

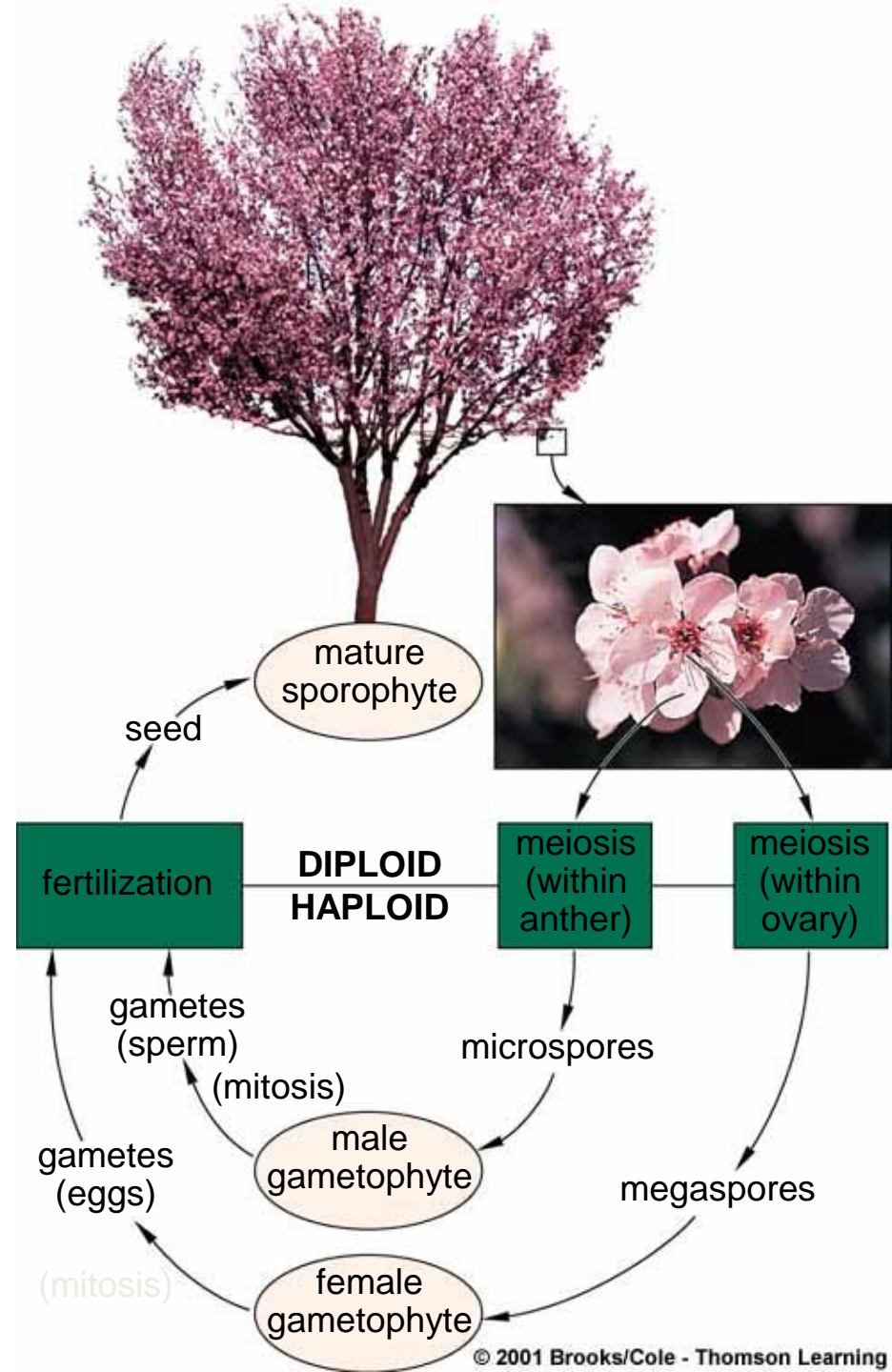
Chapter 31: Plant Reproduction

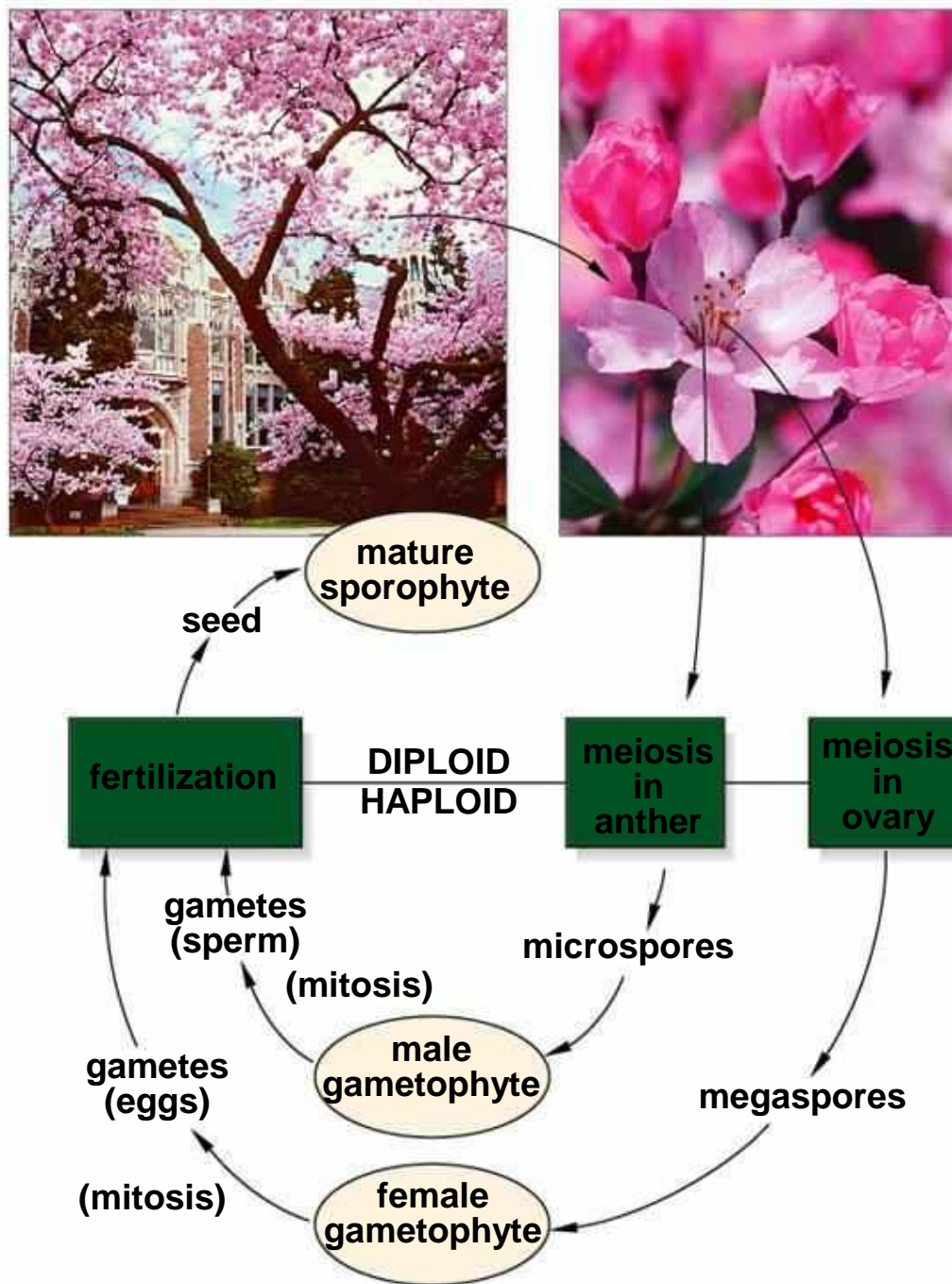
Plants and Pollinators

- **Pollen had evolved by 390 million years ago**
 - Sperm packed inside a nutritious package
 - Transferred first by wind currents
 - Later transferred by insects
- **Plants that attracted insect pollinators with flowers had a reproductive advantage**

Angiosperm Life Cycles

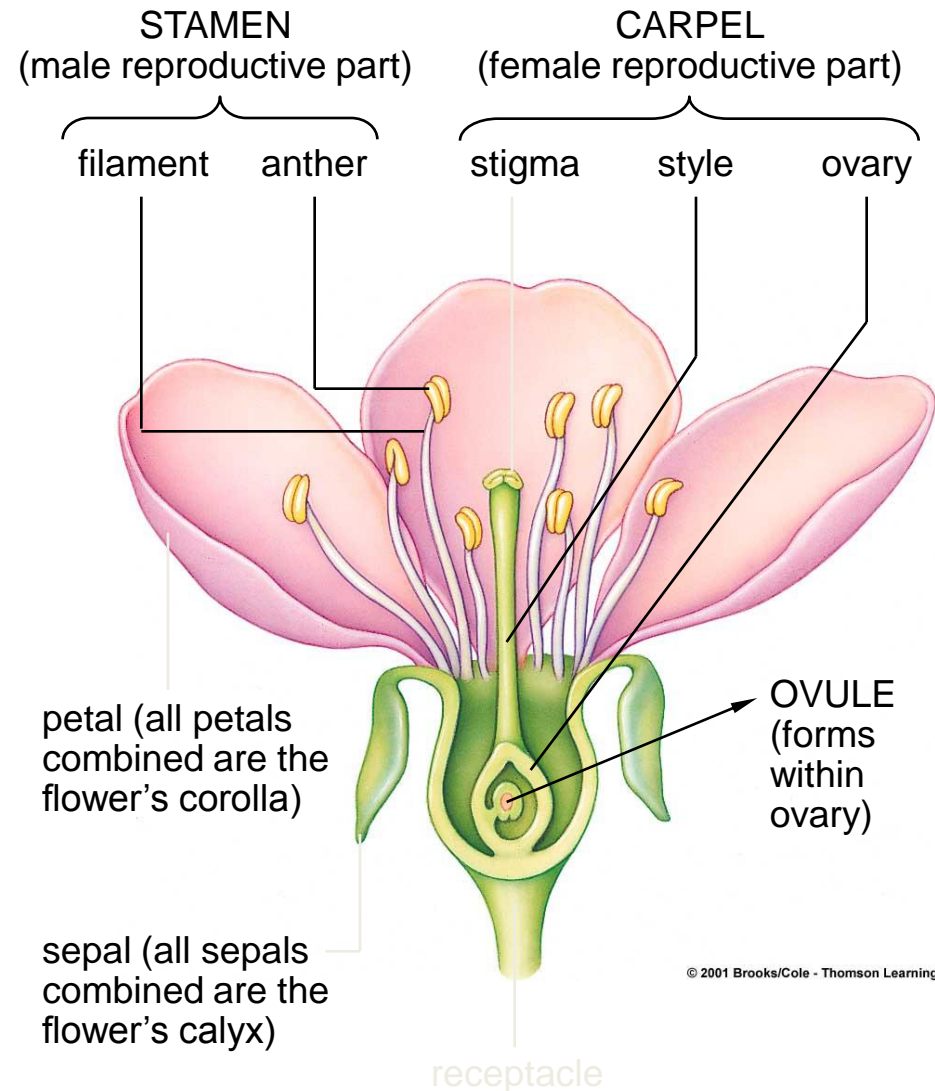
- Dominant form is the diploid sporophyte
- In flowers, haploid spores formed by meiosis develop into gametophytes





Flower Structure

- Nonfertile parts
 - Sepals
 - Receptacle
- Fertile parts
 - Male stamens
 - Female carpel (ovary)

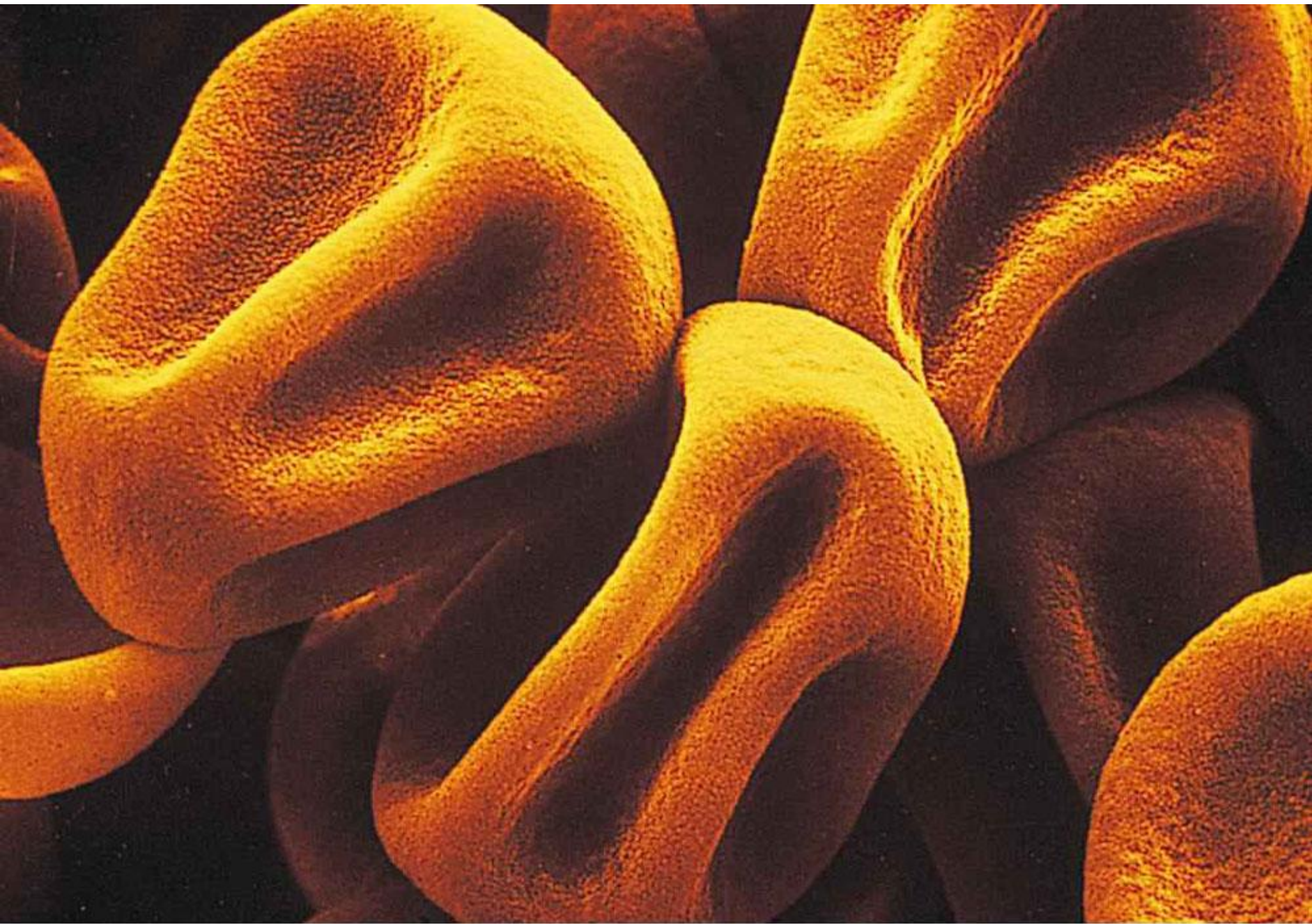


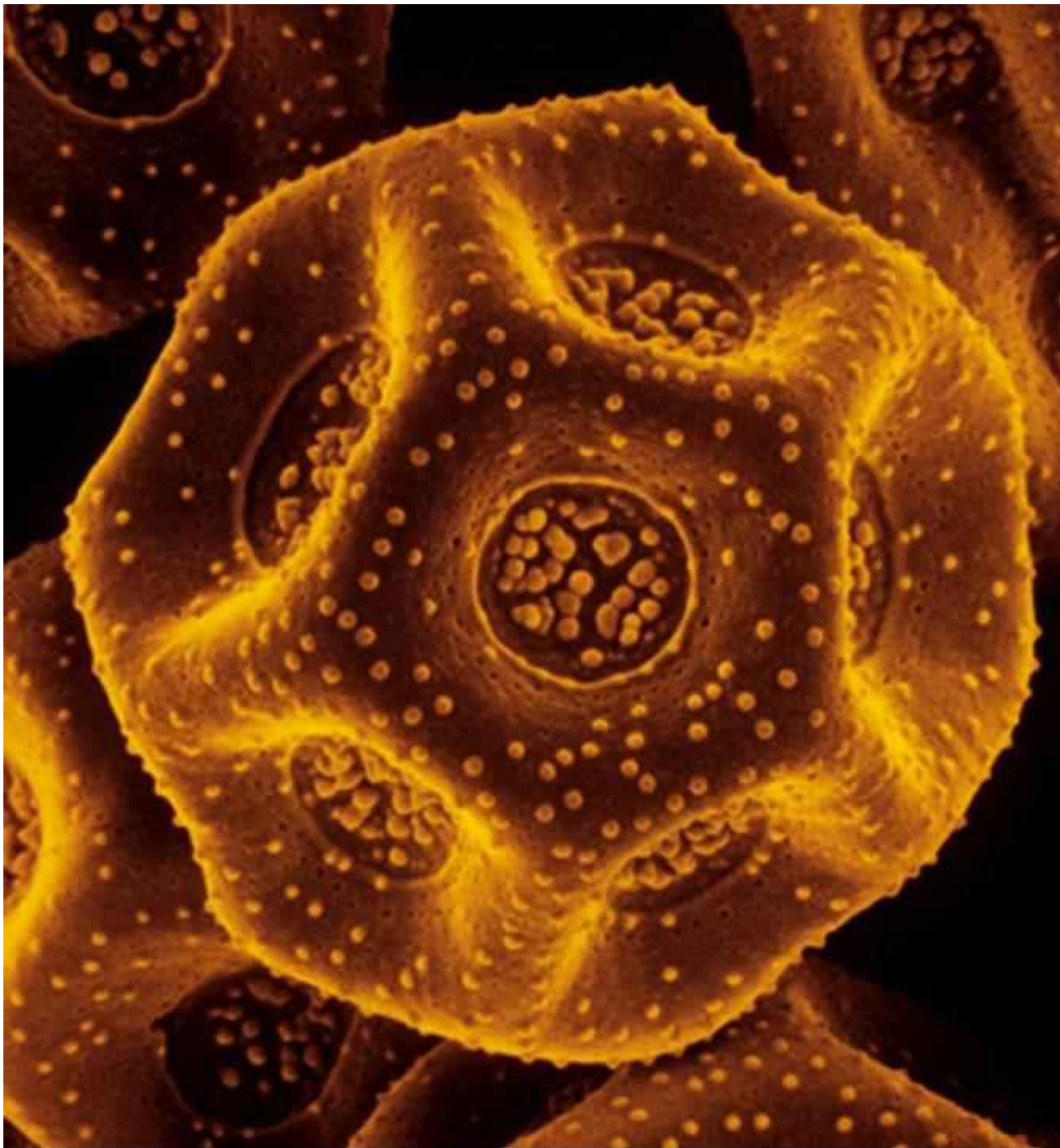
Kinds of Flowers

- **Perfect flowers**
 - Have both male and female parts
- **Imperfect flowers**
 - Are either male or female
 - Same plant may have both male and female flowers
 - Sexes may be on separate plants

Pollen Allergies

- Millions of people are genetically predisposed to overreact to certain kinds of pollen
- Symptoms include a runny nose, reddened and itchy eyelids, and sneezing







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Fig. 31-4c, p.527

Pollination

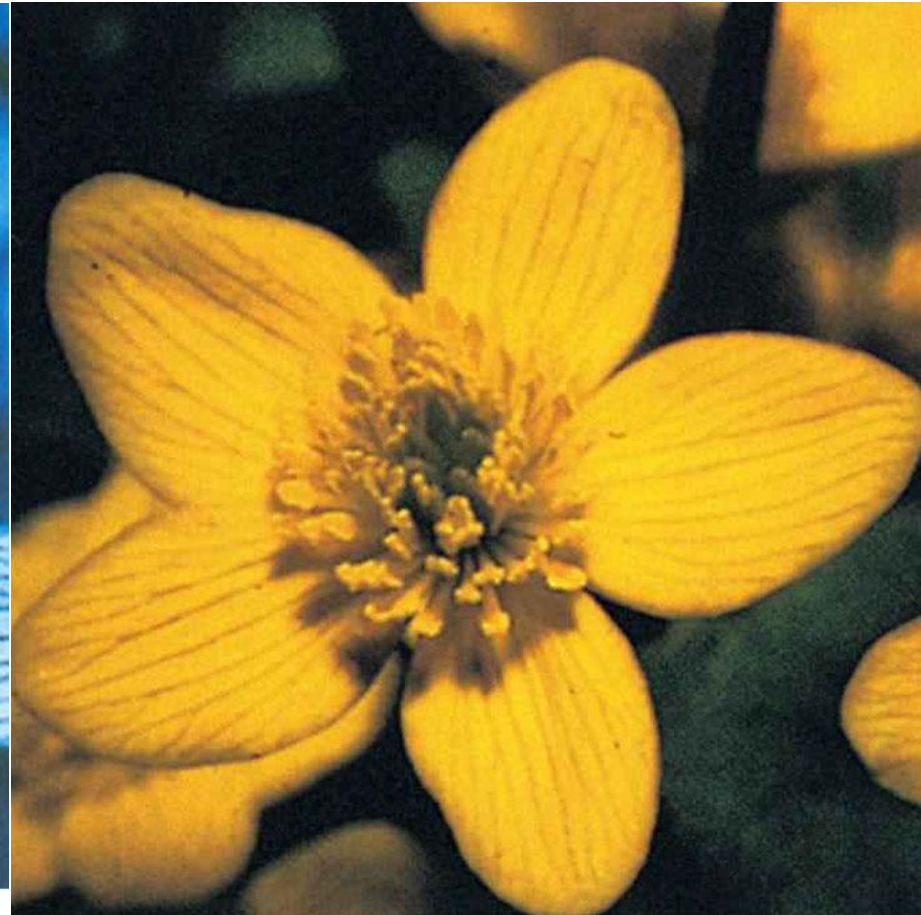
- **Transfer of pollen grains to a receptive stigma**
- **Pollen can be transferred by a variety of agents**
- **When a pollen grain lands on the stigma it germinates**

Pollinators

- Pollination vectors
 - Winds
 - Insects
 - Birds
 - Other animals
- Coevolution with pollinators



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Fig. 31-5a, p.528

Pollinators

- **Visual cues**
 - Size, shape, color, pattern
- **Olfactory cues**
 - Odors from fruit or flowers
 - Pollinators follow concentration gradient of volatile chemicals to their sources
- **Reinforcements**
 - Nectar

Pollinators



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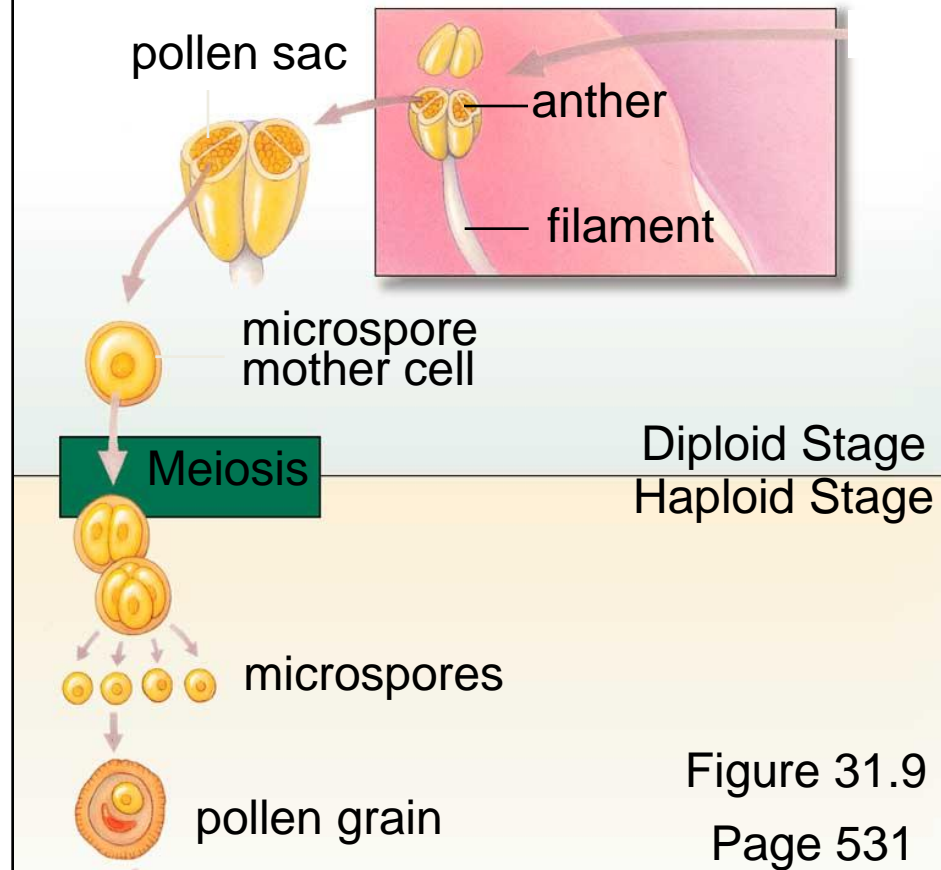
Long Floral Tubes and the Hawkmoths



Fig. 31-7, p.529

Pollen Formation

- Each anther has four pollen sacs
- **Inside pollen sacs, cells undergo meiosis and cytoplasmic division to form microspores**



- **Microspores undergo mitosis to form pollen grains**

Egg Formation

- **Meiosis in ovule produces megaspores**
- **All megaspores but one disintegrate**
- It undergoes mitosis three times without cytoplasmic division
- Result is a cell with eight nuclei
- Division produces seven-celled female gametophyte
- One cell is egg, another will form endosperm

Events inside Ovule

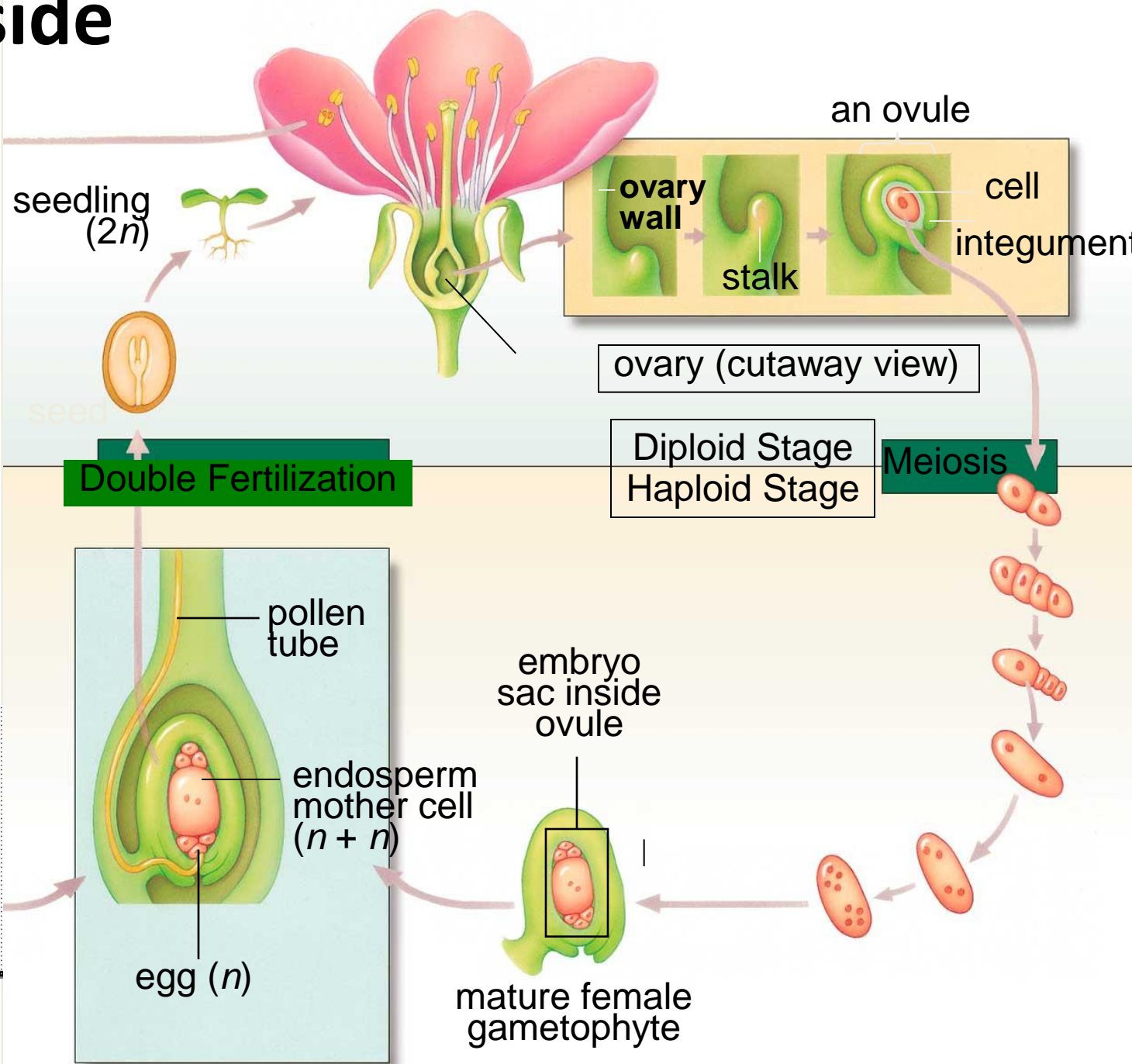
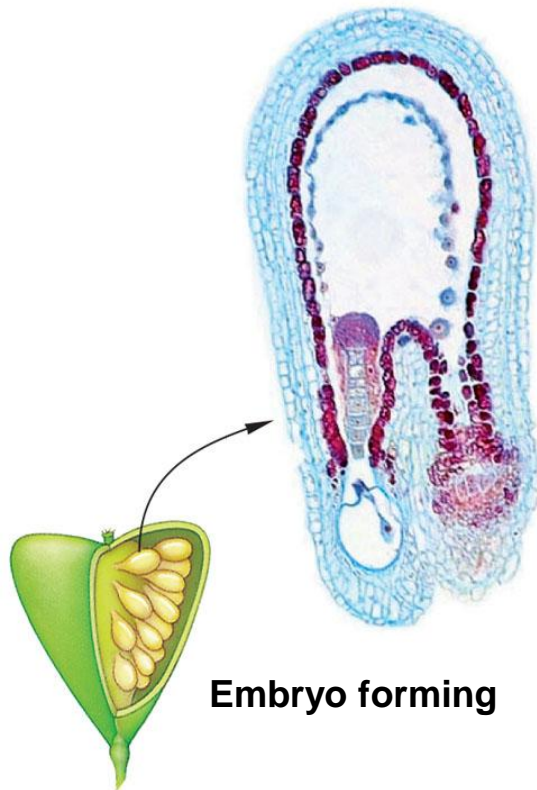


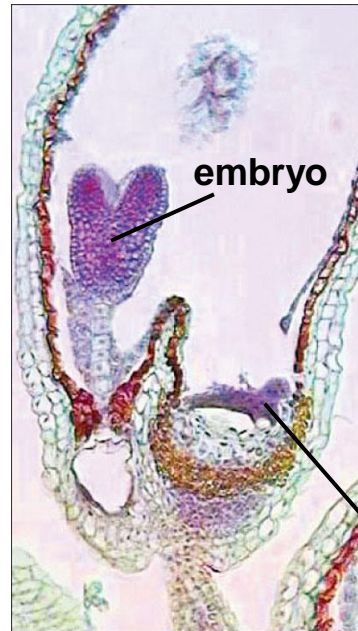
Figure 31.9
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Endosperm Formation

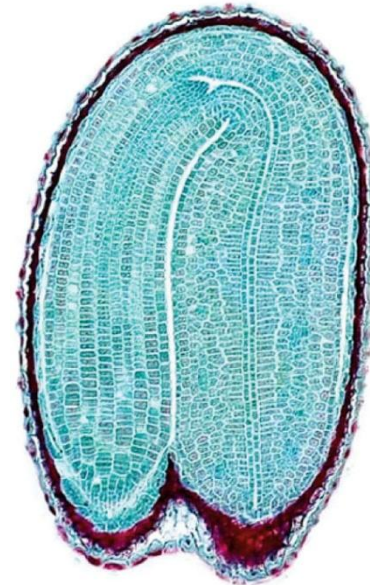
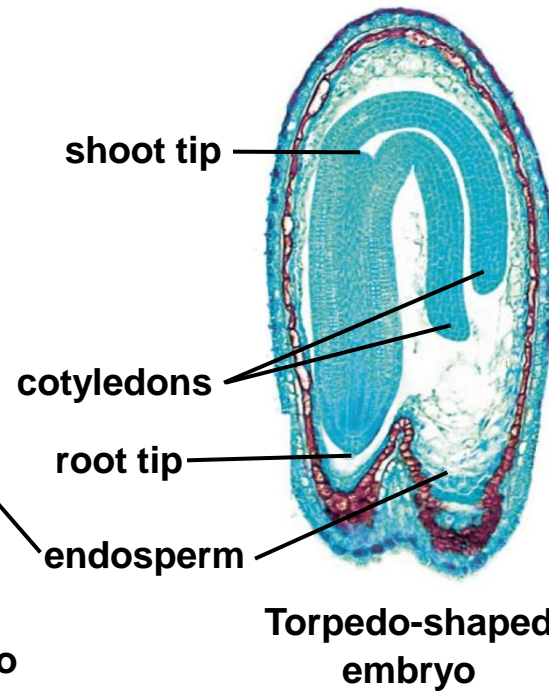
- **Occurs only in angiosperms**
- Fusion of a sperm nucleus with the two nuclei of the endosperm mother cell produces a triploid ($3n$) cell
- **This cell will give rise to the endosperm, the nutritive tissue of the seed**



Embryo forming



Heart-shaped embryo



Mature embryo

Stepped

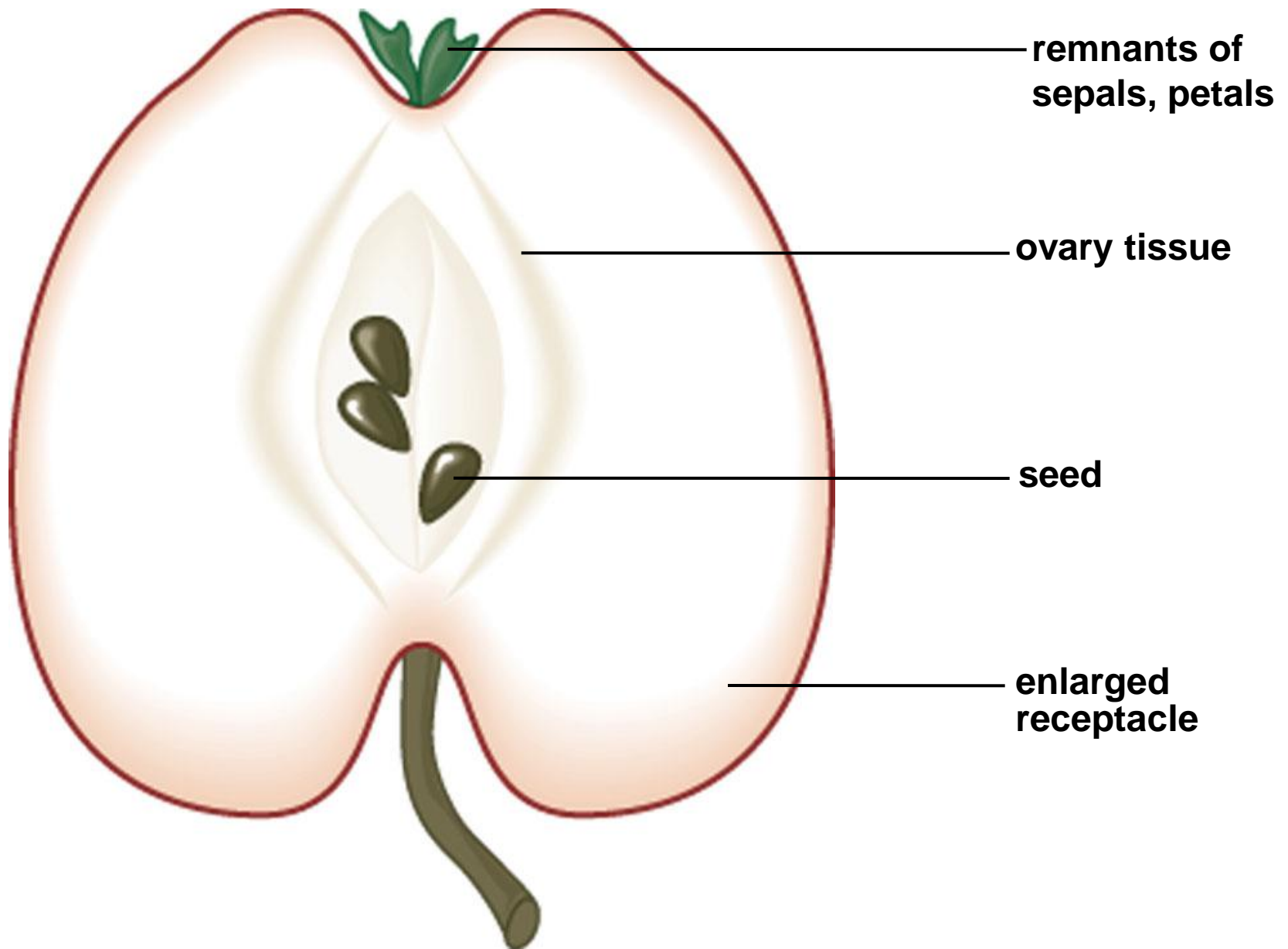
Fig. 31-10, p.532

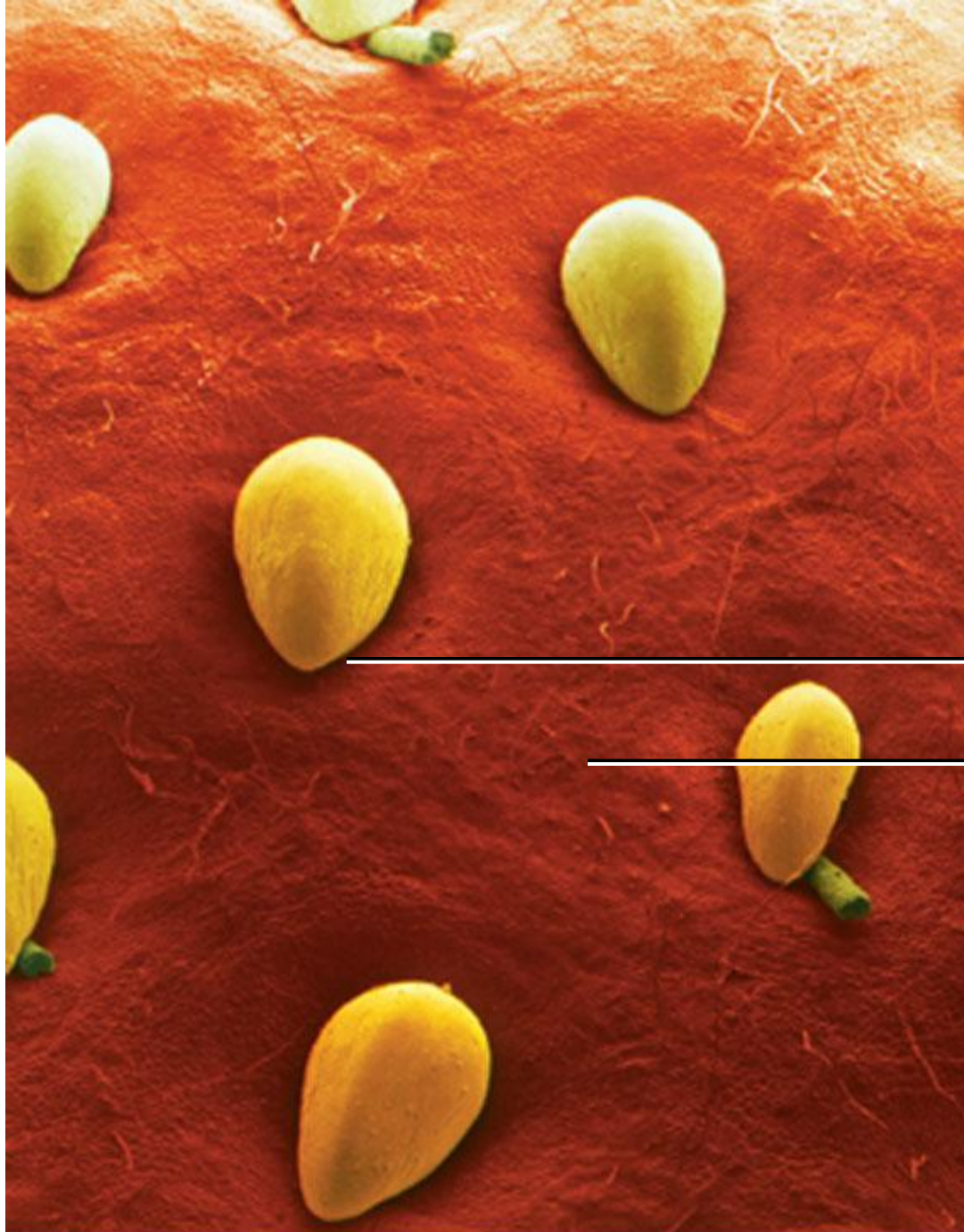
Seed Formation

- Fertilization of the egg produces a diploid sporophyte zygote
- The zygote undergoes mitotic divisions to become an embryo sporophyte
- Seed: A mature ovule, which encases an embryo sporophyte and food reserves inside a protective coat

Structure of a Seed

- **Protective seed coat** is derived from integuments that enclosed the ovule
- **Nutritious endosperm** is food reserve
- **Embryo has one or two cotyledons**
 - Monocot has one
 - Dicot has two





wall of one
dry fruit

expanded
receptacle

Multiple Fruits

- Formed from individual ovaries of many flowers that grew clumped together
- Examples:
 - Pineapple
 - Fig

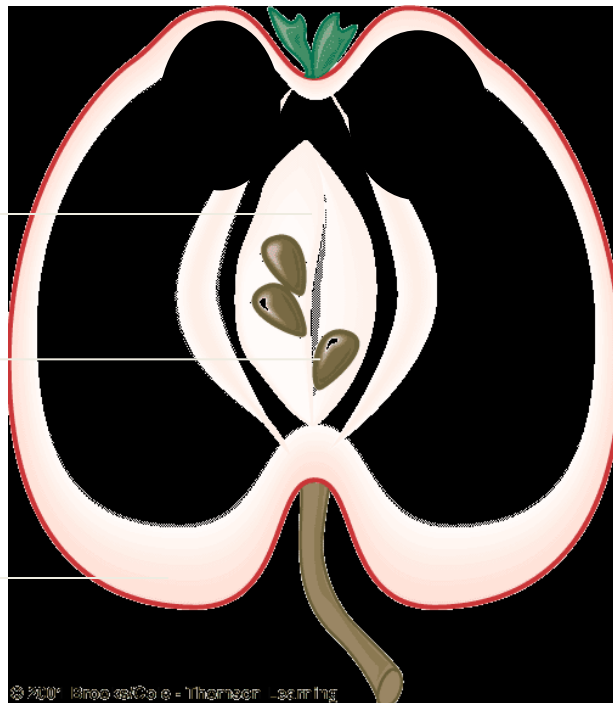
Accessory Fruits

Apple

ovary tissue

seed

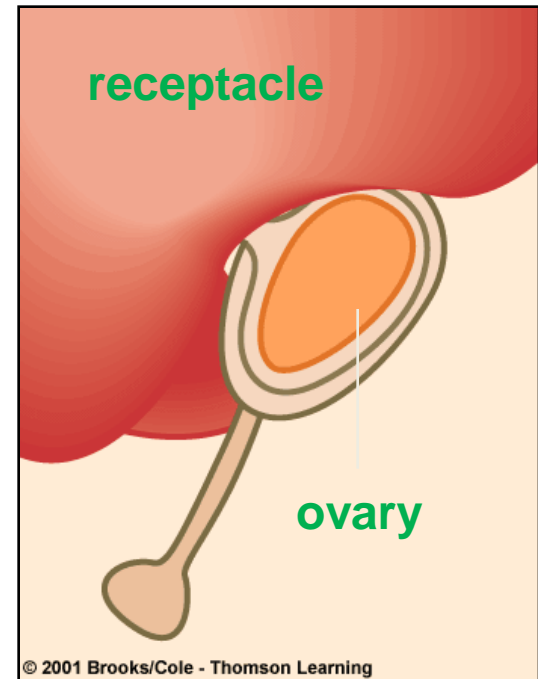
enlarged
receptacle



Strawberry

receptacle

ovary



Seed Dispersal

- Fruit structure is adapted to mode of dispersal
- Some modes of seed dispersal:
 - Wind currents
 - Water currents
 - Animals

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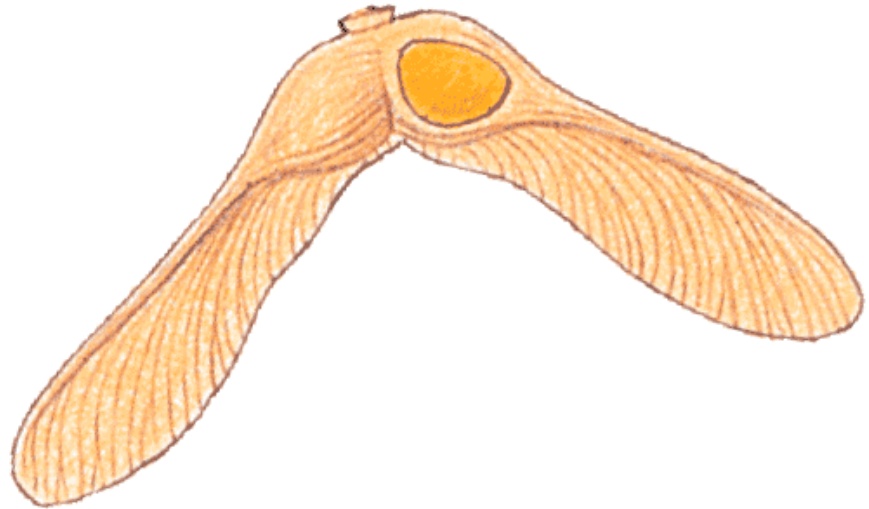


Table 31.1 Three Ways To Classify Fruits

How did the fruit originate?

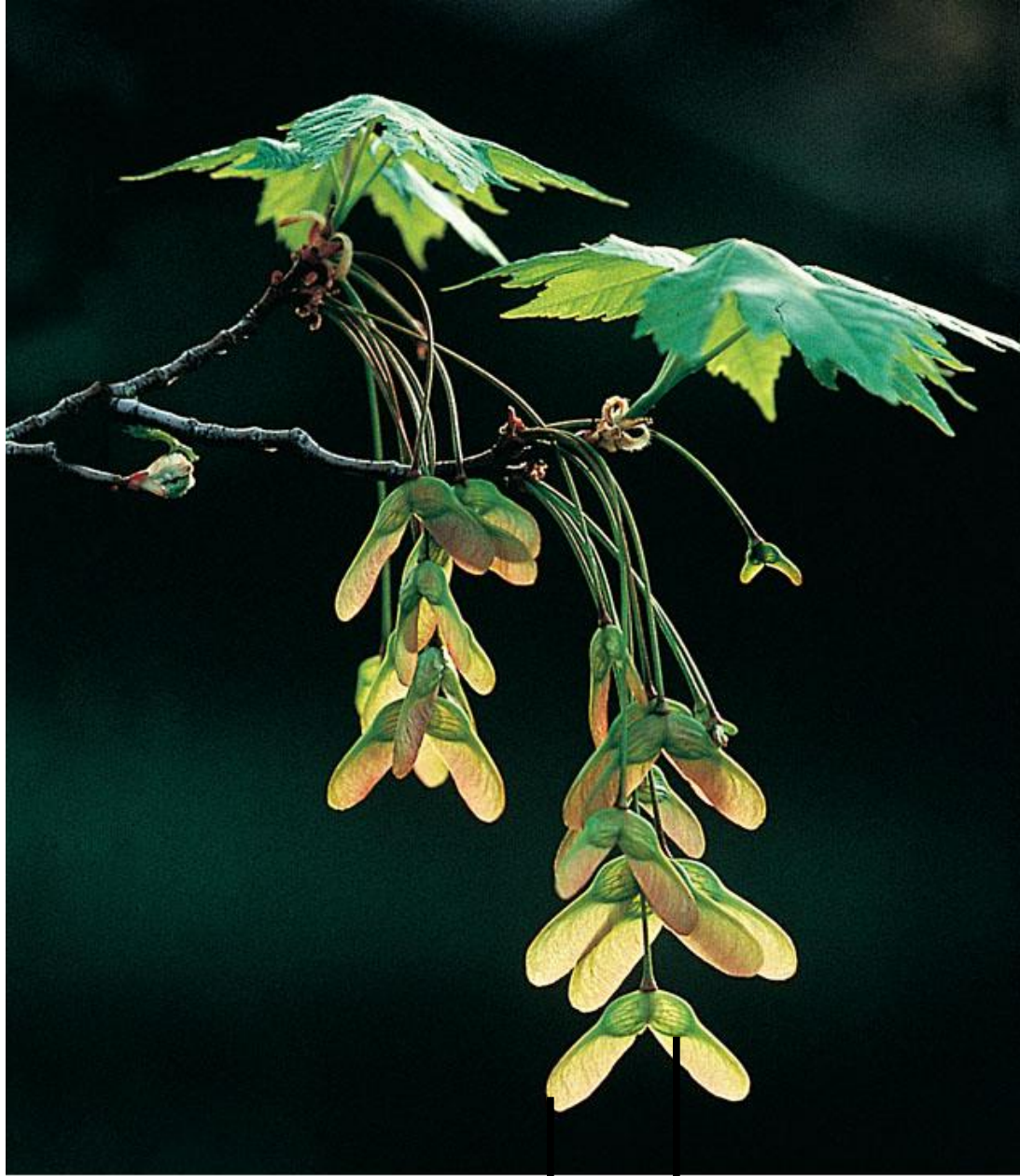
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|--------------------|--|
| 1. Simple fruit | One flower, single or fused carpels |
| 2. Aggregate fruit | One flower, several unfused carpels; becomes cluster of several fruits |
| 3. Multiple fruit | Cluster of individually pollinated flowers that grow and fuse together |

What is the fruit's tissue composition?

- | | |
|--------------------|---|
| 1. True fruit | Only ovarian wall and its contents |
| 2. Accessory fruit | Ovary as well as other floral parts, such as the receptacle |

Is the fruit dry or fleshy?

- | | |
|----------------|---|
| 1. Dry: | |
| a. Dehiscent | Dry fruit wall splits on definite seam to release seeds |
| b. Indehiscent | Seeds dispersed from the parent plant inside intact, dry fruit wall |
| 2. Fleshy: | |
| a. Drupe | Fleshy fruit around hard pit with one (usually) seed inside |
| b. Berry | Fleshy fruit, no pit, one to many seeds |
| | Pepo: Hard rind on ovary wall |
| | Hesperidium: Leathery rind on ovary wall |
| c. Pome | Fleshy accessory tissues, seeds in elastic core |



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wing

seed (in carpel)

Fig. 31-12a, p.534

Asexual Reproduction

- New roots or shoots grow from extensions or fragments of existing plants
- Proceeds by way of mitosis
- All offspring are genetically identical (unless mutation occurs)



Table 31.2 Asexual Reproductive Modes of Flowering Plants

Mechanism	Examples	Characteristics
Vegetative Reproduction on Modified Stems		
1. Runner	Strawberry	New plants arise at nodes along aboveground horizontal stems.
2. Rhizome	Bermuda grass	New plants arise at nodes of underground horizontal stems.
3. Corm	Gladiolus	New plants arise from axillary buds on short, carbohydrate-storing, underground stems.
4. Tuber	Potato	New shoots arise from axillary buds (tubers are enlarged tips of slender underground rhizomes).
5. Bulb	Onion, lily	New bulbs arise from axillary buds on short underground stems.
Parthenogenesis		
	Orange, rose	Embryo develops without nuclear or cellular fusion (for example, from an unfertilized haploid egg or by developing adventitiously, from tissue surrounding the embryo sac).
Vegetative Propagation		
	Jade plant, African violet	New plant develops from tissue or structure (a leaf, for instance) that drops from the parent plant or gets separated from it.
Tissue Culture Propagation		
	Orchid, lily, wheat, rice, corn, tulip	New plant induced to arise from a parent plant cell that is not irreversibly differentiated.