Reproduction in Plants

- Plants have evolved different reproductive strategies for the continuation of their species.

- Some plants reproduce sexually while others reproduce asexually, in contrast to animal species, which rely almost exclusively on sexual reproduction.

- Plant sexual reproduction usually depends on pollinating agents, while asexual reproduction is independent of these agents.

- Flowers are often the showiest or most strongly-scented part of plants. With their bright colors, fragrances, and interesting shapes and sizes, flowers attract insects, birds, and animals to serve their pollination needs.

- Other plants pollinate via wind or water; still others self-pollinate.

Asexual Reproduction:

requires only 1 parent and the offspring are an <u>exact copy</u> of the parent---a clone

Asexual Reproduction:

- Organisms that reproduce asexually cannot develop much variety, because they are “copying” the original organism exactly.

- **Asexual Reproduction**
- Vegetative reproduction is a type of asexual reproduction. Other terms that apply are vegetative propagation, clonal growth, or vegetative multiplication.

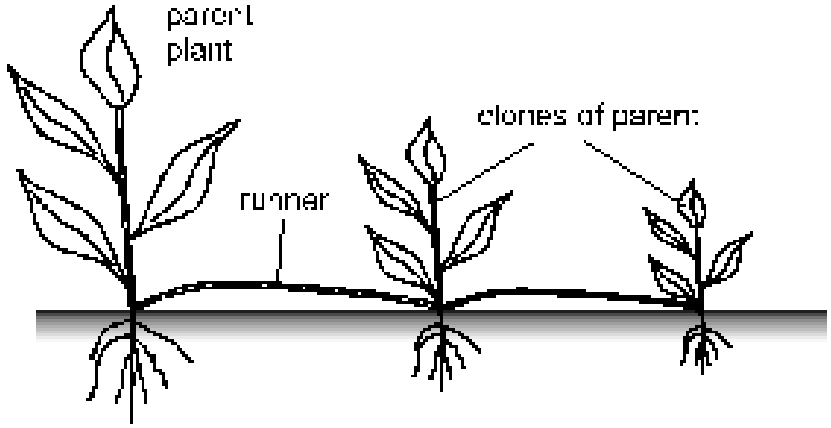
- Vegetative growth is enlargement of the individual plant, while vegetative reproduction is any process that results in new plant “individuals” without production of seeds or spores.

- It is both a natural process in many, many species as well as a process utilized or encouraged by horticulturists and farmers to obtain quantities of economically-valuable plants.

- In this respect, it is a form of cloning that has been carried out by humanity for thousands of years and by plants for hundreds of millions of years.

Offspring will have same genes as parents

1. **Vegetative Propagation**:
   - Producing new individuals from roots, stems, or leaves of existing plants
   - Examples:
     - Runners- modified stems that grow along the top of the ground & send out their own roots
     - Strawberries



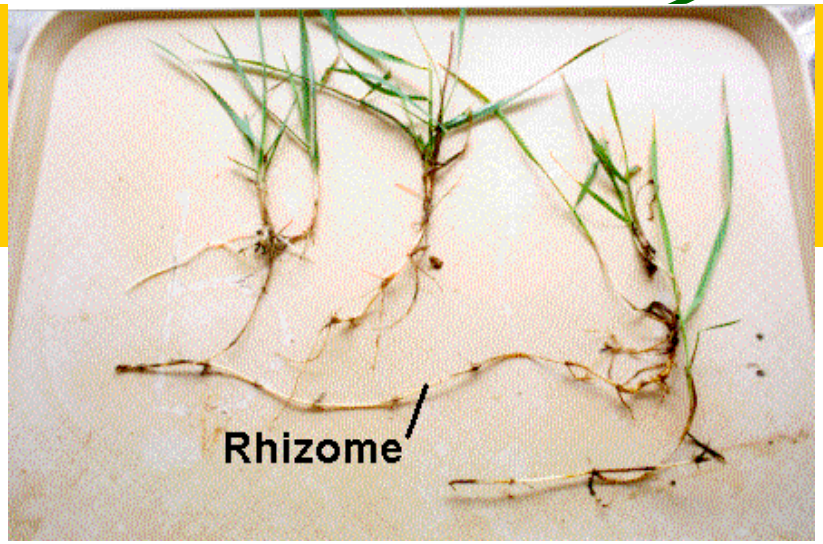
Runners

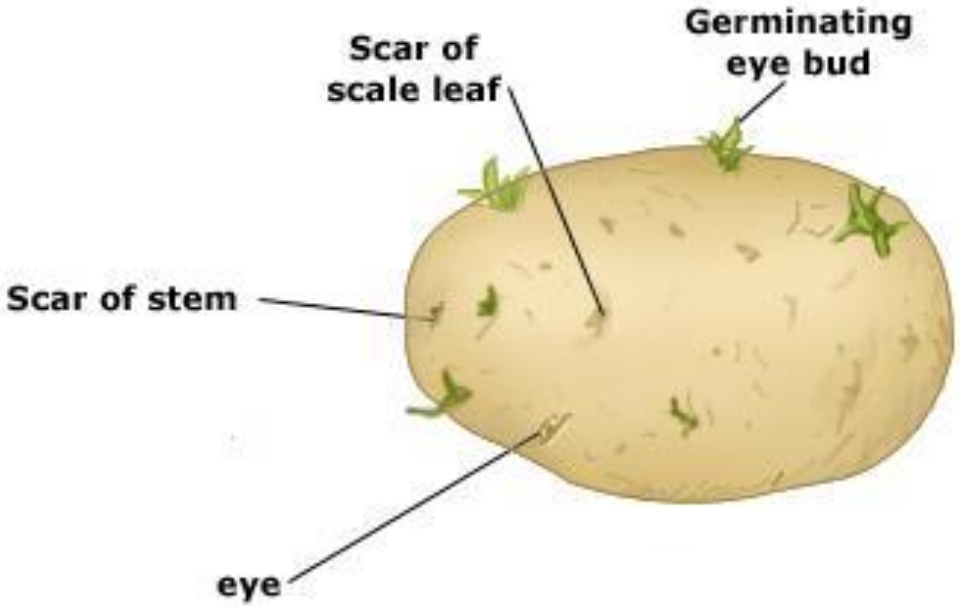
2. **Rhizomes**-

- modified stems that grow under the soil, produce new roots from stem.
- Ex- Grasses

3. **Tubers**-

- shorter, thicker stems that produce an "eye" which is capable of producing a new plant.
- Ex-Potato





4. **Bulbs**-

- Stem covered with modified leaves which can produce a new plant
- Ex: Onion

5. **Food Storing Roots**-

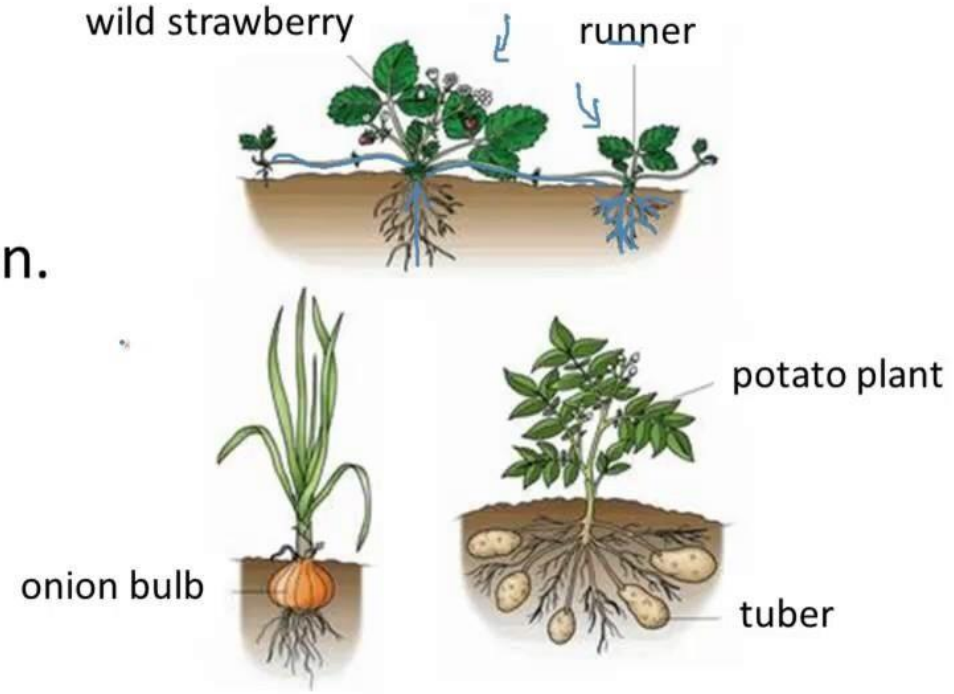
- Roots which are capable of producing a new plant
- Ex: carrots & beets

How do plant reproduce asexually?

Key Concepts:

- Plants reproduce asexually through vegetative propagation.

Natural	Artificial
• Bulbs	• Cutting
• Tubers	• Layering
• Runners	• Grafting
• Rhizomes	



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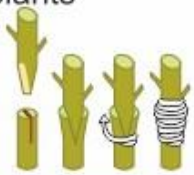
Artificial Vegetative Propagation

Cutting – A part of stem is cut and the cut end grows into new plant when placed in moist soil
e.g. mango, guava, litchi, lemon, rose

Layering – The stem of a plant is bent down until it touches the soil. The stem is then cut once it develops roots and grows into a new plant.
e.g. lemon, rose, jasmine

Grafting – The stem of a plant is cut and then fitted on another strong plant and covered with grafting wax.
e.g. apples, oranges, water melon, ornamental plants



Air Layering – A slanting cut is made in the stem and kept separate with a toothpick. Moss and plastic is wrapped around it till roots grow. Then new plant is cut and planted separately.

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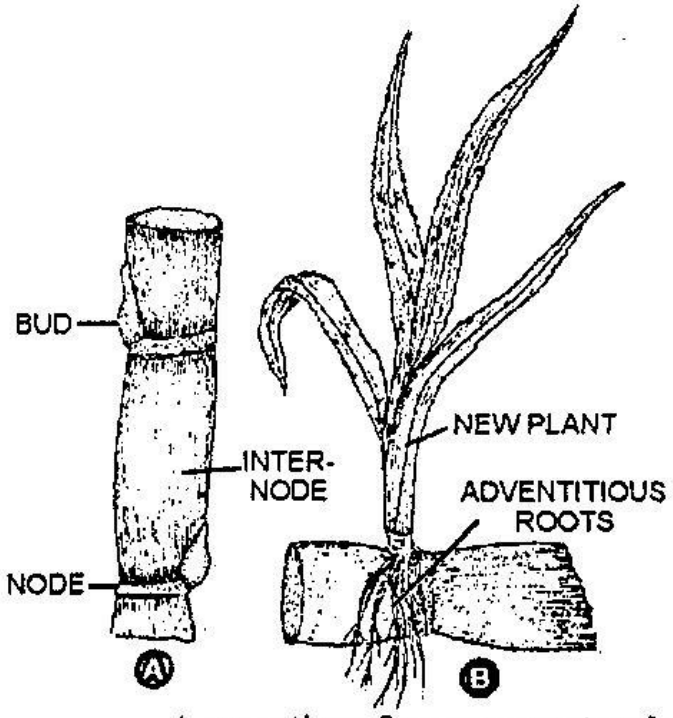
Artificial Propagation

- Method of Asexual reproduction
- most used in agriculture

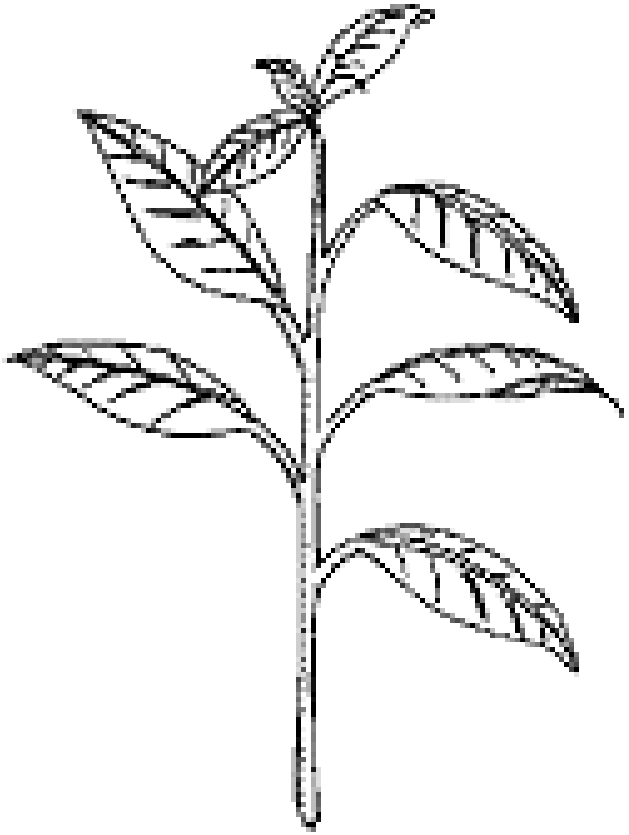
1. Cuttings- pieces of stem cut from parent kept in water, moist soil or sand

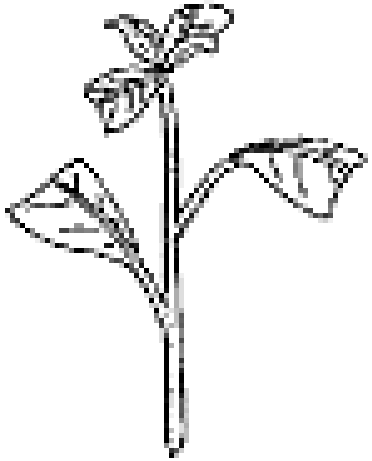
- Will put out new roots.
- Ex:-Many garden plants



A. a portion of sugarcane stem having buds; B. a bud growing into new plant.

Stem cutting

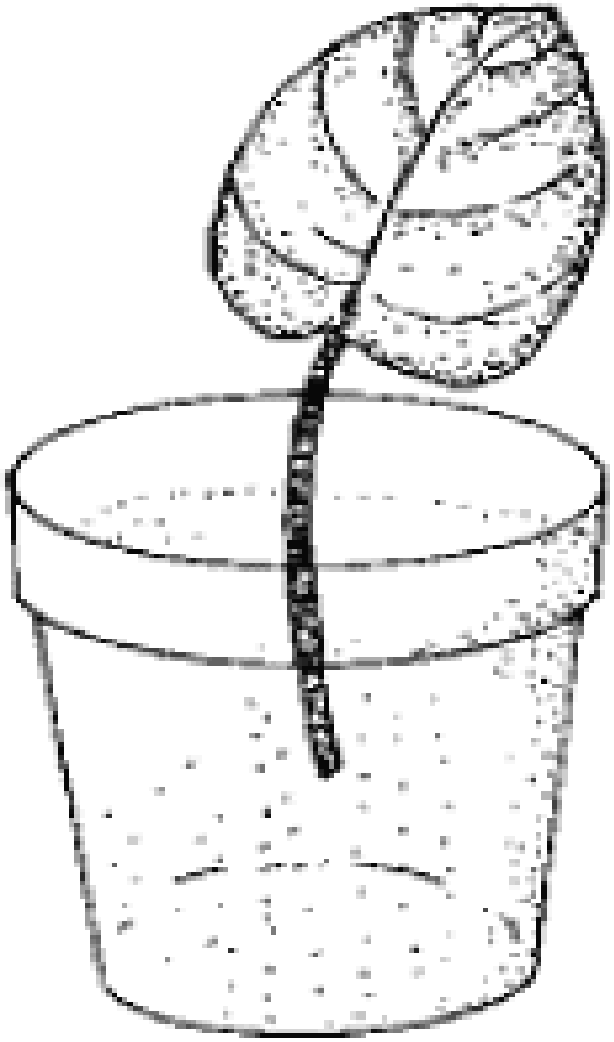




Examples:

Pothos , Purple Leaf Plant
Philodendron
Wandering Jews

Leaf cutting



Examples:

African Violets

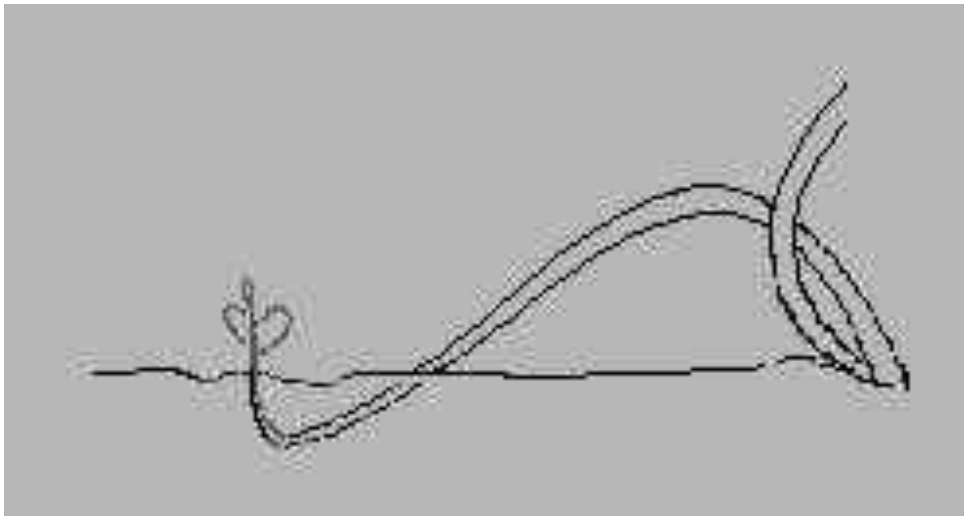
Partial leaf cutting

Examples:

Sansevieria (Mother – In - Law- Tongue)

Night Blooming Cereus

Layering



Examples: Pothos, Philodendron,

Air Layering

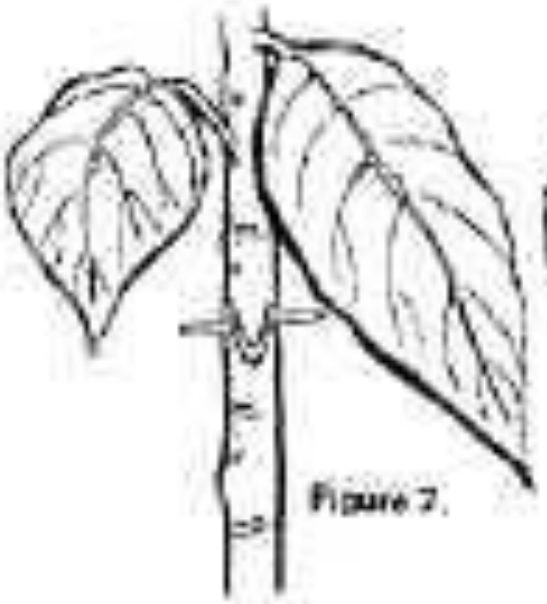
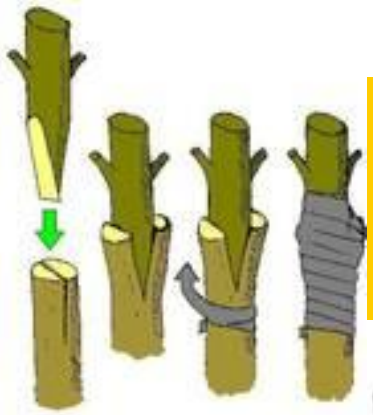


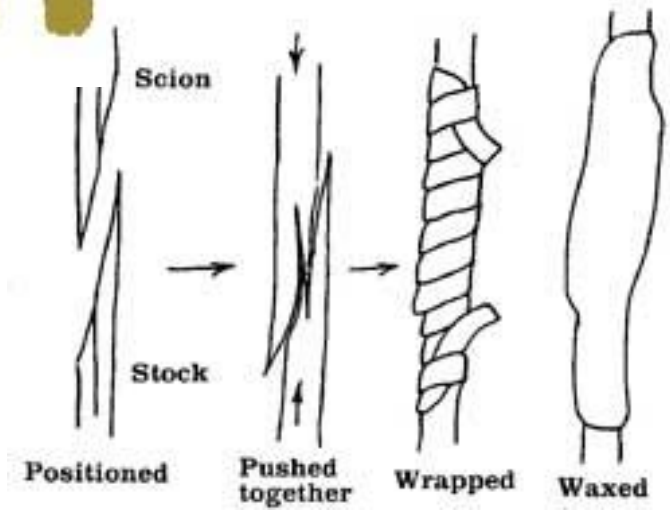
Figure 7.

Figure 8.

2. **Grafting**-
   - Buds or sections are cut from one plant
   - Attached to another that is already rooted in the soil.
- Ex- Roses, Fruit Trees

3. **Tissue culture**-
   - pieces of the center of stem are removed
   - placed in flasks with growth medium
   - a whole new plant will develop





Fragmentation

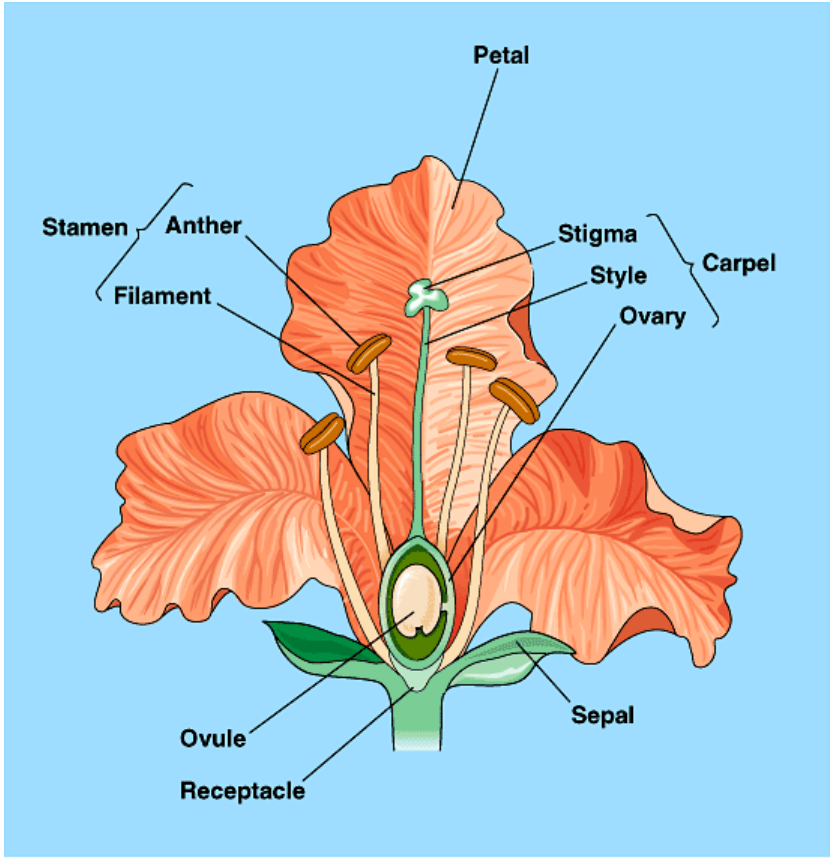
In this form, the body of the parent breaks into distinct pieces, each of which can produce an offspring.

Pieces of coral broken off in storms can grow into new colonies.

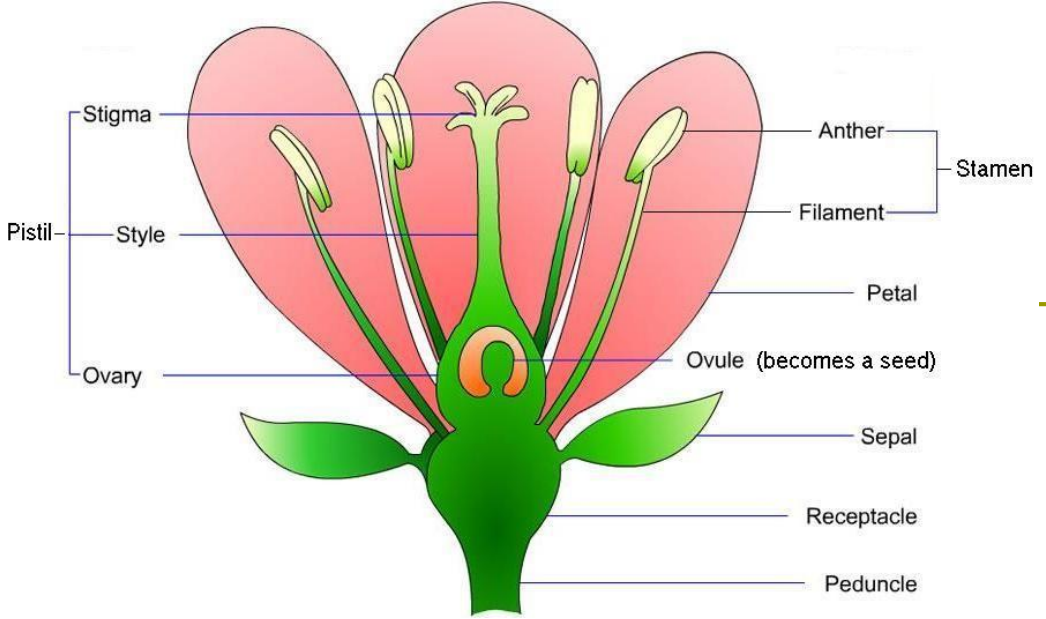
A new starfish can grow from one detached arm.

A Review of Flower Structure

- Flowers are the reproductive structures of flowering plants
- Review: structure of an idealized flower
  - ✓ Male parts?
  - ✓ Female parts?



Female reproductive organ



Male reproductive organ

Pistil

*Stigma –top of the pistil,

Sticky surface for pollen to stick to

*Style – connects the stigma to the ovary

*Ovary –contains ovules (eggs)

Stamen

*Anther – produces sperm nuclei by meiosis. Sperm nuclei are enclosed by pollen grains.

*Filament – holds the anther up

Flower Vocabulary

- Monoecious vs. Dioecious Plants
  - ✓ Plant species are monoecious (“one house”) f the male and female parts are found on the same individual plant
  - ✓ Plant species are dioecious (“two houses”) f the male and female parts are found on separate plants

Dioecious Plants

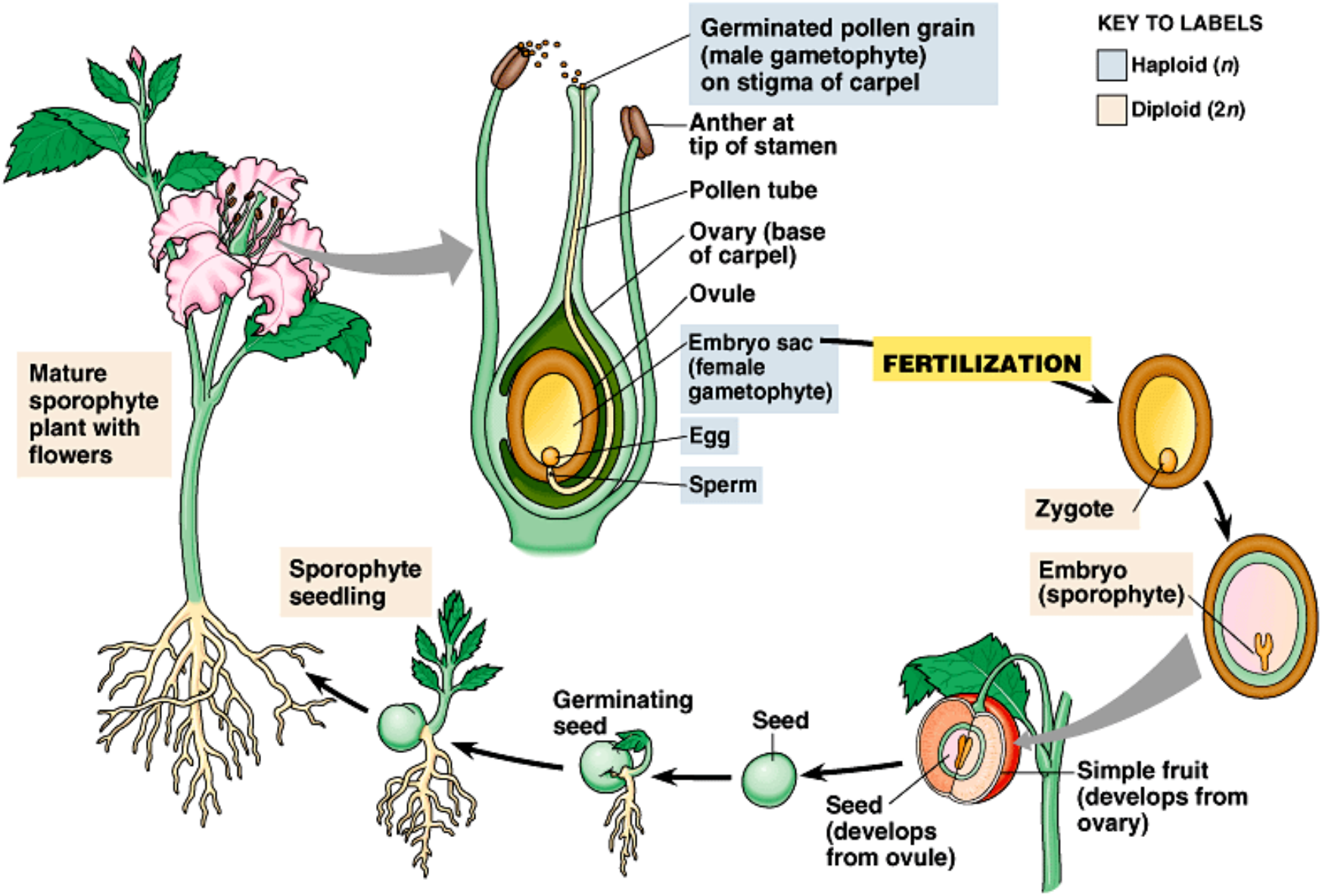
Alternation of Generations (Revisited)

- The life cycle of angiosperms and other plants are characterized by an alternation of generations, in which haploid (n) and diploid (2n) generations take turns producing each other
  - ✓ Diploid plant (**sporophyte)** produces haploid spores by meiosis
  - ✓ These haploid spores divide by mitosis, producing **gametophytes**
  - ✓ These small male and female haploid plants (**gametophytes**) produce gametes
  - ✓ Gametes unite through **fertilization**, resulting in a diploid zygote
  - ✓ The zygote divides by mitosis, producing the new **sporophyte**

Sexual Reproduction

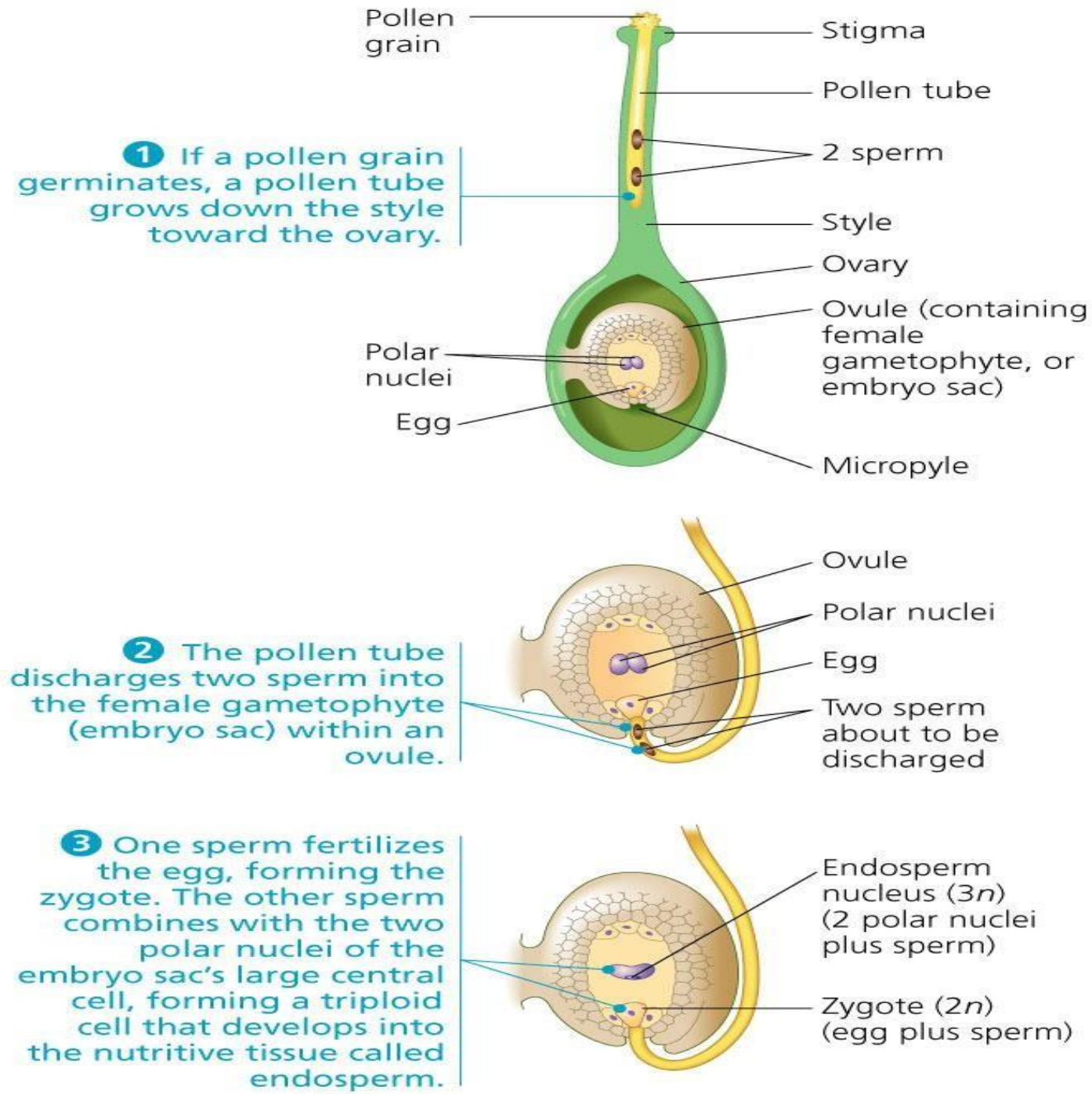
- Reproduction in flowering plants begins with pollination, the transfer of pollen from anther to stigma on the same flower or to the stigma of another flower on the same plant (self-pollination) or from the anther on one plant to the stigma of another plant (cross-pollination).
- Once the pollen grain lodges on the stigma, a pollen tube grows from the pollen grain to an ovule.
- Two sperm nuclei then pass through the pollen tube. One of them unites with the egg nucleus and produces a zygote.
- The other sperm nucleus unites with two polar nuclei to produce an endosperm nucleus.
- The fertilized ovule develops into a seed.

Alternation of Generations



Pollination

- Pollination is the placing of pollen onto the stigma of a carpel
- Pollination is accomplished either by wind or by animals
- A pollen grain absorbs moisture and produces a pollen tube that extends down the style to the ovary
  - ✓ The pollen grain divides by mitosis and produces two sperm
    - One sperm cell fertilizes the egg to form the zygote
    - The other sperm cell combines with the two polar bodies to form a triploid (3n) nucleus
    - This cell will become the endosperm, which serves as a food source to the developing embryo
    - This process (double fertilization) ensures that the endosperm (food source) will develop only in ovules where the egg has been fertilized



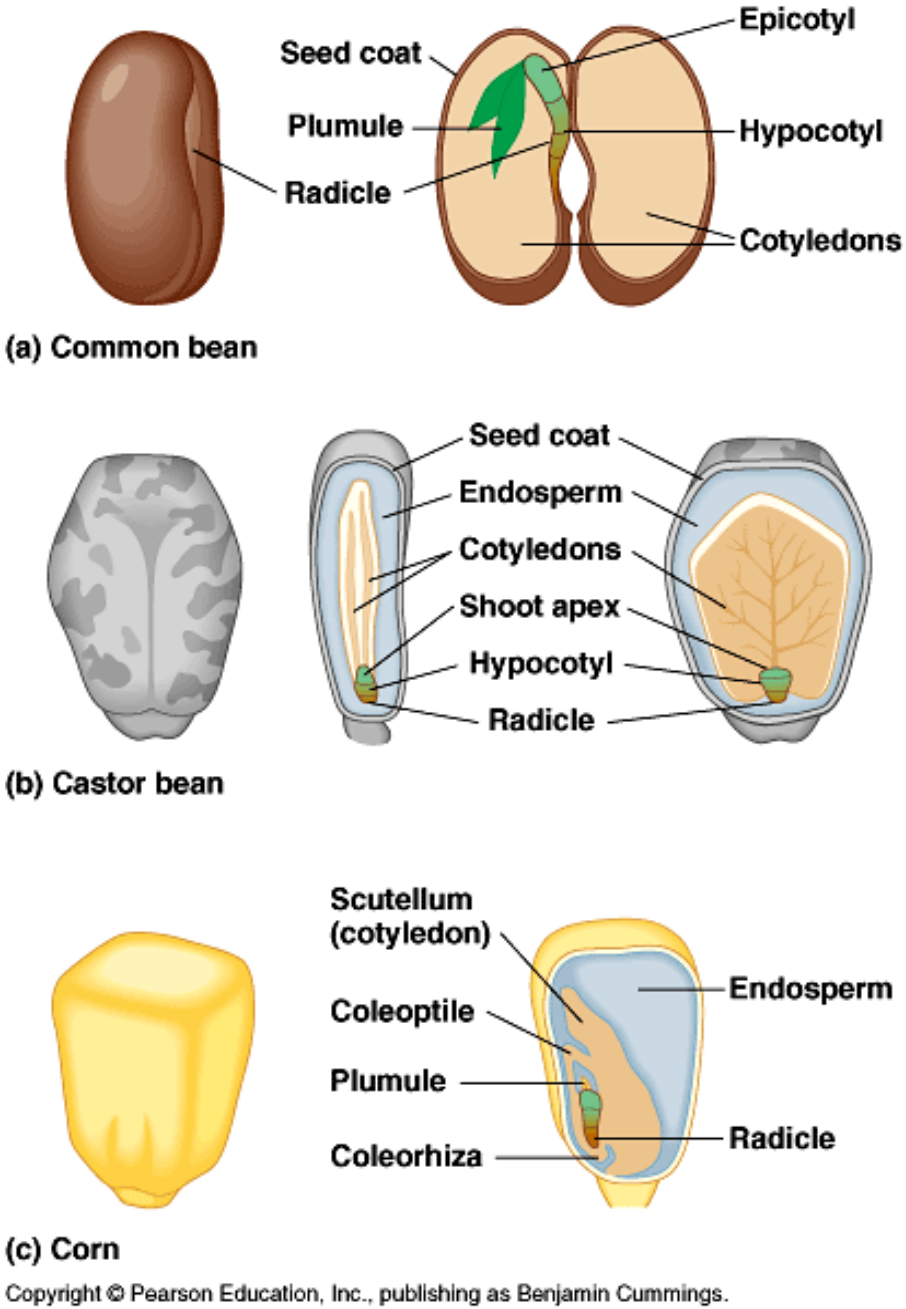
From Ovule to Seed

- After double fertilization, the ovule will develop into a seed and the ovary will develop into a fruit enclosing the seed.
  - ✓ The fruit protects the seeds inside and aids in dispersal (by wind or animals)

- The seed dehydrates as it nears the end of its maturation
  - ✓ The embryo and its food supply (cotyledons, endosperm or both) are enclosed by a hard, protective **seed coat**

Seed Structure

- The **radicle** is the root of the embryo and where germination begins
- The part of the seed **below** the point at which the cotyledons are attached is called the **hypocotyl**
- The portion of the embryonic axis **above** the cotyledons is the **epicotyl**



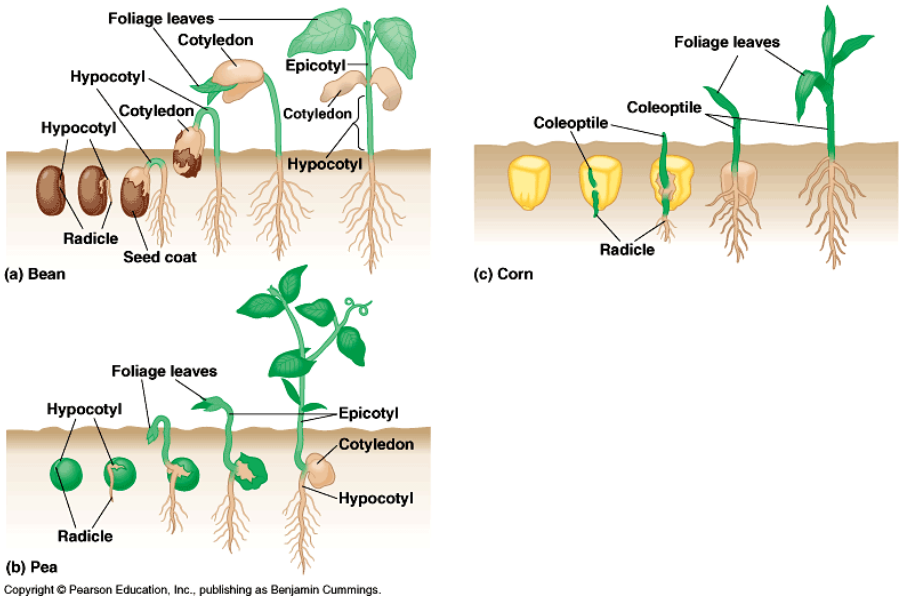
Stages of Seed Germination

(1) The seed absorbs water, causing it to expand and rupture its seed coat

(2) The embryo resumes growth, digesting the storage materials of the endosperm

(3) The radicle (embryonic root) emerges from the germinating seed

(4) The shoot tip breaks through the soil surface



Fruits

- Simple Fruits
  - ✓ A fruit derived from a single ovary
  - ✓ Can be fleshy (cherry) or dry (soybean pod)
- Aggregate Fruit
  - ✓ A fruit that results from a single flower that has several separate carpels
  - ✓ Blackberries, strawberries
- Multiple Fruit
  - ✓ Develops from a group of separate flowers tightly clustered together
  - ✓ Pineapple

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