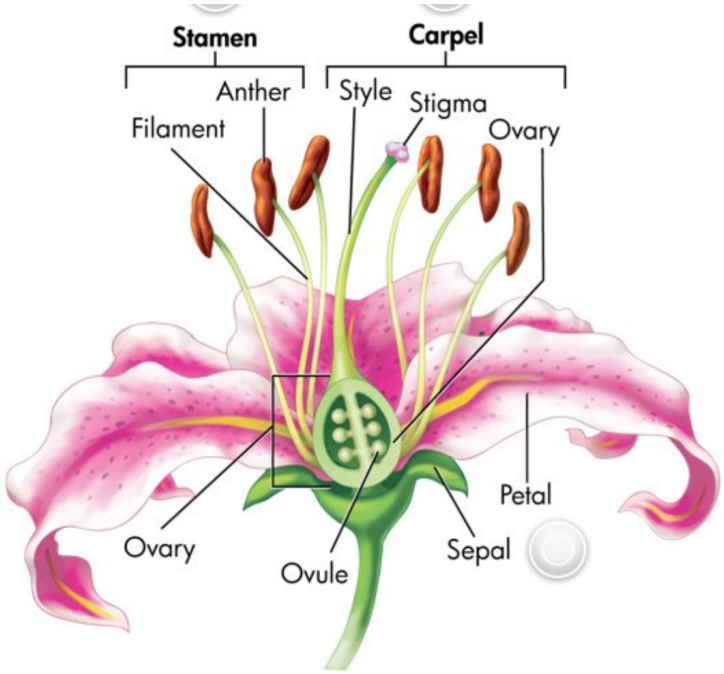
Flowers,reproductive organs composed of 4 different kinds of specialized leaves: (1) Sepals, (2) Petals, (3) Stamens, and (4) Carpels



1. Sepals/ Calyx
   Outermost circle of floral parts contains sepals
   a. In many plants, Sepals are green and closely resemble ordinary leaves
   b. Sepals enclose bud before it opens, and protect the flower while developing
2. Petals/ Corolla
   a. Petals, other brightly colored, found inside the sepals
   b. Colors, number, and shapes of such petals attract insects and other pollinators to the flower
3. Stamens
   a. Within ring of petals are structures that produce male and female gametophytes
   b. Stamens are male parts of the flower.
      i. Each stamen consists of a stalk called a *filament* with an *anther* at its tip.
         1. *Anthers* are the structures in which pollen grains—the male gametophytes—are produced
      ii. In most angiosperm species, the flowers have several stamens
         1. If you rub your hand on the anther of a flower, a yellow-orange dust may stick to your skin. This dust is made up of thousands of individual pollen grains.
4. Carpels
   a. The innermost floral parts
   b. *Carpels* produce and shelter the female gametophytes and, later, seeds
      i. Each carpel has a broad base forming an *ovary*, which contains one or more ovules where female gametophytes are produced.
   c. The diameter of the carpel narrows into a stalk called the *style*
      i. At the top of the style is a sticky or feathery portion known as *stigma* (which is specialized to capture pollen)
   d. Several fused carpels= *pistil*

Variety in Flowers:

- Flowers vary greatly in shape, color, and size
- A typical flowering plant produces both male and female gametophytes
- In some species, however, male and female gametophytes are produced on different plants
- In some species, many flowers grow close together to form a composite structure that looks like a single flower

Angiosperm Life Cycle

- Like other plants, angiosperms have a life cycle that shows an alternation of generations between a *diploid sporophyte* phase and a *haploid gametophyte* stage
  - **o** In vascular plants, including ferns and gymnosperms, sporophyte plant is larger than the gametophyte
  - **o** Trend continues in angiosperms, where male and female gametophytes live within tissues of sporophyte.

Development of Male Gametophytes:

- The male gametophytes—the pollen grains—develop inside anthers
  1. Meiosis produces four haploid spore cells
  2. Each spore undergoes one mitotic division to produce the two haploid nuclei of a single pollen grain
  3. The two nuclei are surrounded by a thick wall that protects the male gametophyte from dryness and damage when it is release

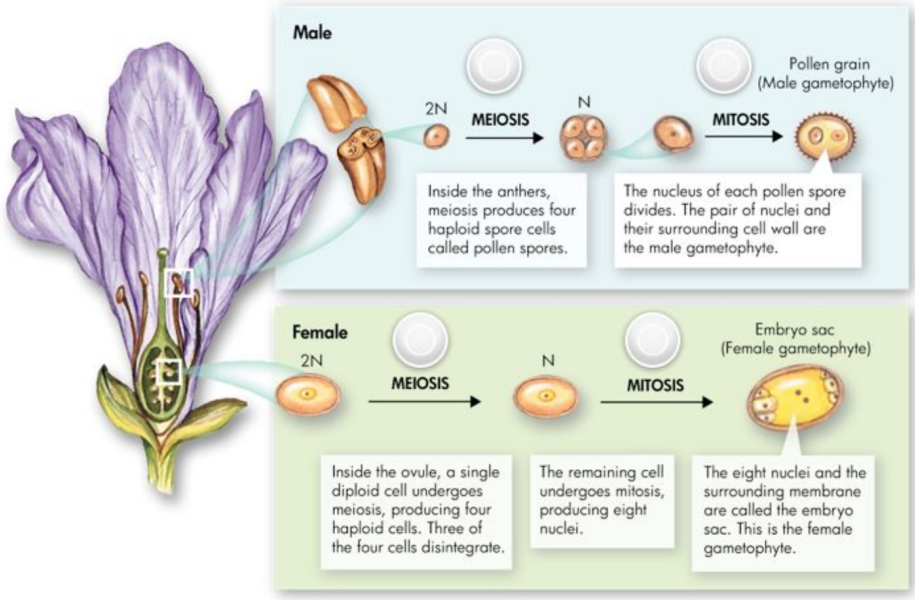
4. The pollen grains stop growing until they are released from the anther and land on a stigma

Development of Female Gametophytes:

- While the male gametophytes are forming, female gametophytes develop inside each carpel of a flower
  1. The ovules—the future seeds—are enveloped in a protective ovary—the future fruit
  2. A single diploid cell goes through meiosis to produce four haploid cells three of which disintegrate
  3. The remaining cell undergoes mitosis, producing eight nuclei
     a. These eight nuclei and the surrounding membrane are called the *embryo sac*
  4. The *embryo sac*, contained within the ovule, makes up the female gametophyte of a flowering plant
  5. Next, cell walls form around six of the eight nuclei
     a. 1 of the 8 nuclei, near the base of the gametophyte, is the nucleus of the egg—the female gamete
  6. If fertilization takes place, this egg cell will fuse with the male gamete to become the zygote that grows into a new sporophyte plant

Pollination:

- Pollination is transfer of pollen to the female portions of the flower
- Some angiosperms are wind pollinated, but most are pollinated by animals
  - As wind pollination is less efficient than animal pollination, wind-pollinated plants, such as the oak tree here, rely on favorable weather and sheer numbers of pollen grains to get pollen from one plant to another
  - Animal-pollinated plants have a variety of adaptations, such as bright colors and sweet nectar, to attract and reward animals



  - Animals have evolved body shapes that enable them to reach nectar deep within certain flower
  - Insect pollination is beneficial to insects and other animals because it provides a dependable source of food—pollen and nectar
    - Plants also benefit because the insects take the pollen directly from flower to flower
    - Insect pollination is more efficient than wind pollination, giving insect-pollinated plants a greater chance of reproductive success
    - The efficiency of insect pollination may be one of the main reasons why angiosperms displaced gymnosperms as the dominant land plants
- *Types of pollination:*

Self-pollination: Transfer of pollen from an anther to a stigma of the same flower.
Cross pollination : Fertilization by transfer of pollen from the anthers of one flower to the stigma of another.
Artificial pollination: A person manually moves the pollen to a female

Fertilization

1. If a pollen grain lands on the stigma of a flower of the same species, it begins to grow a pollen tube
2. Of the pollen grains two cells, one cell—the "generative" cell—divides and forms two sperm cells
   a. The other cell becomes the pollen tube
3. The pollen tube contains a tube nucleus and the two sperm cells
   a. The pollen tube grows into the style, where it eventually reaches the ovary and enters an ovule

- Inside the embryo sac, two distinct fertilizations take place—a process called double fertilization
  1. First, one of the sperm nuclei fuses with the egg nucleus to produce a diploid zygote

    a. The zygote will grow into the new plant embryo
2. 2nd, the other sperm nucleus fuses with 2 polar nuclei in the embryo sac to form a triploid (3N) cell
    a. Cell will grow into a food-rich tissue,endosperm, which nourishes the seedling as it grows

- The process of fertilization in angiosperms is distinct from that found in other plants
- Two fertilization events take place—one produces the zygote and the other a tissue, called endosperm, within the seed
- The rich supply of endosperm will nourish the embryo as it grows
- Double fertilization may be another reason why the angiosperms have been so successful
    - By using endosperm to store food, the flowering plant spends very little energy on producing seeds from ovules until double fertilization has actually taken place
    - The energy saved can be used to make many more seeds.

Seed and fruit development:

- Development of seed, which protects and nourishes plant embryo, contributed greatly to success of land plants
- Angiosperm seed, encased inside a fruit, was an even better adaptation
- Once fertilization of an angiosperm is complete, nutrients flow into the flower tissue and support the developmen of the growing embryo within the seed
    - As angiosperm seeds mature, ovary walls thicken to form a fruit that encloses the developing seeds. A fruit is simply a matured angiosperm ovary, usually containing seeds
    - Exception found in commercially grown fruits,selectively bred to be seedless
- The term fruit applies to the sweet things we usually think of as fruits, such as apples, grapes, and strawberries
    - Foods such as peas, corn, beans,cucumbers, and tomatoes, vegetables, are also fruits.
- Ovary wall surrounding a simple fruit may be fleshy, as it is in grapes and tomatoes, or tough and dry, like the shell that surrounds peanuts. (The peanuts themselves are the seeds.)

Seed Dispersal : Each seed is enclosed in a sweet, juicy fruit, making it a tasty treat for all kinds of animals

Dispersal by Animals:

- The seeds of many plants, especially those encased in sweet, fleshy fruits, are often eaten by animals
    - Seeds are covered with tough coatings, allowing to pass through animal's digestive system unharmed
    - The seeds then sprout in the feces eliminated from the animal
    - These fruits provide nutrition for the animal and also help the plant disperse its seeds—often to areas where there is less competition with the parent plants
    - Animals usually disperse seeds contained in fleshy, nutritious fruits.
- Animals also disperse many dry fruits, but not necessarily by eating them
    - Dry fruits sometimes have burs or hooks that catch in an animal's fur, enabling them to be carried away

Dispersal by Wind and Water

- Seeds dispersed by wind or water are typically contained in lightweight fruits that allow them to be carried in the air or in buoyant fruits that allow them to float on the surface of the water
    - A dandelion seed, for example, is attached to a dry fruit that has a parachute-like structure
    - This adaptation allows the seed to glide considerable distances away from the parent plant

Formation of a seed:

- **Pollen Grain**: A structure produced by plants containing the male haploid gamete to be used in reproduction. The gamete is covered by protective layers, which perform their role until the pollen grain is capable of fertilizing when reaching the female stigma.
    - **Microspore**: haploid spores produced by a plant sporophyte. In seed plants, it corresponds to the developing pollen grain at the single nucleus stage.
    - **Tube nucleus:** One of the two nuclei produced when the haploid nucleus of a pollen grain divides by mitosis (compare generative nucleus). The tube nucleus is thought to control growth of the pollen tube. Starts the
    - **Sperm/Generative nucleus:** the one of the two nuclei resulting from the first division in the pollen grain of a seed plant that gives rise to sperm nuclei
    - **Steps**: Microspores attach the stigma(top of style)>the tube nucleus forma a tube and the generative nucleus falls in and fertilizes the egg and the 2 polar bodies

- **Ovary**: where the egg (ovule) is fertilized and grows
    - **Ovule**: Structure in seed plants which contains the (nucleus), megaspore (embryo sac), a food store, and a coat, and develops into a seed after fertilization.
- **Megaspore**: Egg in the female plant
- **Double Fertilization:** when the flower fertilizes twice (the generative nucleus fertilizes the Ovule and the polar bodies)
- **Polyploidy**: Organism or cell having more than twice haploid number of chromosomes (3N+)… the more "N"= larger flashy part
- **Zygote**: A cell in diploid state following fertilization or union of haploid male sex cell (e.g. sperm) and haploid female sex cell (e.g. ovum).
- Endosperm: nutritive tissue surrounding the embryo within seeds of flowering plants.