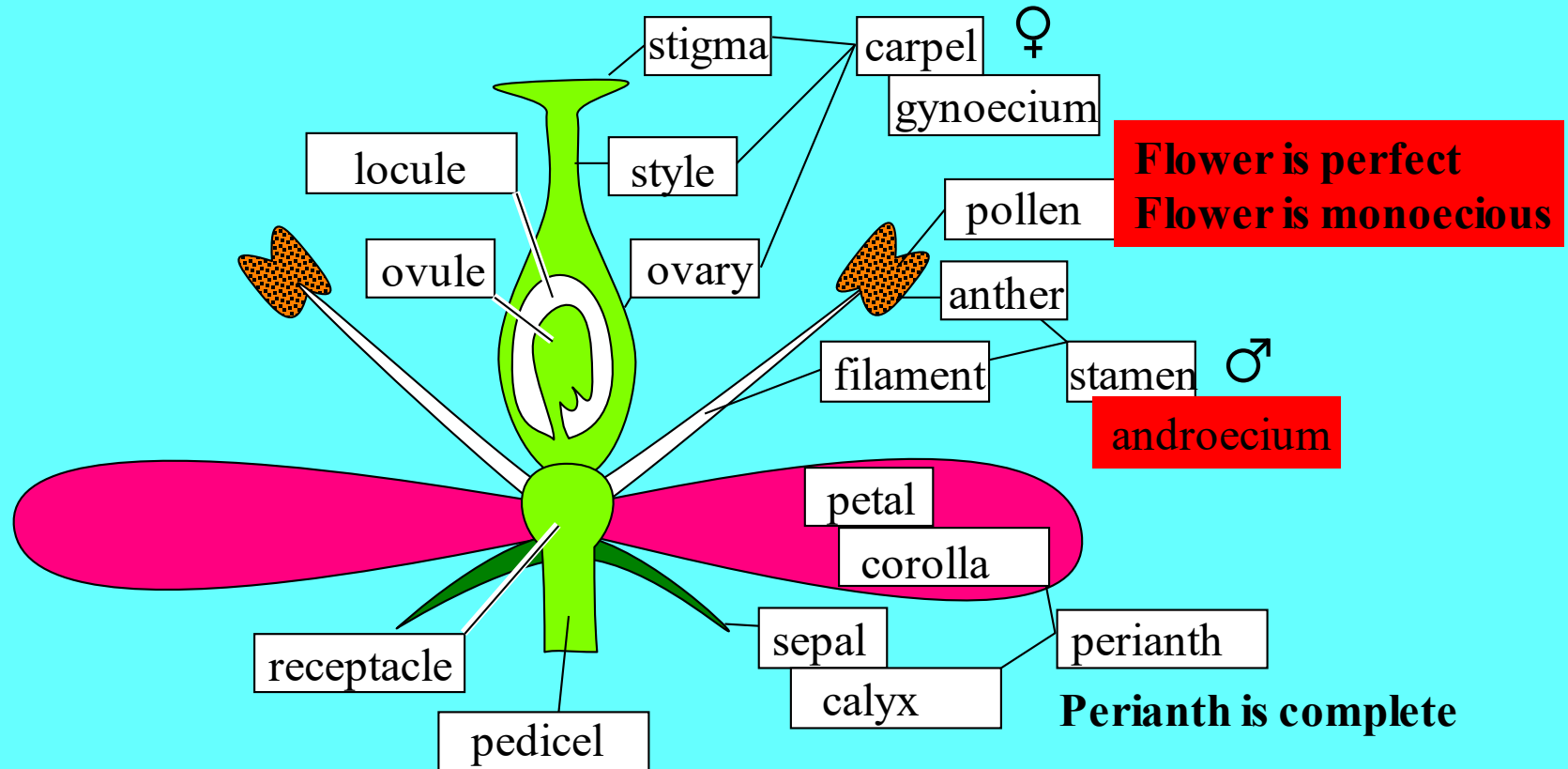


OVARY

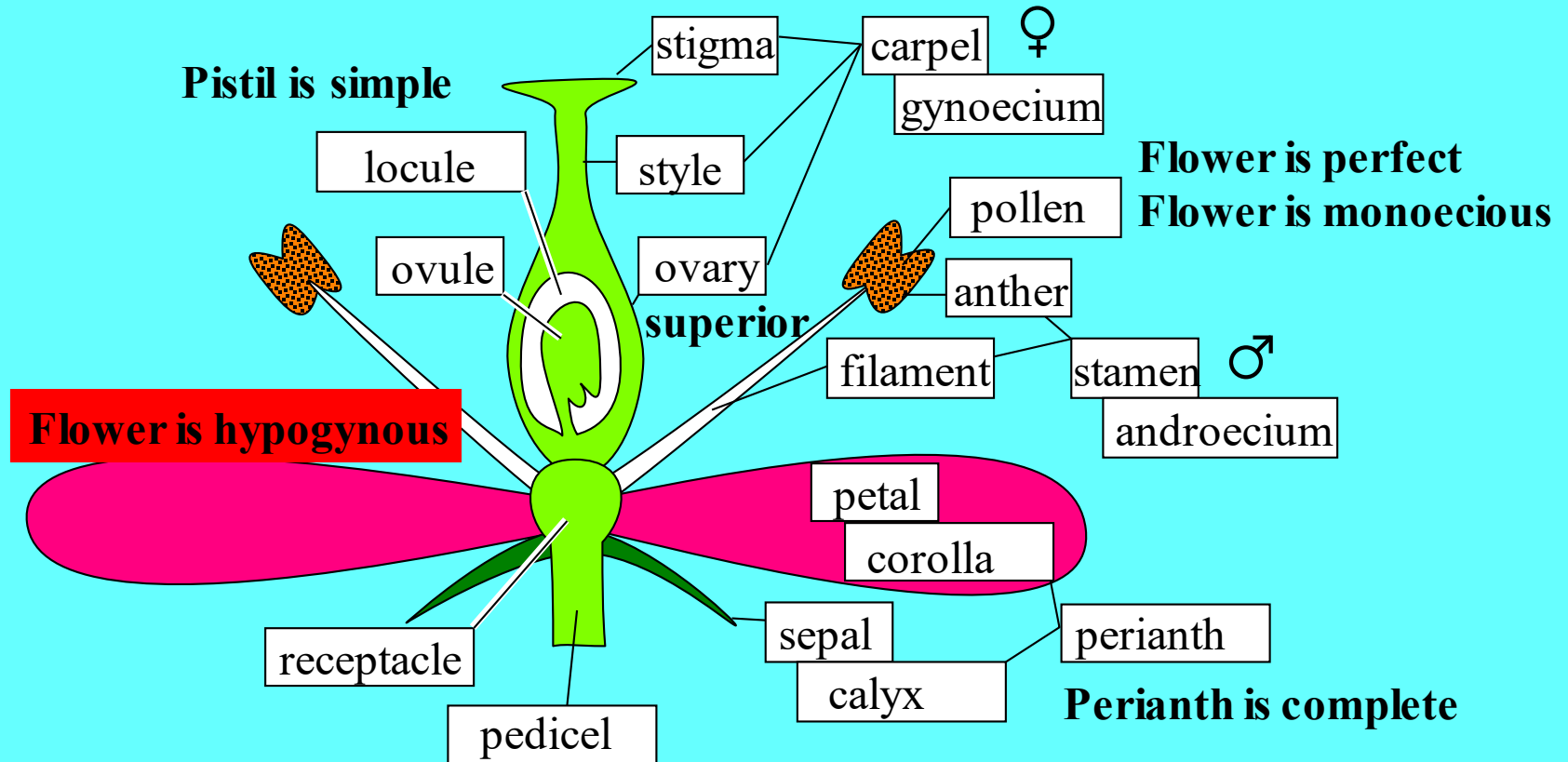
- * Superior Ovary –
- * Inferior Ovary
 - Ovary with ovules.
 - Seeds develop from ovules
 - Fruit develops from ovary (simple or compound ovary)

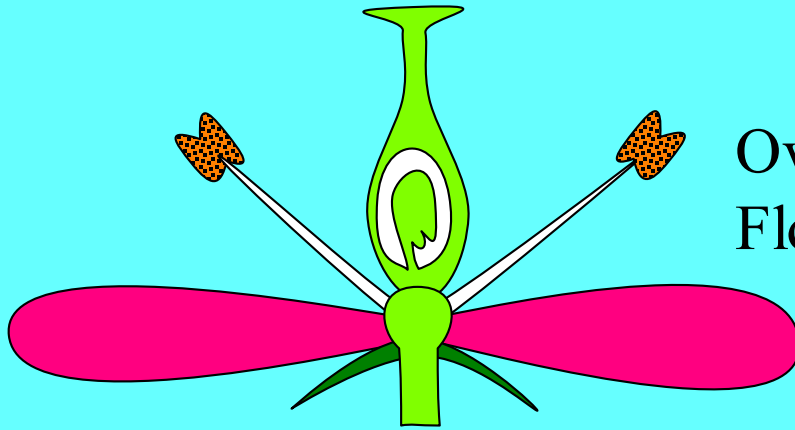


Basic Flower Structure

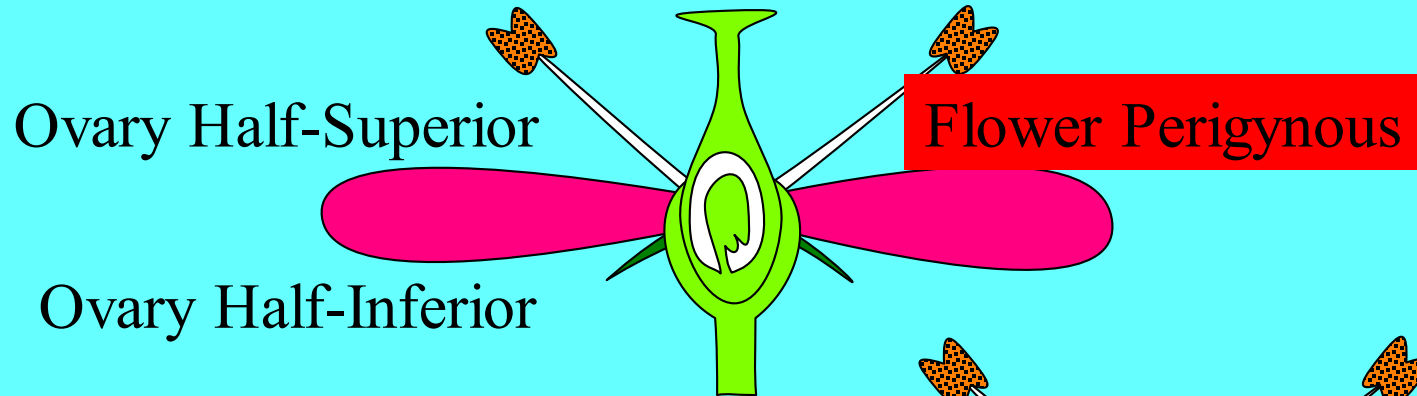


Basic Flower Structure





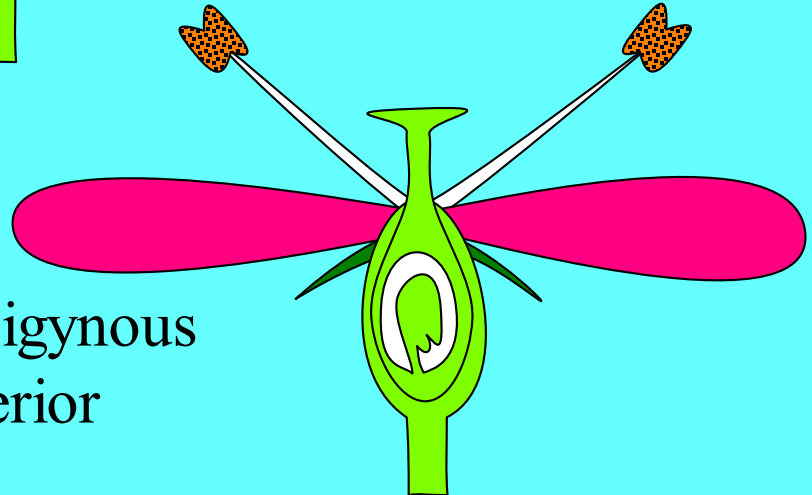
Ovary Superior
Flower Hypogynous



Ovary Half-Superior

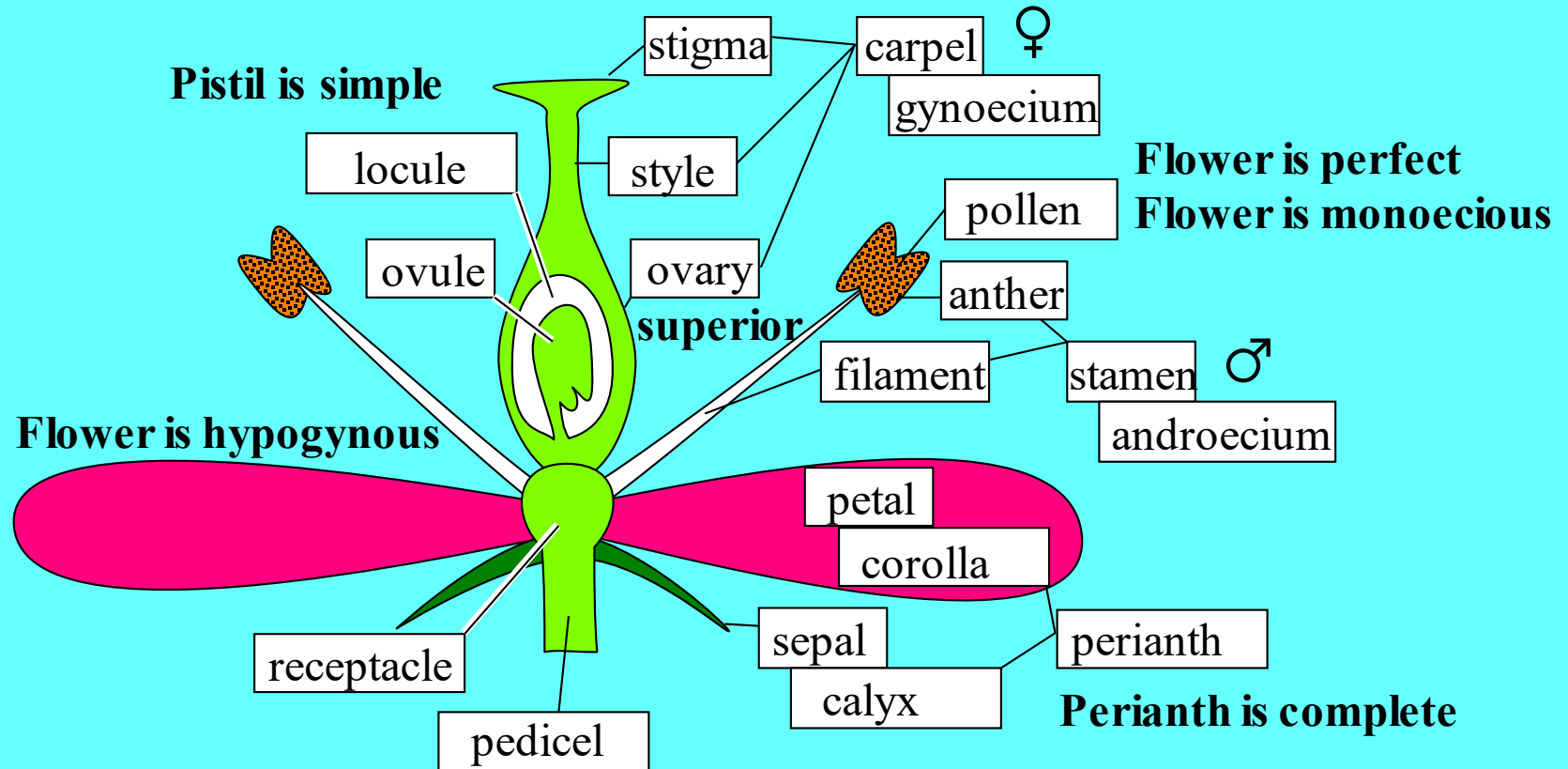
Flower Perigynous

Ovary Half-Inferior

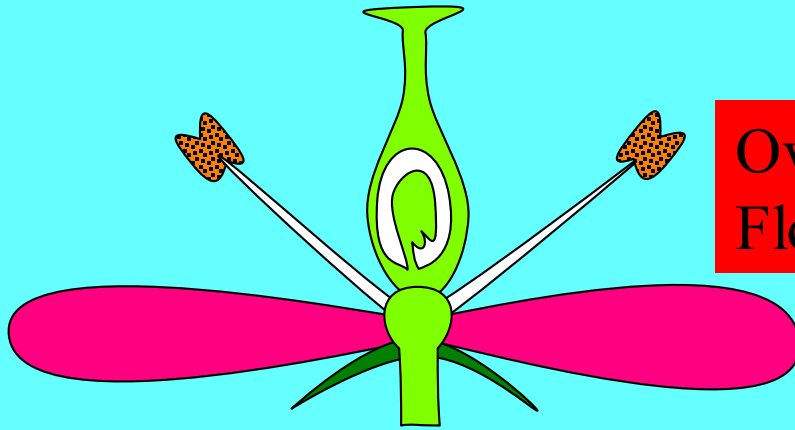


Flower Epigynous
Ovary Inferior

Basic Flower Structure

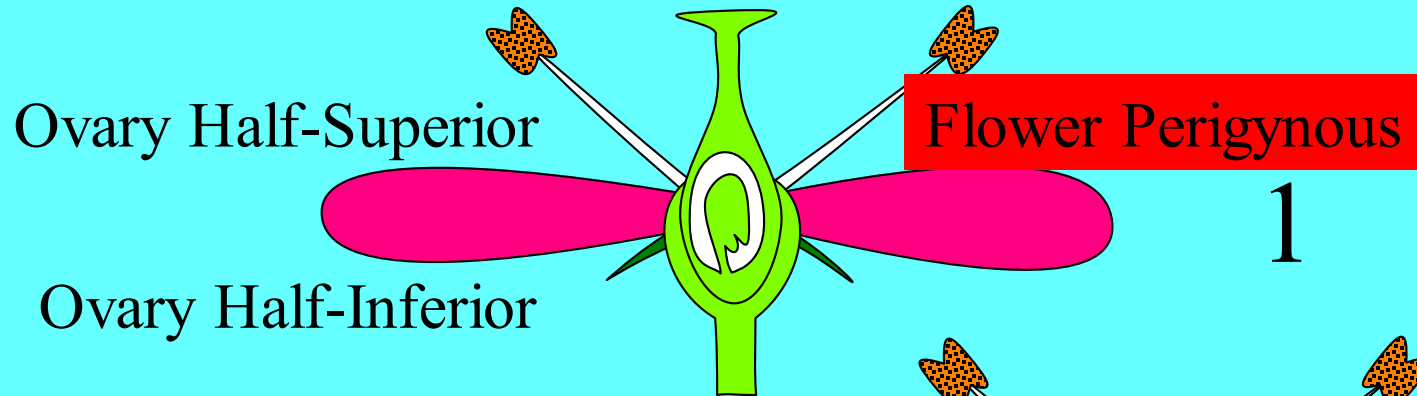


**This longitudinal section view does not
allow us to consider symmetry**



Ovary Superior
Flower Hypogynous

1

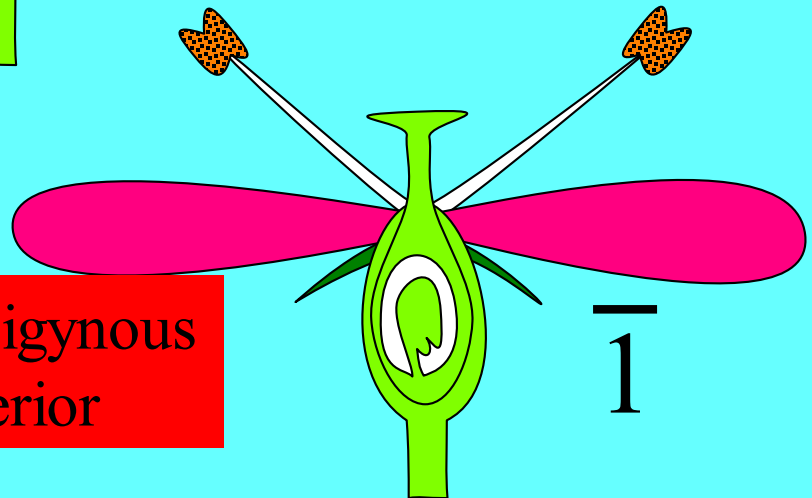


Ovary Half-Superior

Flower Perigynous

Ovary Half-Inferior

1



Flower Epigynous
Ovary Inferior

1

Incomplete Flowers

Grass flowers: incomplete, usually imperfect (separate male and female flowers)

- A tulip is complete (though the sepals are the same color as the petals) and perfect.

Incomplete Flowers

- Incomplete flowers lack one or more of the four major floral parts:
- *Imperfect* flowers are incomplete flowers lacking either stamens (female flowers) or carpels (male flowers).



The Male Gametophyte

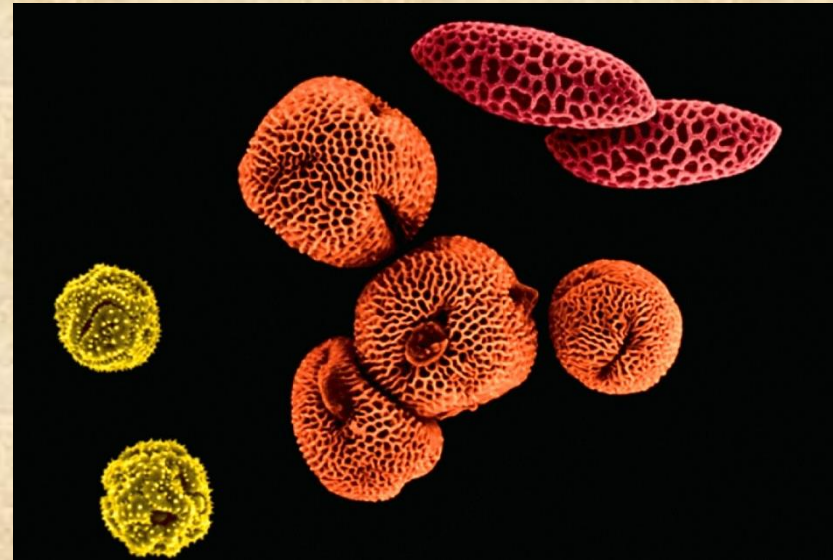


- Pollen contains the male gametophyte.
- Pollen develops within anthers of diploid sporophyte plants.

The Male Gametophyte



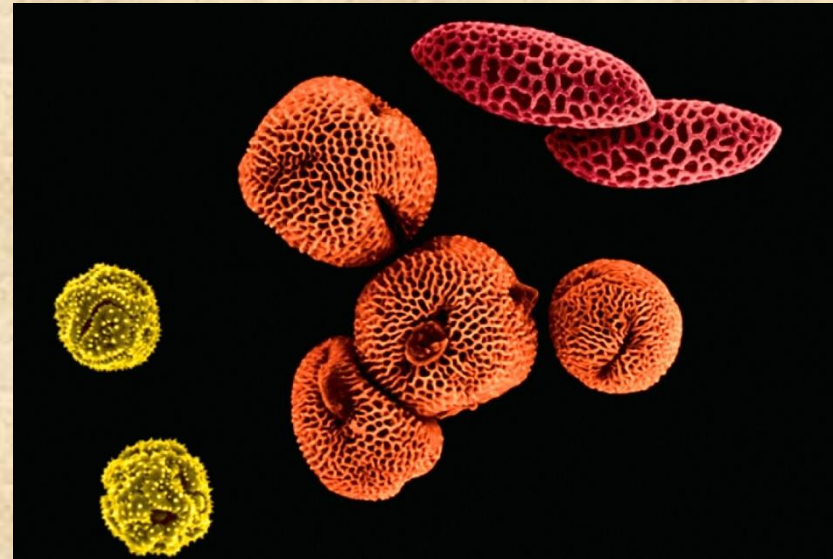
- Each anther consists of four pollen sacs that contain microspore mother cells.
- Each diploid microspore mother cell divides by meiosis to form four haploid microspores.



The Male Gametophyte



- Each microspore divides by *mitosis* to form an immature male gametophyte consisting of two cells.
 - Tube cell (will form a pollen tube after pollination).
 - Generative cell (will divide by *mitosis* to form two sperm after pollination).



The Female Gametophyte

- The embryo sac is the female gametophyte and develops within the ovary of diploid sporophyte plants.
- Each ovary contains one or more ovules
- Each ovule consists of integuments (protective layers of cells) that surround a megaspore mother cell



The Female Gametophyte

- Megaspore mother cell divides by meiosis to form four haploid megaspores (three degenerate, one survives).
- Nucleus of remaining megaspore divides by mitosis three times (without cytokinesis) to form a single cell with 8 haploid nuclei.



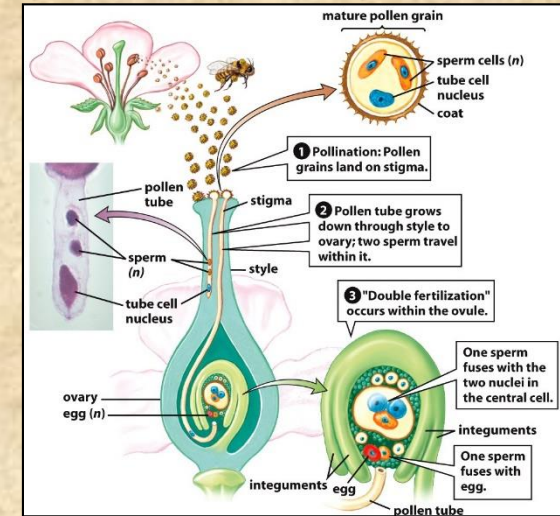
The Female Gametophyte

- Plasma membranes partition the cell into a seven-celled embryo sac
 - Three small cells at either end; one is the egg.
 - One large central cell containing two polar nuclei.



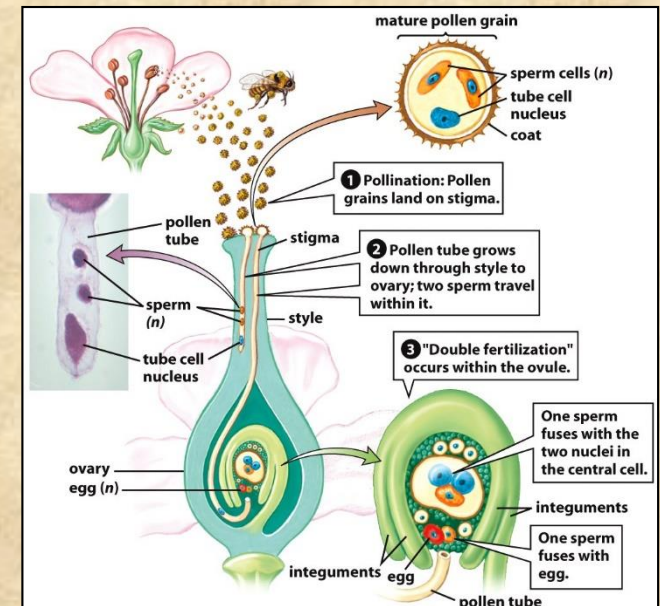
Pollination

- **Pollination** occurs when a pollen grain lands on the stigma of a compatible plant.
- Pollen grain absorbs water and germinates.
 - Tube cell extends, forming a pollen tube that grows down the style.
 - Generative cell divides (mitosis) to form two sperm cells
- Sperm cells follow pollen tube to the ovule.



Double Fertilization

- Double fertilization is unique to flowering plants.
- Double fertilization is the process by which two sperm fuse with two cells of the embryo sac.
 - One sperm fuses with the egg to form the diploid ($2n$) zygote
 - Second sperm fuses with both polar nuclei to form the endosperm cell.



Structure of Flowers

❖ Flowers can be produced singly or in inflorescences.

- **Inflorescence**

- **Spike:**

- **Raceme:**

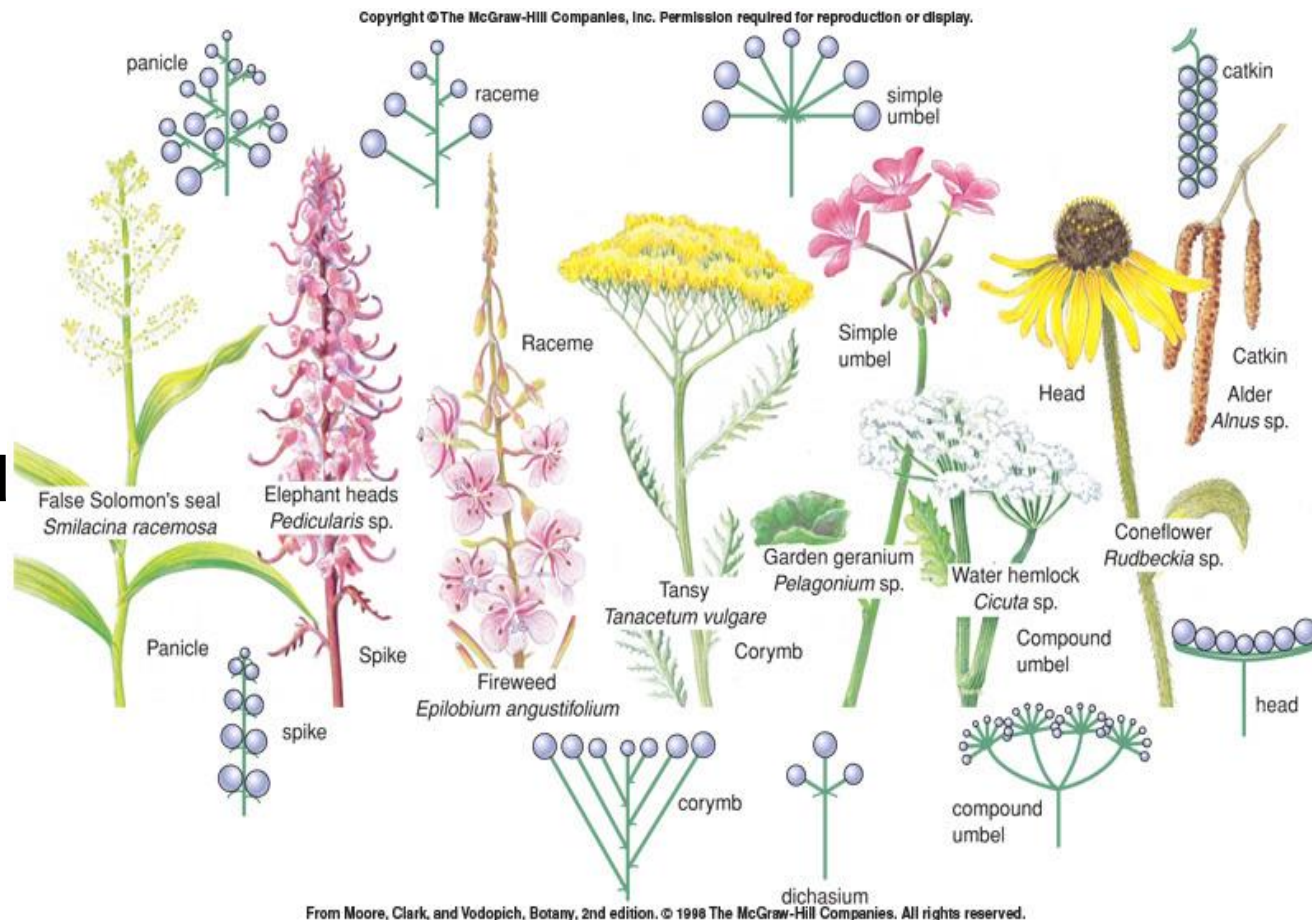
- **Panicle:**

- **Umbel:**

- **Compound Umbel:**

- **Head:**

- **Catkin:**



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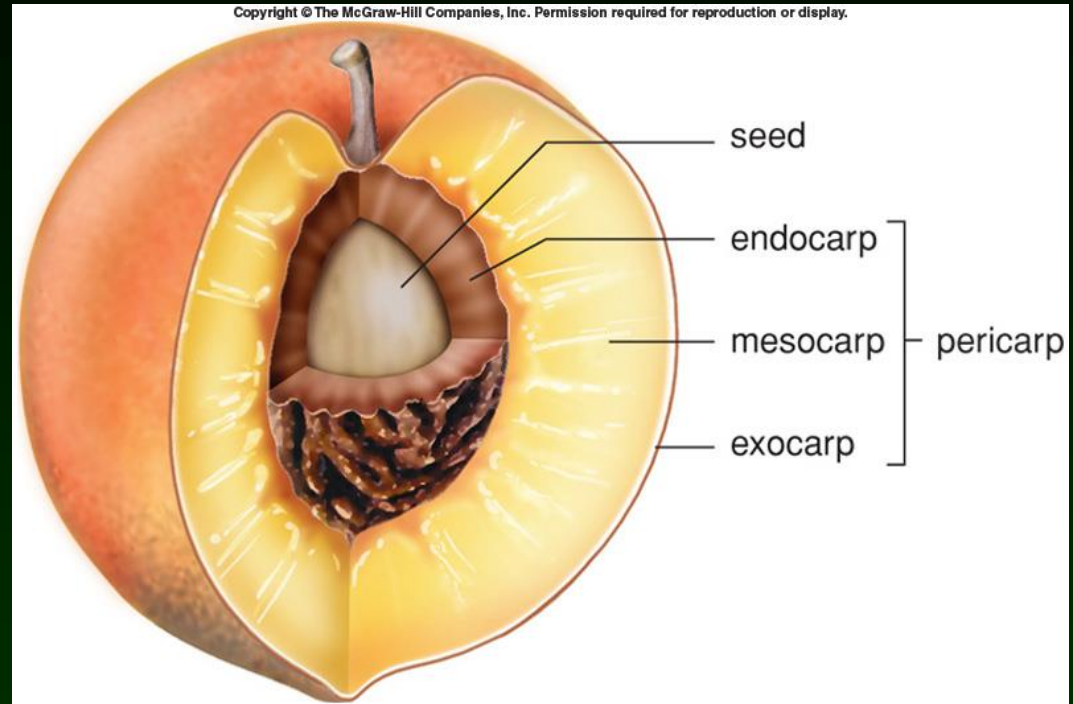
Fruits



Tomato
fruit

Fruit Anatomy

- ❖ **Pericarp:**
Three regions collectively
- ❖ **Fruit Regions**
 - **Exocarp:**
 - **Endocarp:**
 - **Mesocarp:**



Peach fruit

❖ Variability of fruits

- fleshy or dry
- Formed from one or more flower



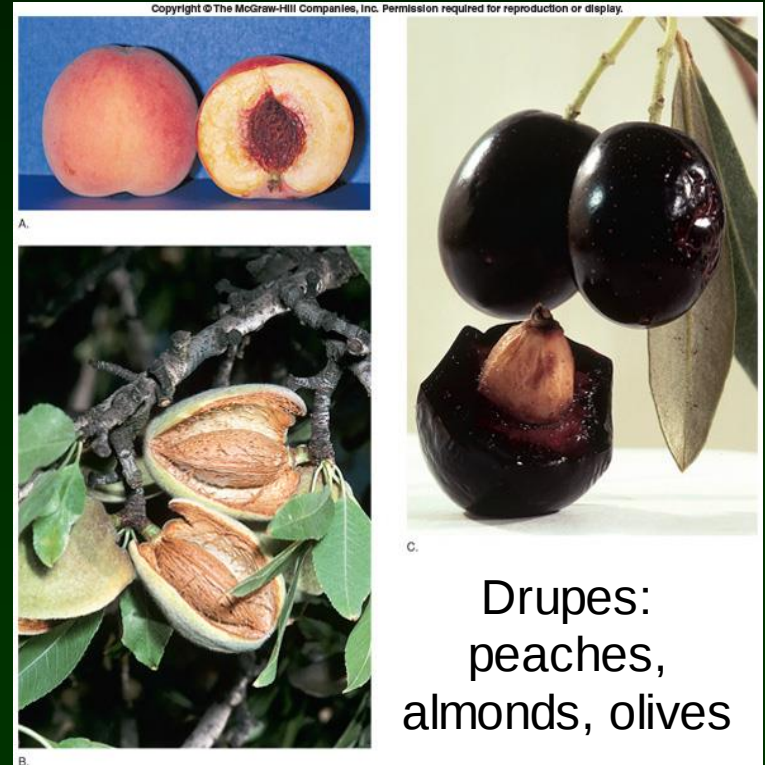
Types of Fruits

❖ Fleshy Fruits:

• SIMPLE FLESHY FRUITS: # PISTILS

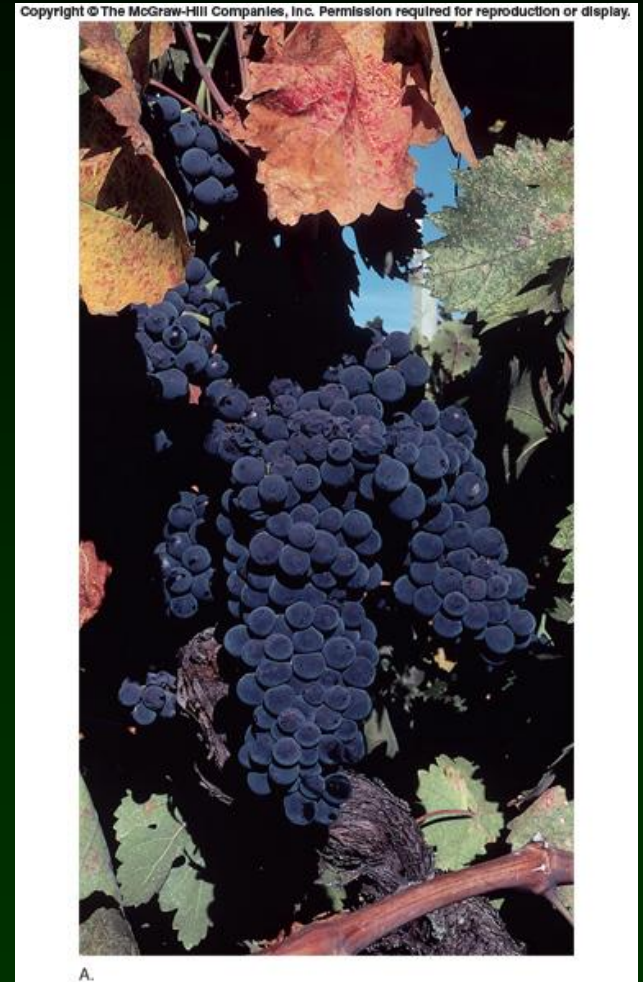
– Drupe:

- single seed
- enclosed by hard, stony endocarp (pit)



Simple fleshy fruits

- **Berry**
 - True berry - thin skin and soft
 - Pepo - Relatively thick rind
 - Hesperidium – leathery skin has citric acid glands



Grape berries

– Pome - receptacle grows:

- Endocarp papery or leathery
- Apples, pears



Apple pomes

Fruits

❖ Complex Fleshy Fruits

- Aggregate Fruits
 - Derived from single flower with several to many pistils



B.

© Pixtal/age fotostock

Blackberry aggregate fruits

- Multiple Fruits
 - several to many individual flowers in single inflorescence
 - Mulberries, Osage orange, pineapples, figs



Fruits

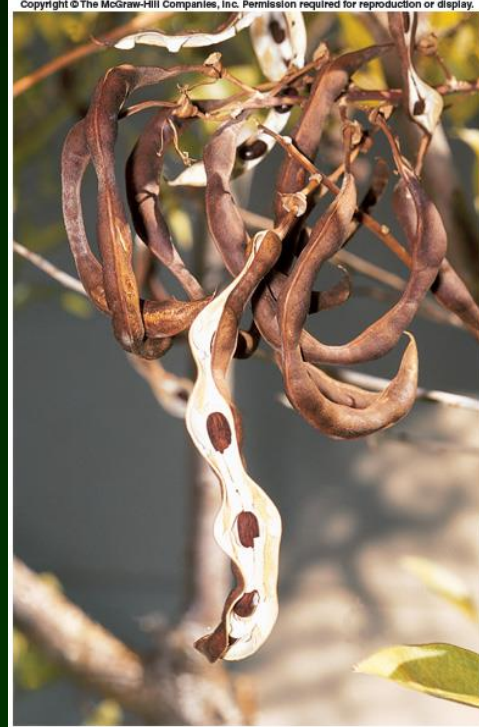
- ❖ **Dry Fruits - Mesocarp dry at maturity**
 - **Dehiscent or indehiscent**

DEHISCENT FRUITS

- **Follicle - Splits along one side (milkweed)**
- **Legume - Splits along two sides (pea)**



Milkweed follicle

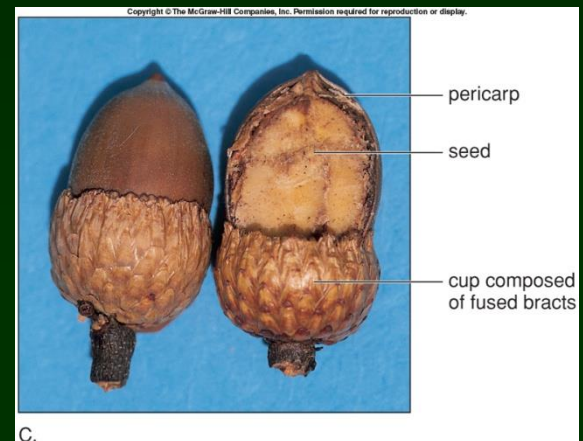
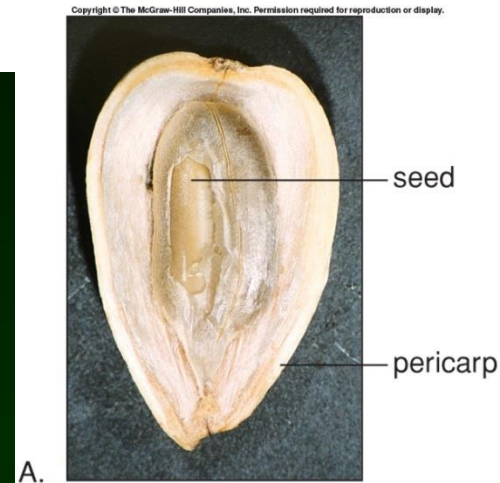


Legumes

Fruits

- ❖ Dry Fruits
- ❖ INDEHISCENT FRUITS =

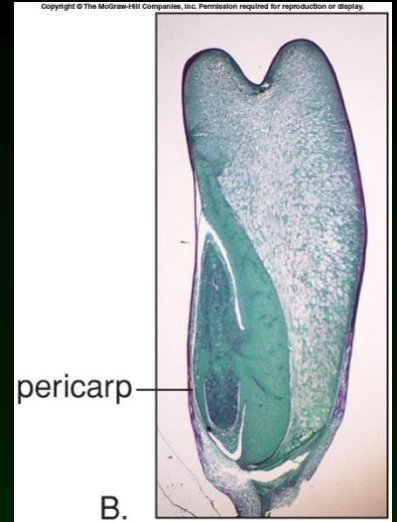
- Single seed: united with pericarp
 - Achene - Base of seed attached to pericarp.
 - Examples
 - Nut - harder and thicker pericarp with:
 - Examples:



Fruits

❖ Indehiscent Fruits

- Grain (Caryopsis) - Pericarp tightly united with seed



Corn section

Fruit and Seed Dispersal

❖ Dispersal by Wind

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Fruit and Seed Dispersal

❖ Dispersal by Animals

Burr Grass Fruit

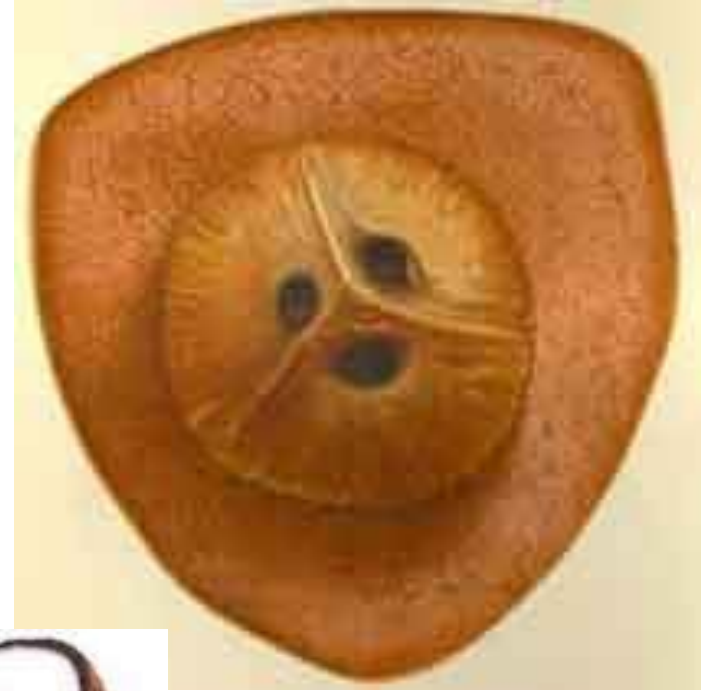


photo by jimlittle2



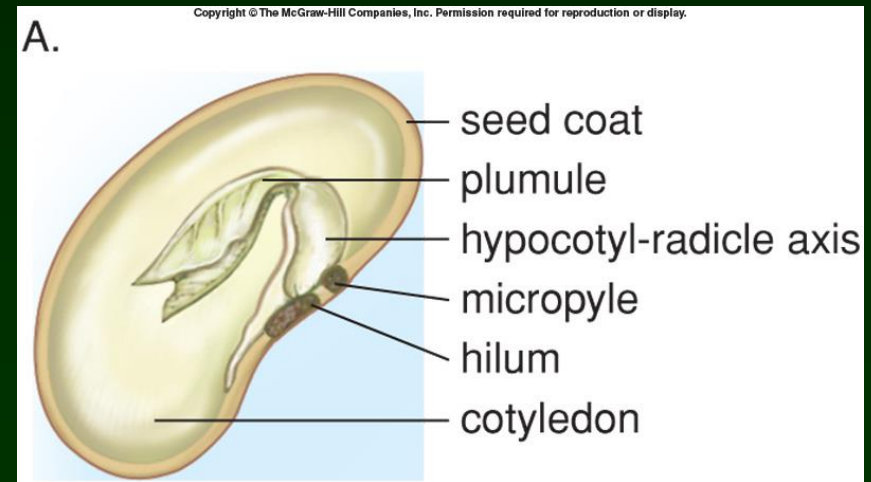
❖ Water Dispersal

- Some fruits contain trapped air for floatation.



❖ Structure

- **Ovules develop into seeds.**
 - **Cotyledons** - Food storage organs that function as “seed leaves”
 - **Embryo** = cotyledons and plantlet



Bean seed

Germination

❖ Germination =

- Fruit Ripe when – after embryo develops.

