

Reproduction

- **Asexual Reproduction**

- Offspring's genes all come from the same parent without the fusion of egg and sperm

- **Sexual Reproduction**

- fusion of two haploid gametes (sperm and egg) to form a diploid zygote

Asexual Reproduction in Plants

- no alternation of generations
- new plants are cloned from parts of the adult plant

Asexual Reproduction in Plants

Forms of Vegetative Reproduction

- **Rhizomes**
 - Underground stems
- **Stolons or runners**
 - Long slender stems that run along the surface of the soil
- **Fragmentation**
 - Adventitious leaves or roots (suckers), cuttings

Figure 35.4 Modified shoots: Stolons, strawberry (top left); rhizomes, iris (top right); tubers, potato (bottom left); bulb, onion (bottom right)





Asexual Reproduction in Animals

- **Fission**

- the separation of the parent into two or more offspring of equal size

- **Budding**

- new individuals split off from existing ones

- **Fragmentation and regeneration**

- the breaking of the body into several pieces, some or all of which develop into new adults

- **Parthenogenesis**

- Development of unfertilized eggs

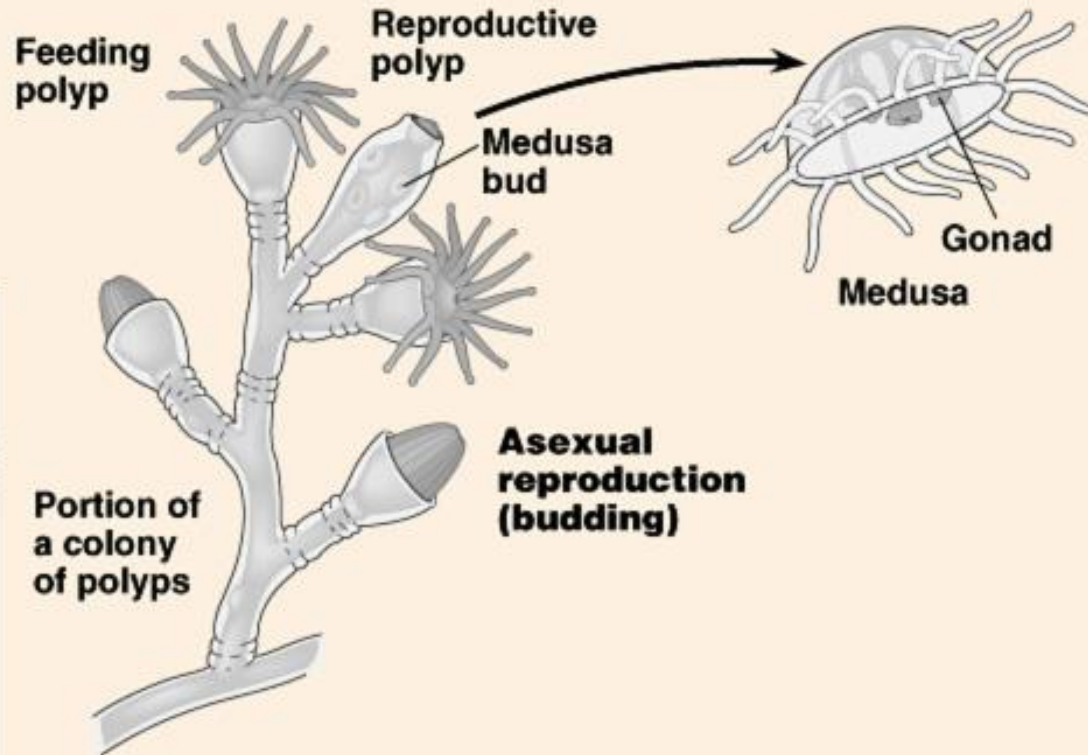
Fission: asexual reproduction of a sea anemone (*Anthopleura elegantissima*)



Budding: The life cycle of the hydrozoan *Obelia*



1 mm



■ Haploid (n)
□ Diploid ($2n$)

Advantages of Asexual Reproduction

- no mate
- quick
- favored in stable, favorable environments

Advantage of Sexual Reproduction

- **Increases genetic variability**
- advantageous when environmental conditions are unstable or change often

Sexual Reproduction

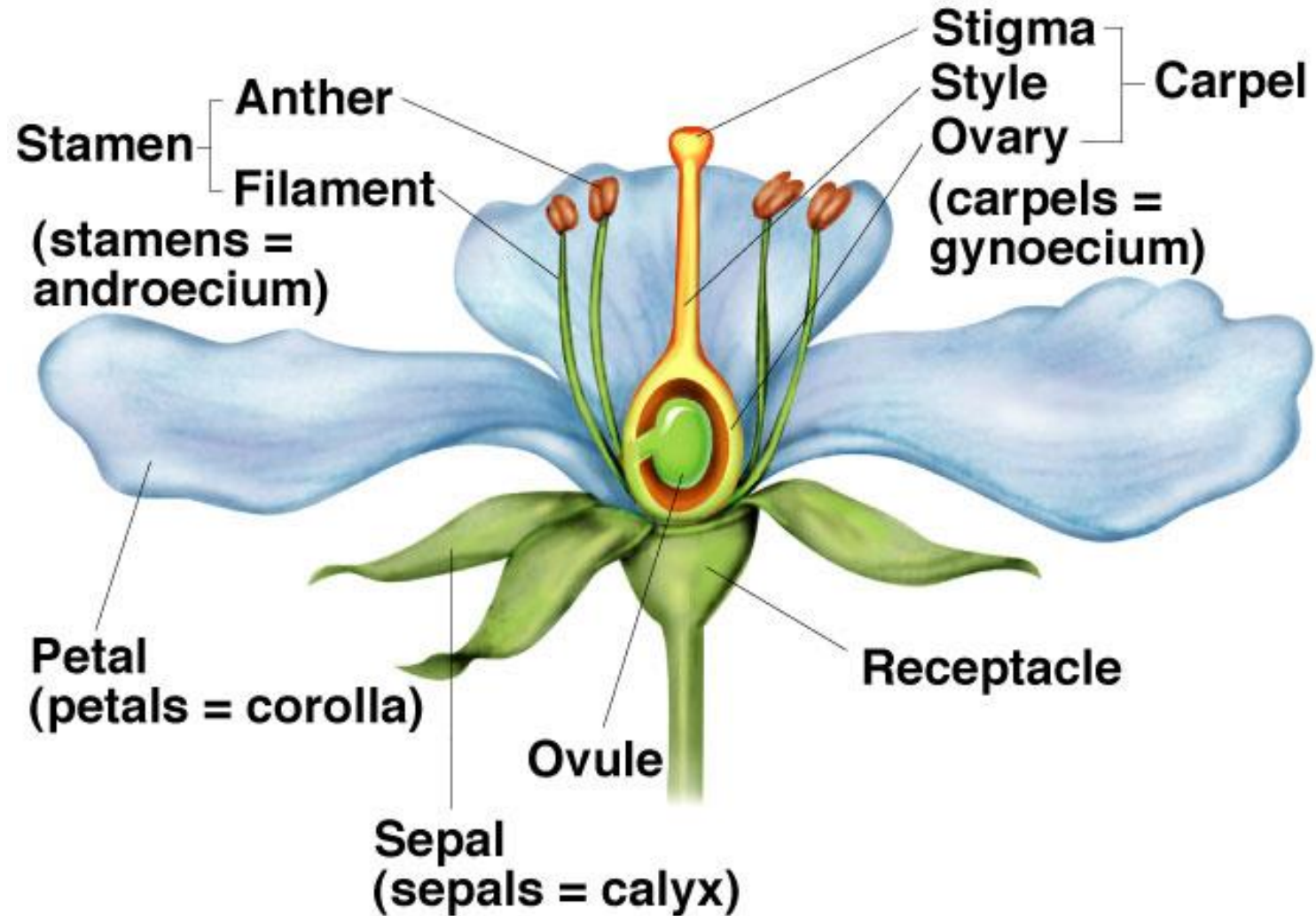
- female gamete= **egg**
 - relatively large and nonmotile
- male gamete = **sperm**
 - small and motile
- The two gametes unite during **fertilization**

Pollination in “Higher” Plants

- The process by which pollen is placed on the stigma

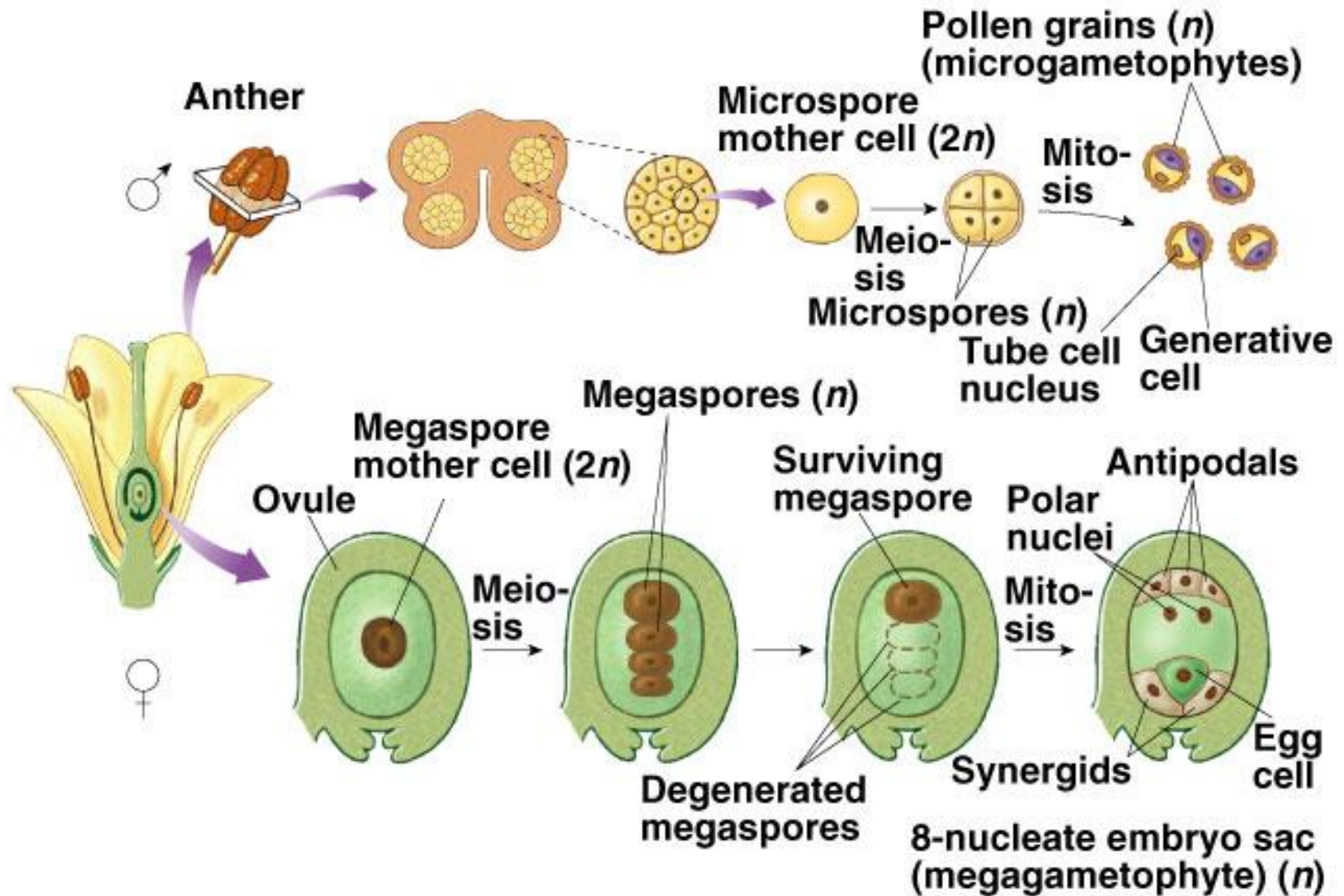
Figure 41.13 Structure of a flower

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Formation of Pollen Grains and Embryo Sac

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Wind Pollination

- Early plants
- gymnosperms and some angiosperms (oaks, birches, grasses)
- Pollen only travels small distances (100m)

Wind pollinated grass : yellow anthers

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Pollination by Animals

- many angiosperms
- animal pollinators are bees, butterflies, moths, hummingbirds

Figure 30.18 Flower-pollinator relationships: Scottish broom flower and honeybee (left), hummingbird (top right), baobab tree and bat (bottom right)



Pollination by Animals

- Leads to increased flower specialization
 - coevolution
- Flower gets pollinated and the animal gets food – pollen and nectar

How a bee sees a flower

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(a)



(b)

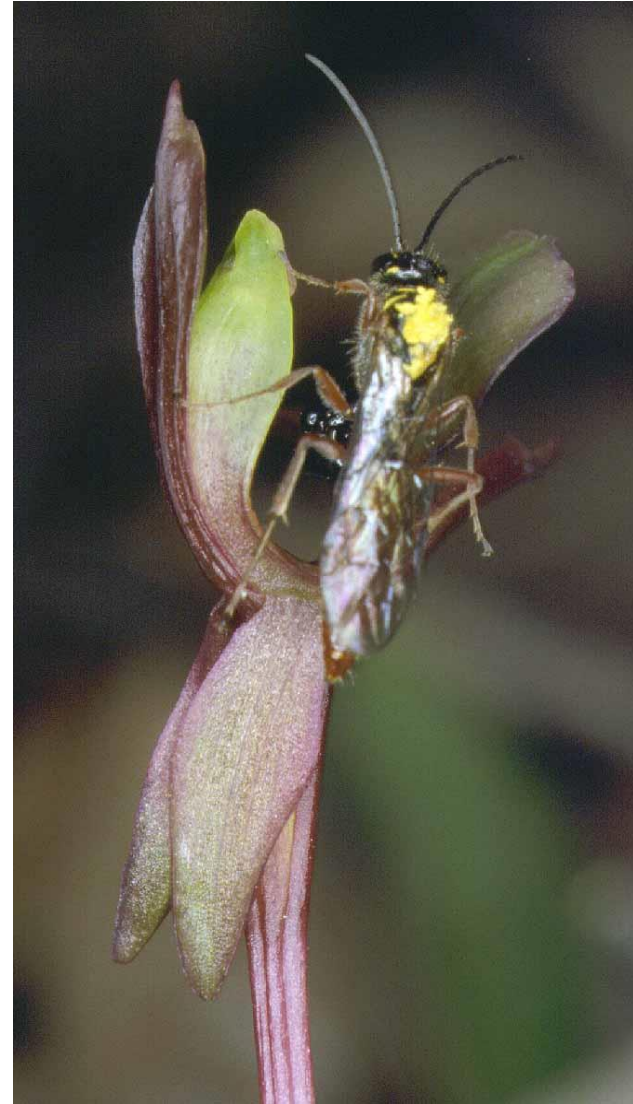
Mimicry

- Flower
 - *Orchid (Chiloglottis trapeziformis)*
- Pollinator
 - *Wasp (Neozeleboria cryptoides)*

Flowers produce female pheromones and
mimic female wasp shape



Male wasp tries to copulate with flower
causing pollen to be deposited onto male wasp



Male wasp flies to another flower and deposits pollen while trying to copulate

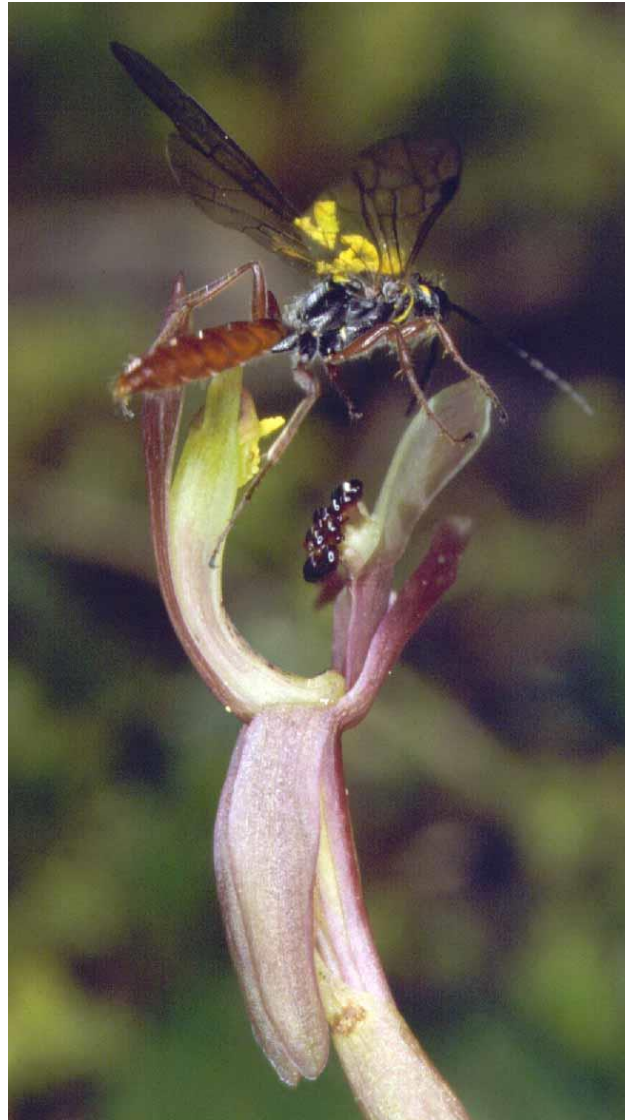
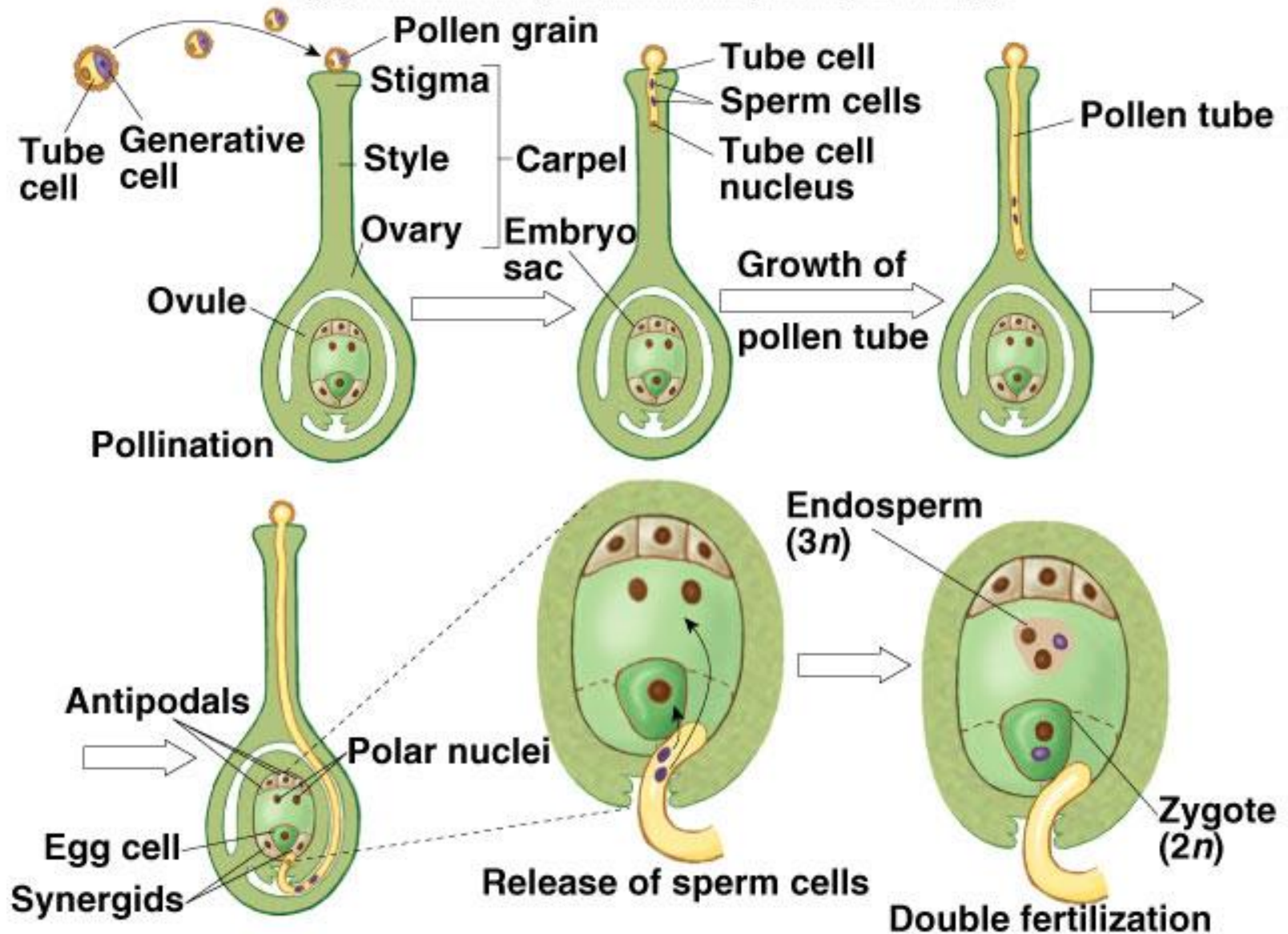


Figure 41.27 Growth of the pollen tube and double fertilization

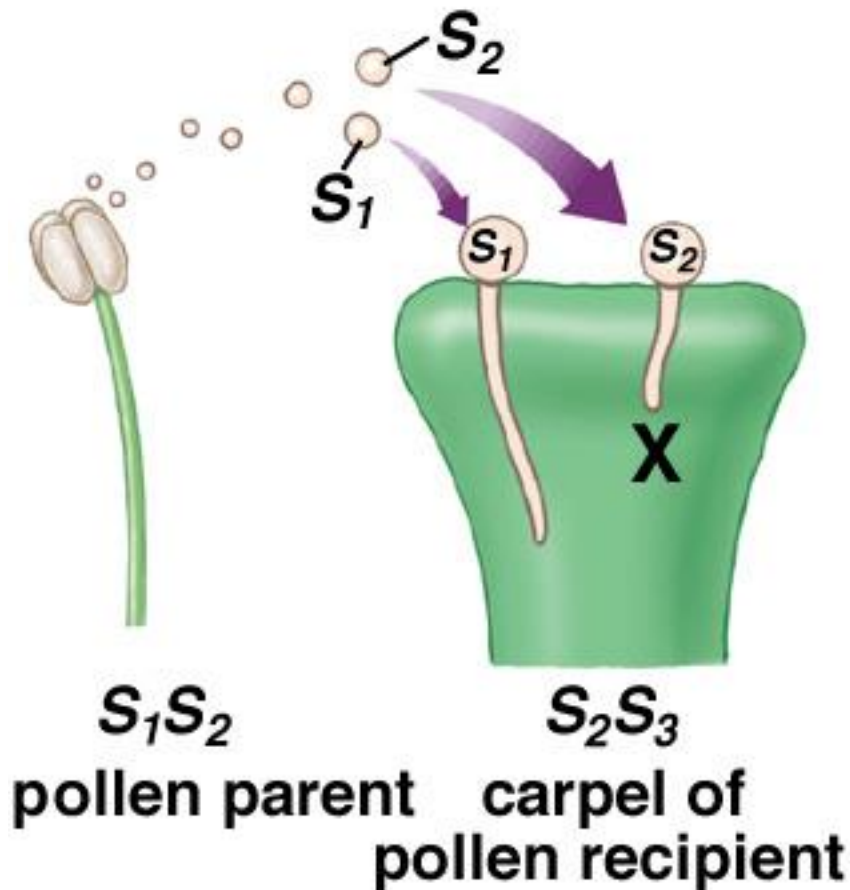
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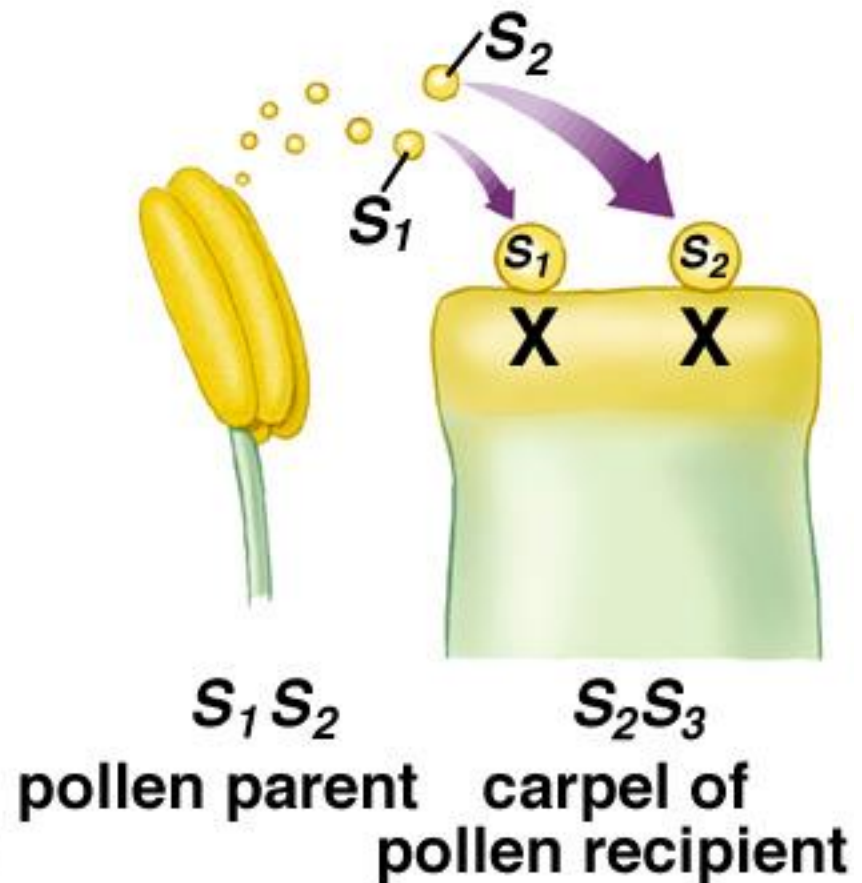
Double Fertilization in Plants

- One sperm fuses with the egg
 - forms the zygote
- other sperm cell fuses with the two polar nuclei in the embryo sac
 - form the triploid endosperm (nourishes the embryo)

Self-Incompatibility in Flowers

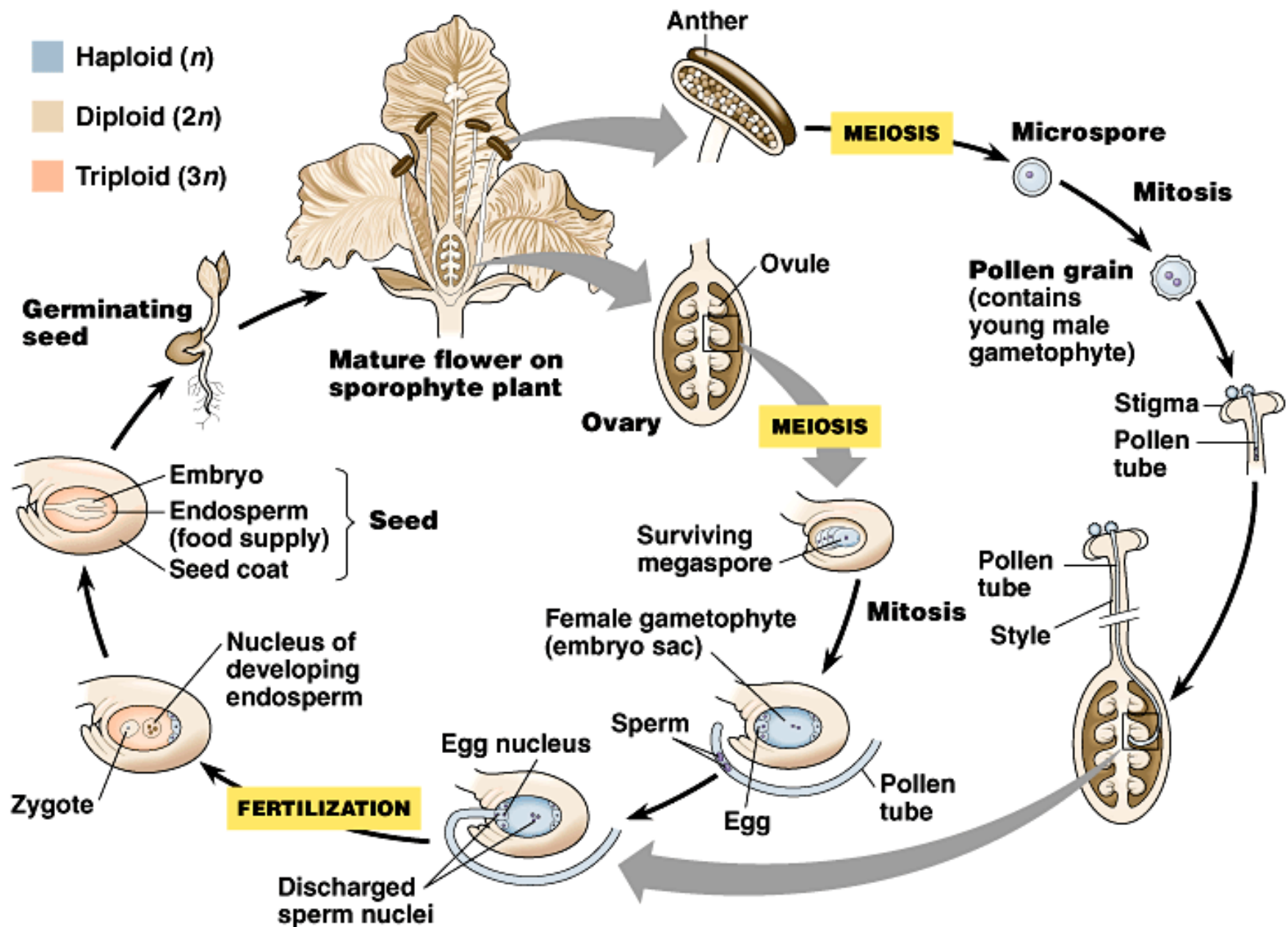


**Gametophytic
self-incompatibility**

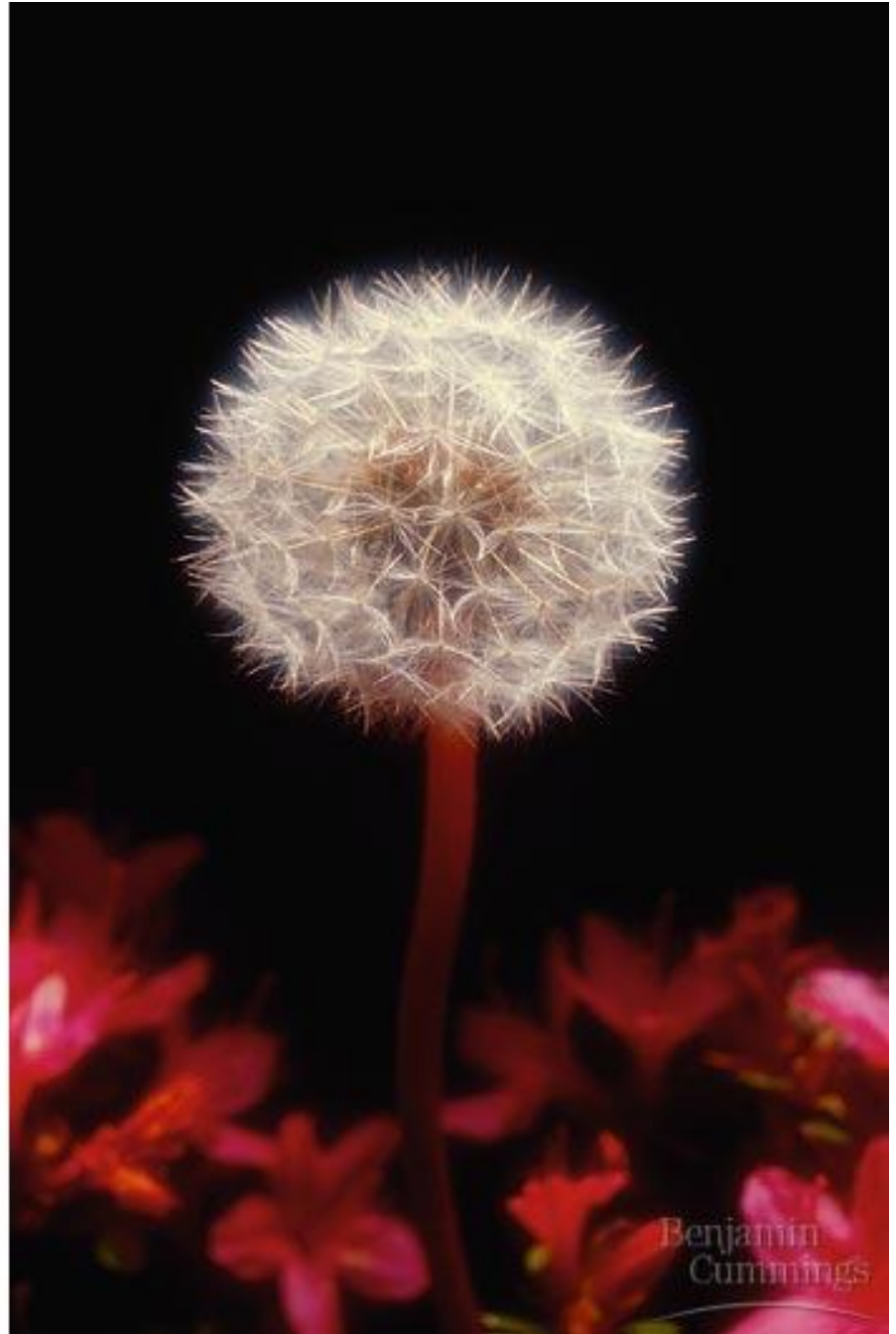


**Sporophytic
self-incompatibility**

The life cycle of an angiosperm



Fruit adaptations that enhance seed dispersal: Red berries (left), dandelion (right)



Benjamin
Cummings

Fertilization in Animals

Two major patterns of fertilization:

- **External fertilization**
 - Eggs are shed by the female and fertilized by the male in the environment
- **Internal fertilization**
 - fertilization takes place within the female's body

External Fertilization

- Moist environments
- Requires synchronization
 - due to environmental cues or pheromones
- large numbers of zygotes but low survival rate
 - no parental care

External Fertilization

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Internal Fertilization

- Requires cooperative behavior leading to copulation
- Requires sophisticated reproductive systems with copulatory organs
- fewer zygotes but increased survival
 - protection of the embryo and parental care

After Internal Fertilization

- **Oviparity**
 - Fertilized eggs deposited outside of body
 - Some fish, most reptiles, all birds

After Internal Fertilization

- **Ovoviviparity**
 - Fertilized eggs retained within mother
 - Embryos get nutrition from yolk
 - Some fish, some reptiles

After Internal Fertilization

- **Viviparity**

- Embryos develop within mother
- Get nutrition from the mother
- Most cartilaginous fish, most mammals