

The Plant Kingdom: Seed Plants

Chapter 28

Learning Objective 1

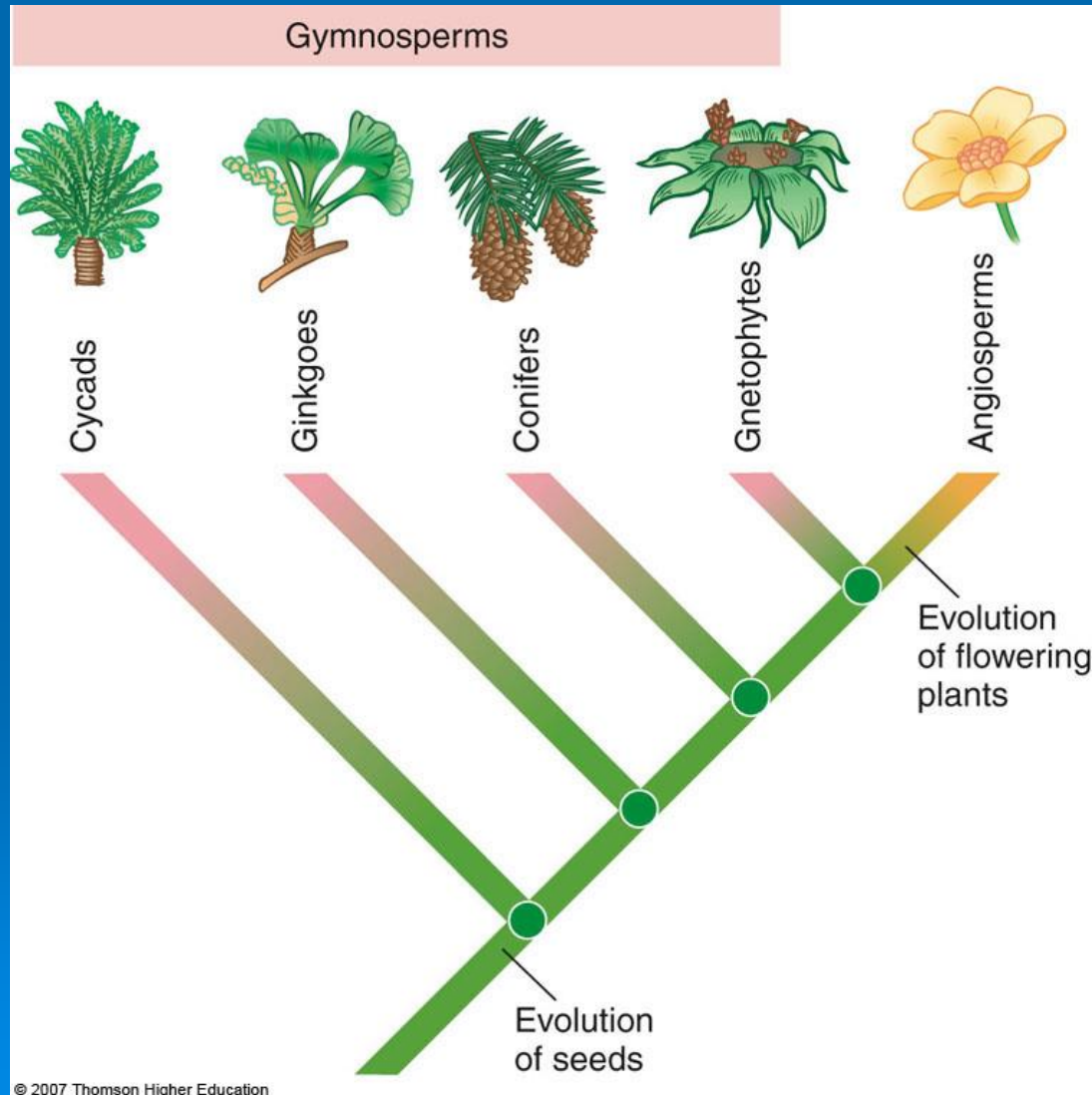
- Compare the features of **gymnosperms** and **angiosperms**



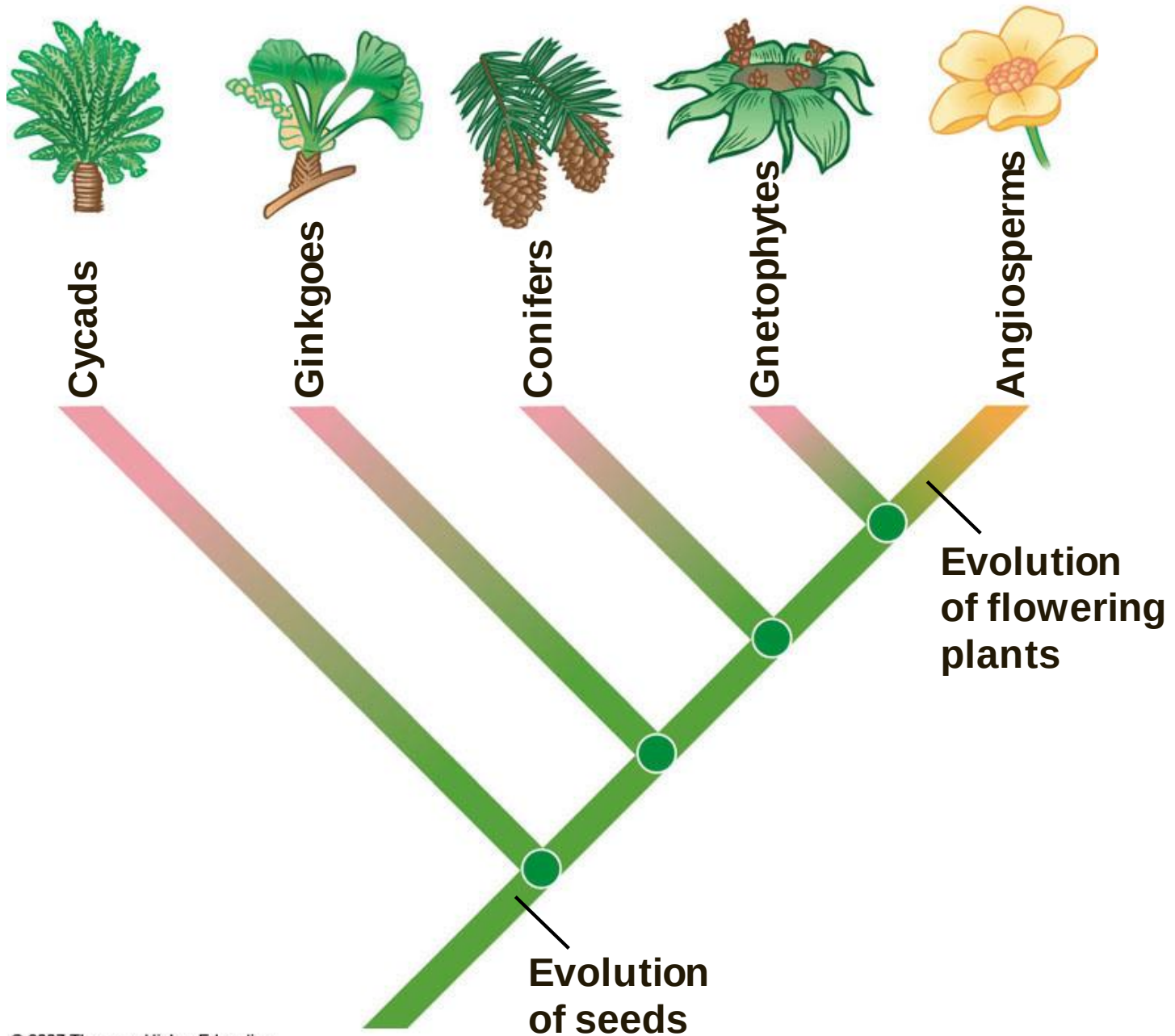
Two Groups of Seed Plants

- **Gymnosperms**
 - seeds are totally exposed or borne on the scales of cone
 - ovary wall does not surround the ovules
- **Angiosperms**
 - flowering plants
 - produce seeds within a fruit (a mature ovary)

Gymnosperm and Angiosperm Evolution



Gymnosperms



KEY CONCEPTS

- *Seed plants include gymnosperms and angiosperms*

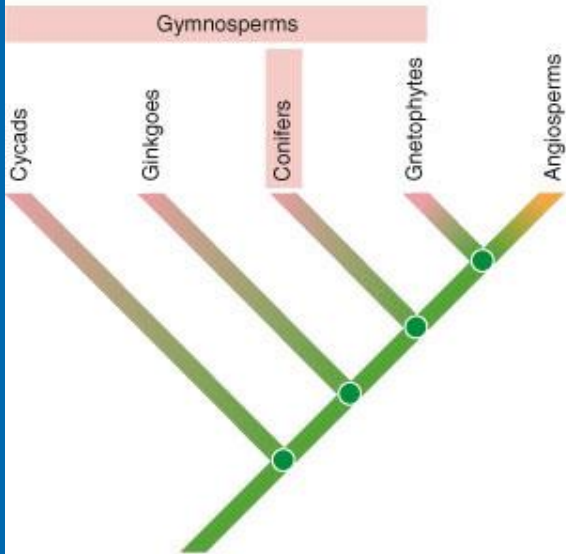


Learning Objective 2

- Trace the steps in the life cycle of a pine
- Compare its sporophyte and gametophyte generations



Conifers



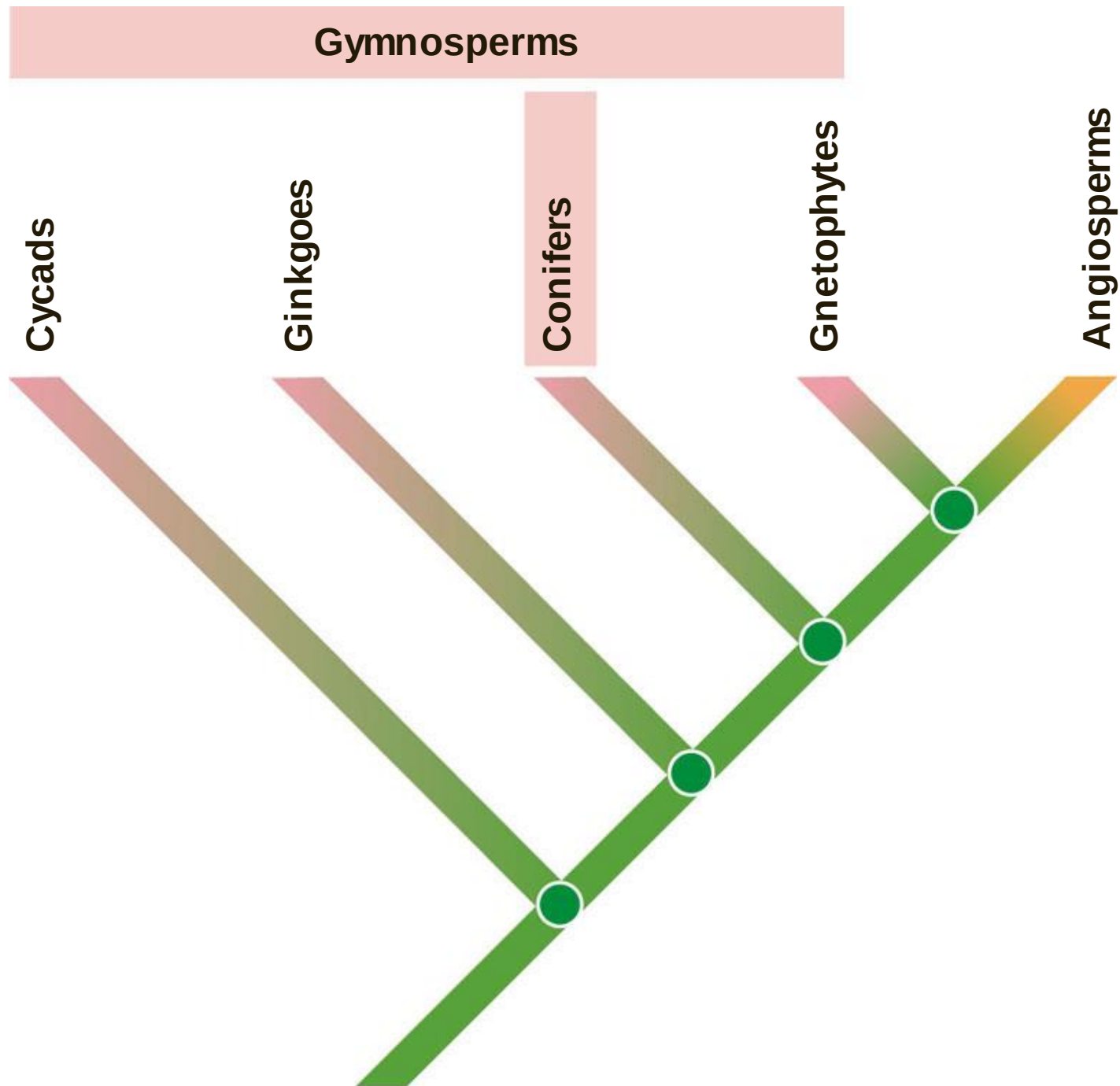
(a)



(b)



(c)





(a)



(b)



(c)

Pine Life Cycle 1

- Pine tree
 - a mature sporophyte
- Pine gametophytes
 - extremely small
 - nutritionally dependent on sporophyte generation



Pine Life Cycle 2

- Pine is heterosporous
 - produces microspores and megaspores in separate cones
- Male cones produce **microspores** that develop into **pollen grains** (immature male gametophytes)
 - carried by air currents to female cones



Pine Life Cycle 3

- Female cones produce megaspores
- One of each four megaspores (meiosis) develops into a female gametophyte
 - within an ovule (megasporangium)

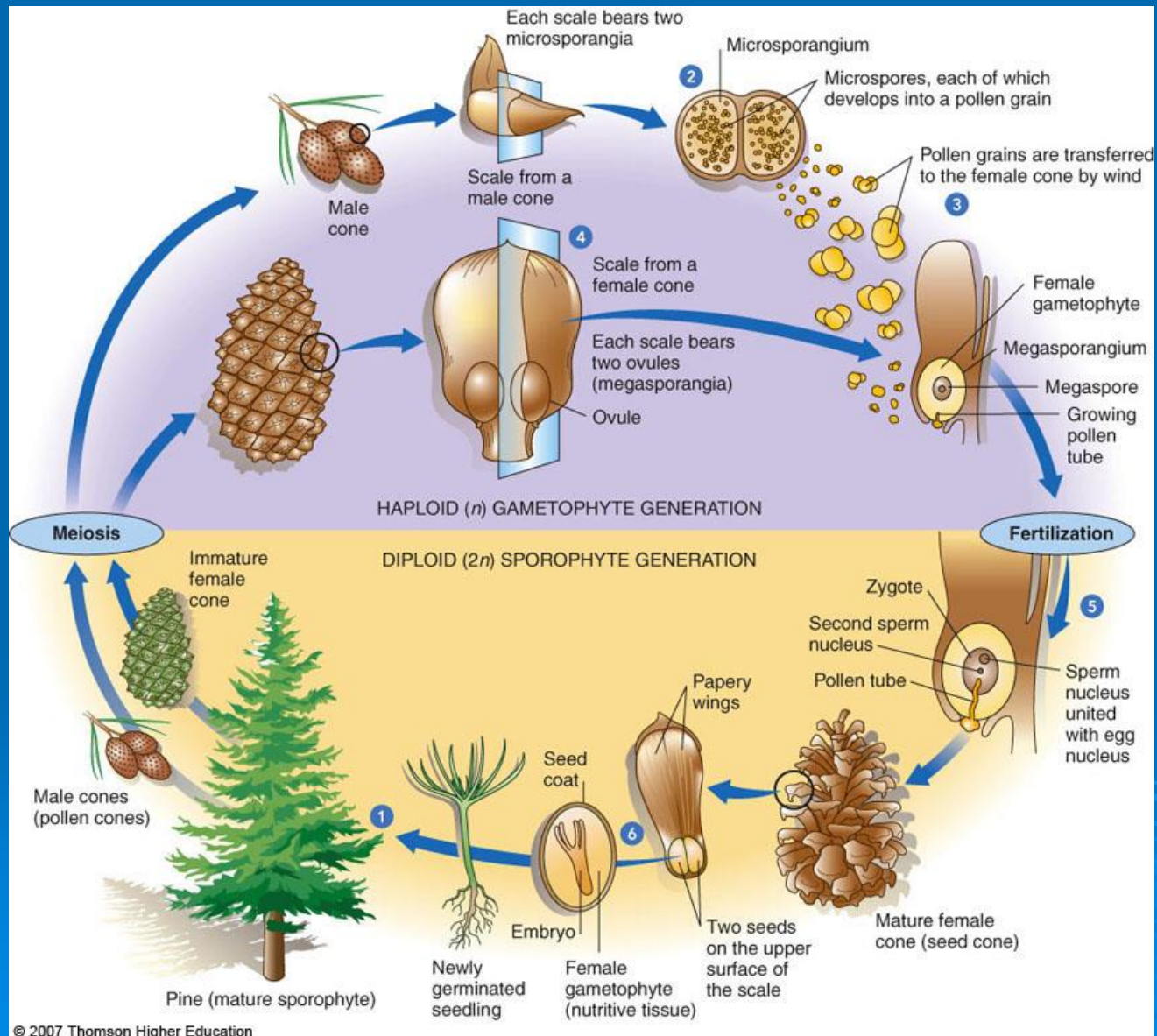


Pine Life Cycle 4

- Pollination
 - transfer of pollen to female cones
- Pollen tube
 - grows through megasporangium to egg within archegonium
- After fertilization
 - zygote develops into embryo encased inside seed adapted for wind dispersal



Pine Life Cycle



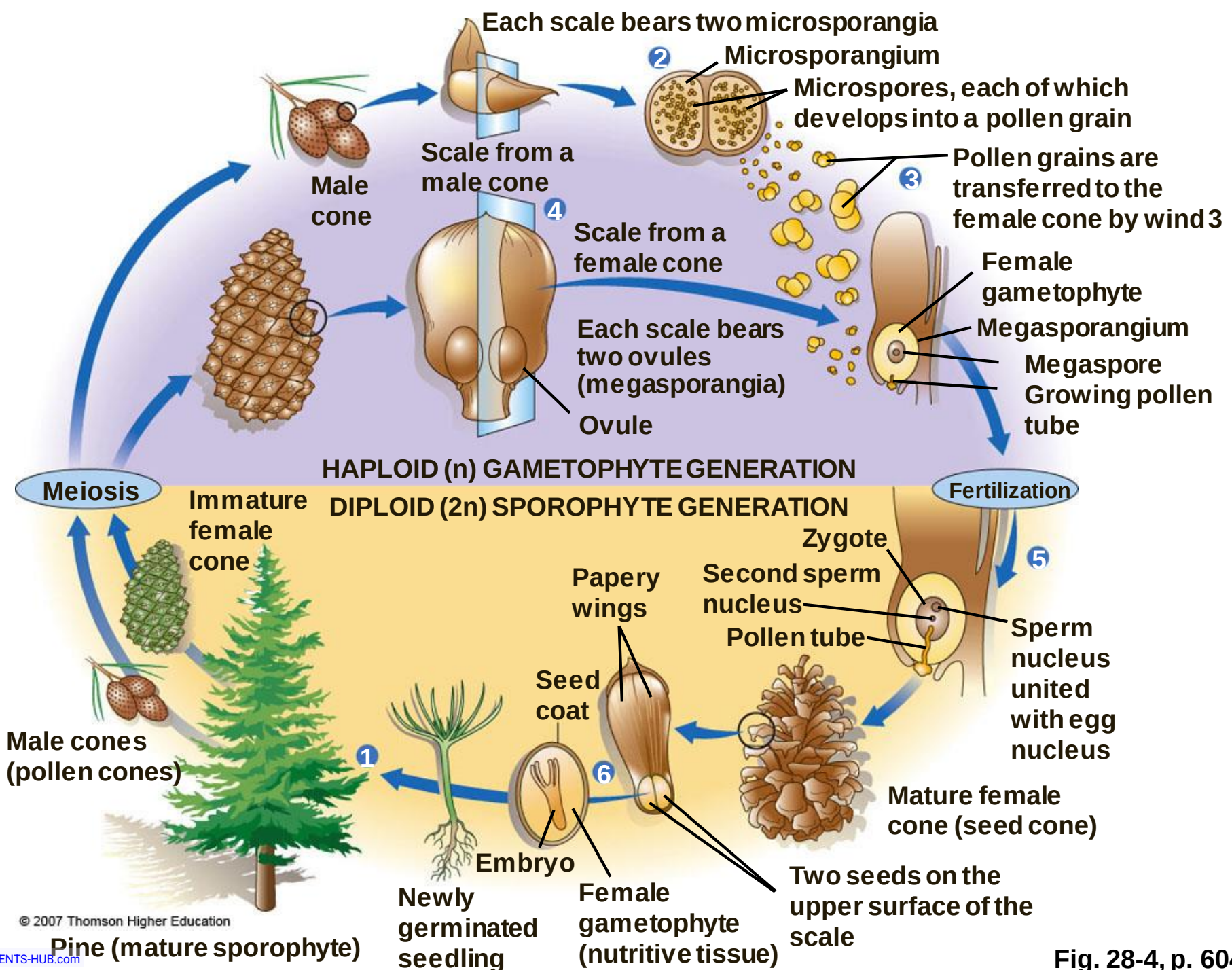


Fig. 28-4, p. 604

Learning Objective 3

- What features distinguish gymnosperms from bryophytes and ferns?



Gymnosperms

- Are vascular plants
 - unlike bryophytes
- Produce seeds
 - unlike bryophytes and ferns
- Produce wind-borne pollen grains
 - unlike ferns and other seedless vascular plants

KEY CONCEPTS

- *Gymnosperms produce exposed seeds, usually in cones borne on the sporophytes*



Learning Objective 4

- What are the four phyla of **gymnosperms**?



Conifers (Phylum Coniferophyta)

- Largest phylum of gymnosperms
- Woody plants that bear **needles** (leaves that are usually evergreen)
 - produce seeds in cones
- Most are **monoecious**
 - have male and female reproductive parts in separate cones on same plant



Male and Female Cones



© 2007 Thomson Higher Education

KEY CONCEPTS

- *Conifers are the most diverse and numerous of the four living gymnosperm phyla*

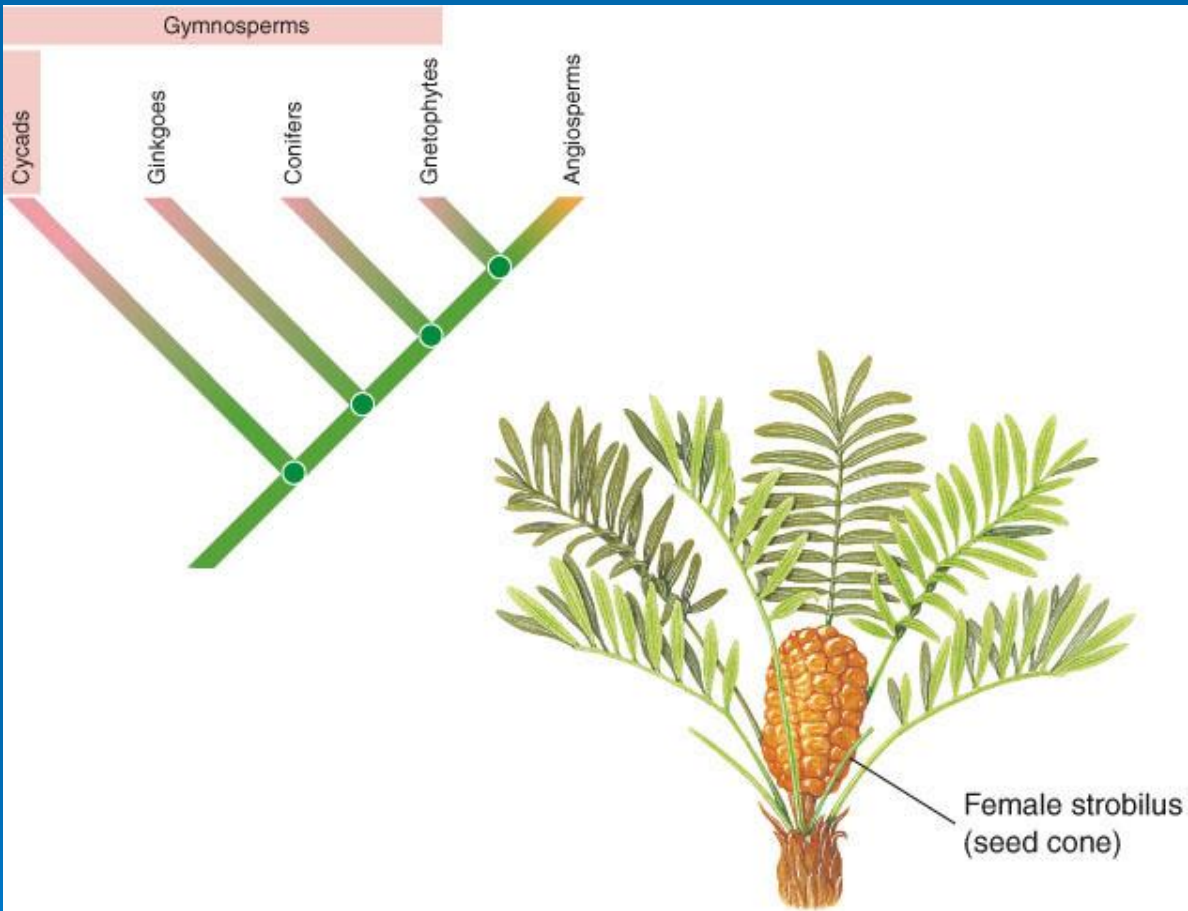


Cycads (Phylum Cycadophyta)

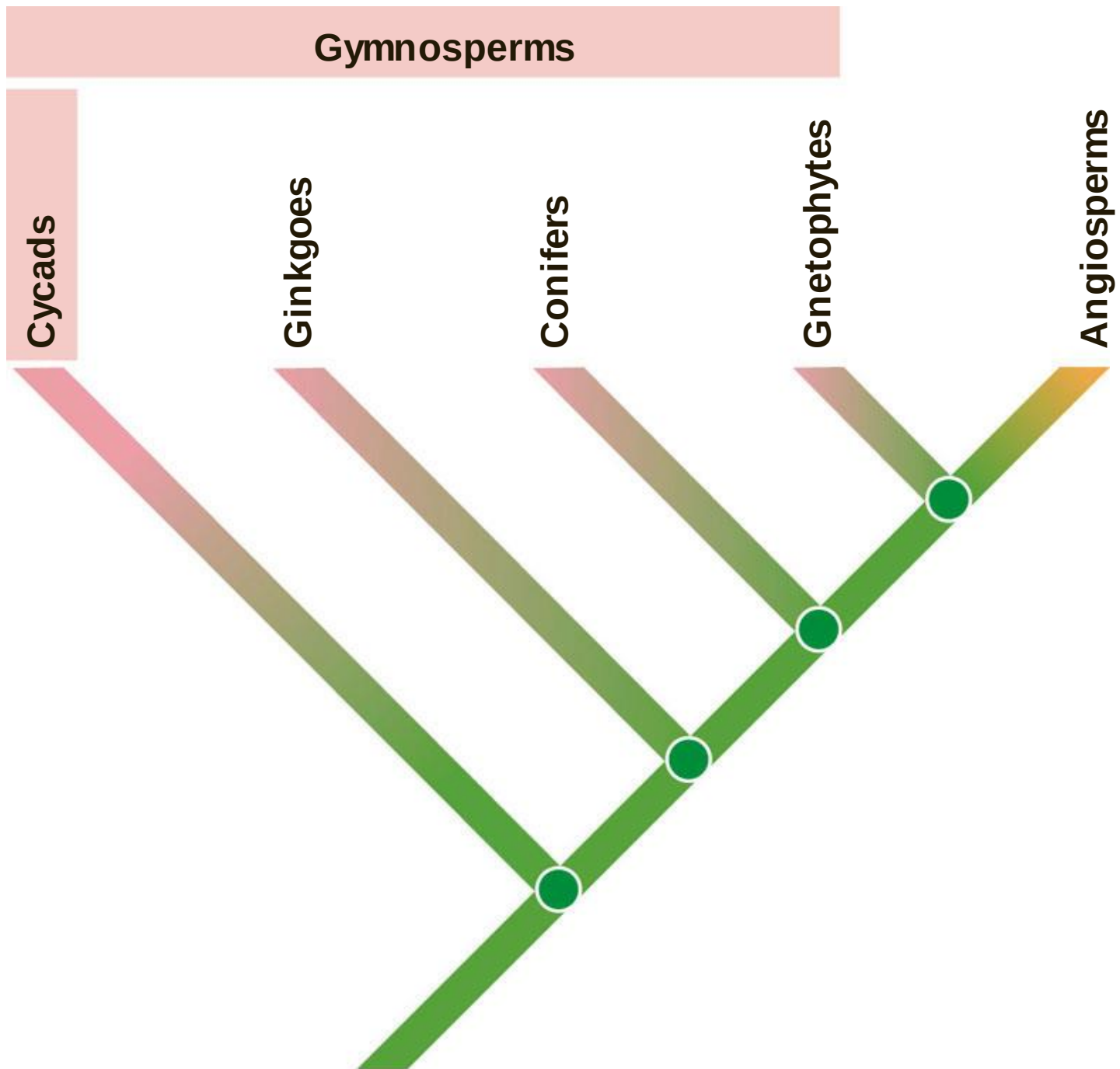
- Palmlike or fernlike in appearance
- Are **dioecious**
 - have male and female reproductive structures on separate plants
 - but reproduce with pollen and seeds in conelike structures

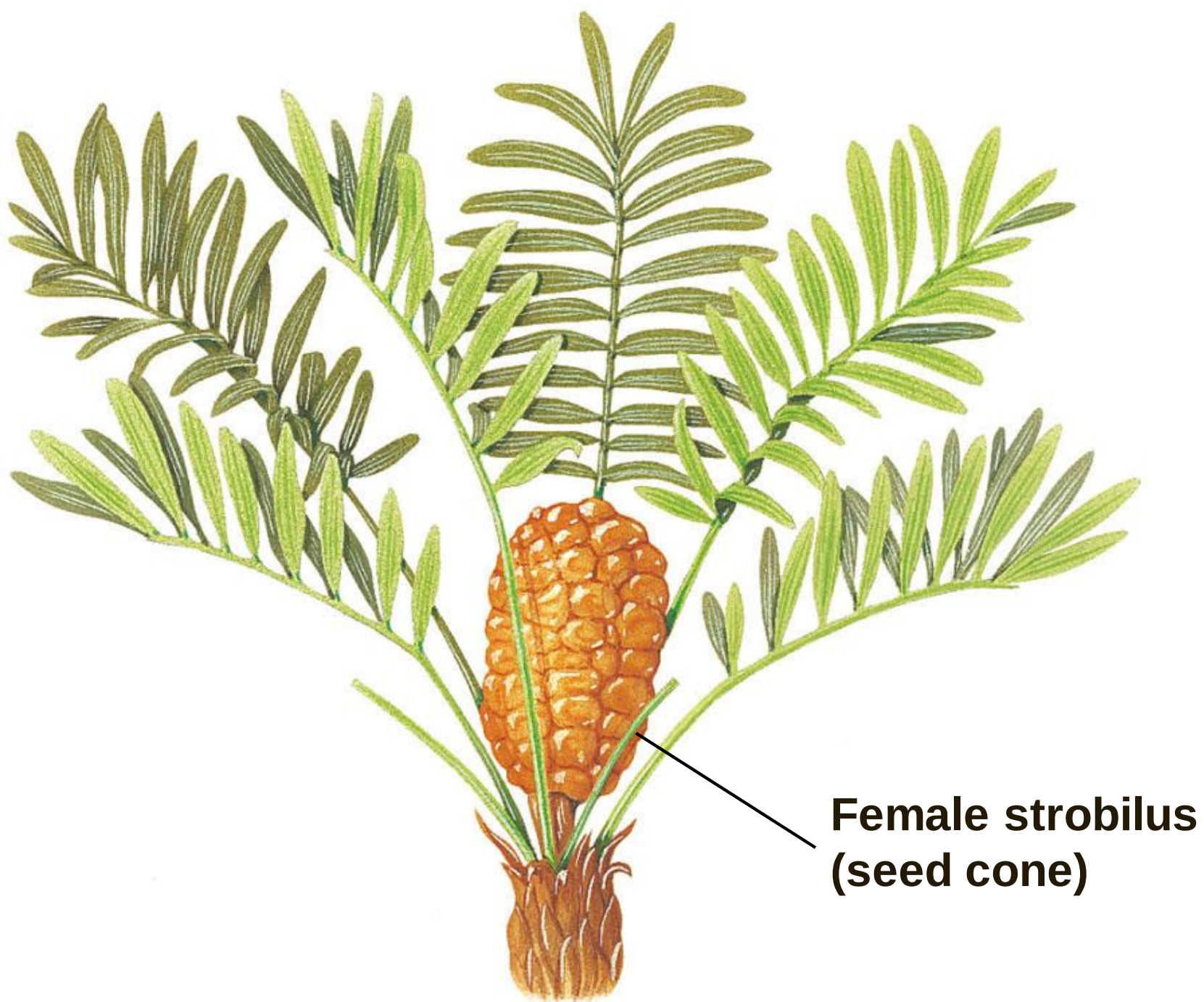


Cycads

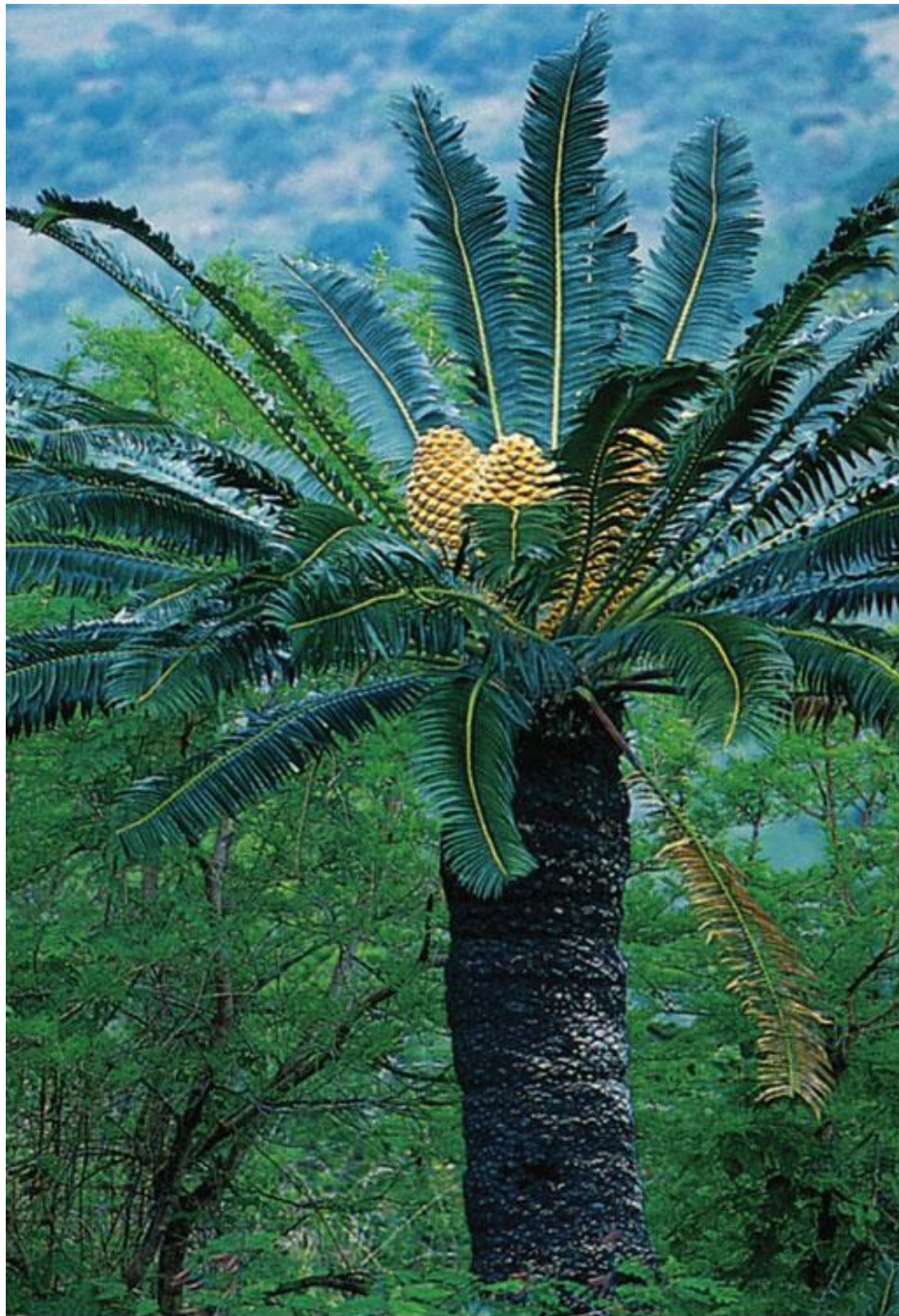


© 2007 Thomson Higher Education





**Female strobilus
(seed cone)**



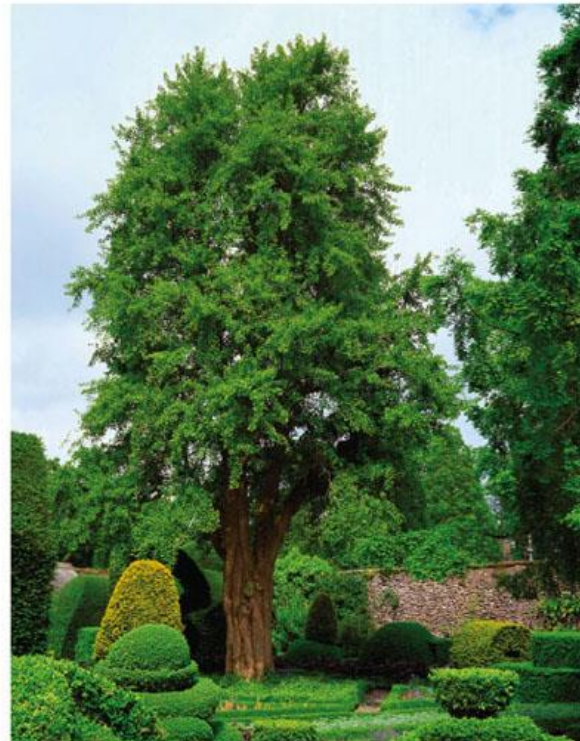
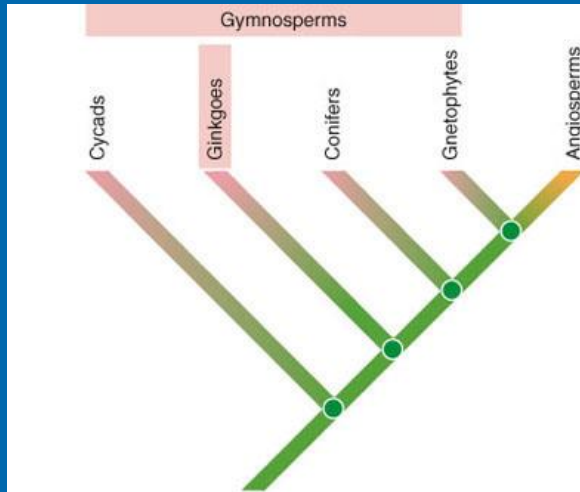
© 2007 Thomson Higher Education

Fig. 28-6b, p. 605

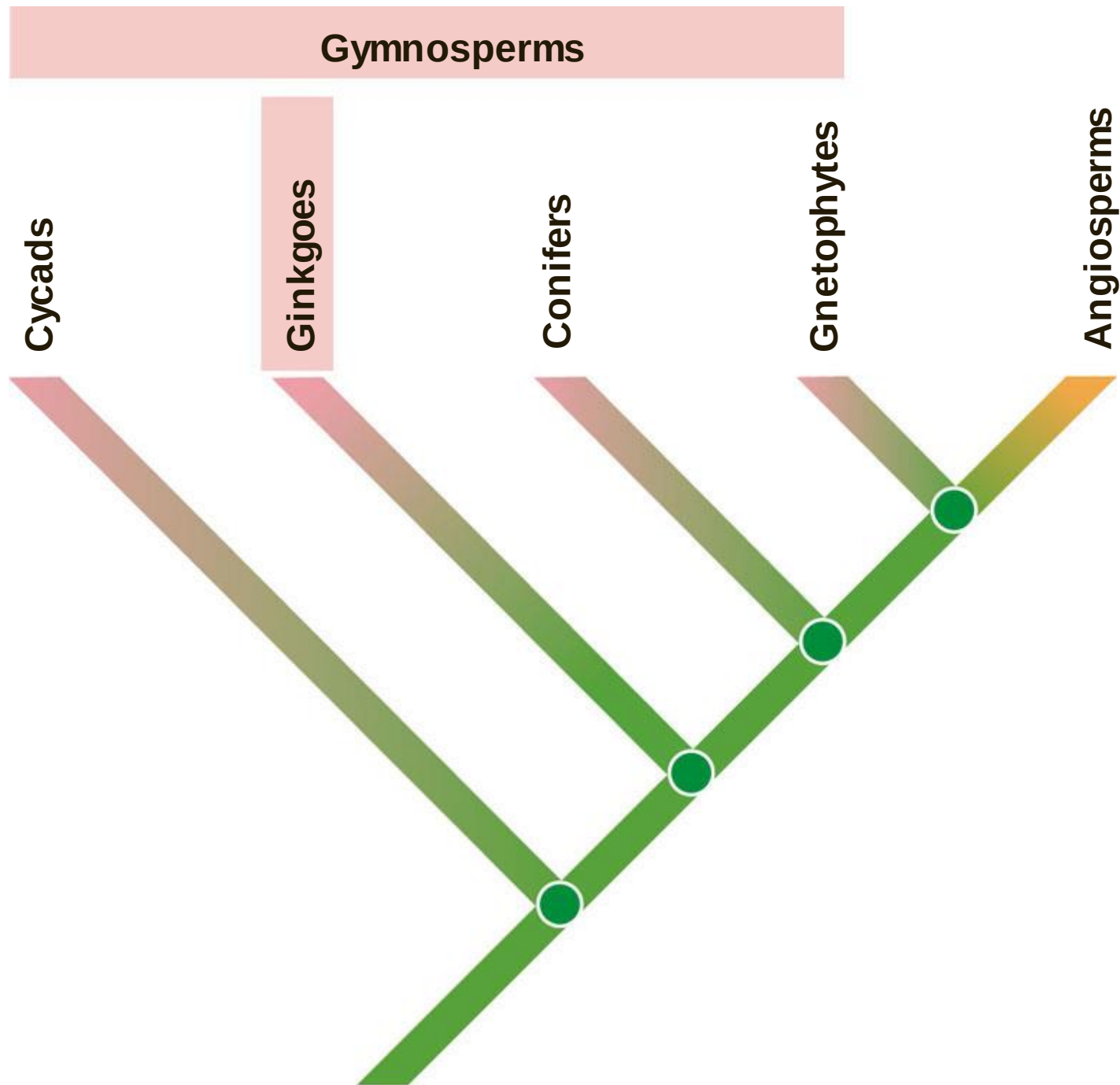
Phylum Ginkgophyta

- *Ginkgo biloba*
 - only surviving species in phylum
 - deciduous, dioecious tree
- Female **ginkgo** produces fleshy seeds directly on branches

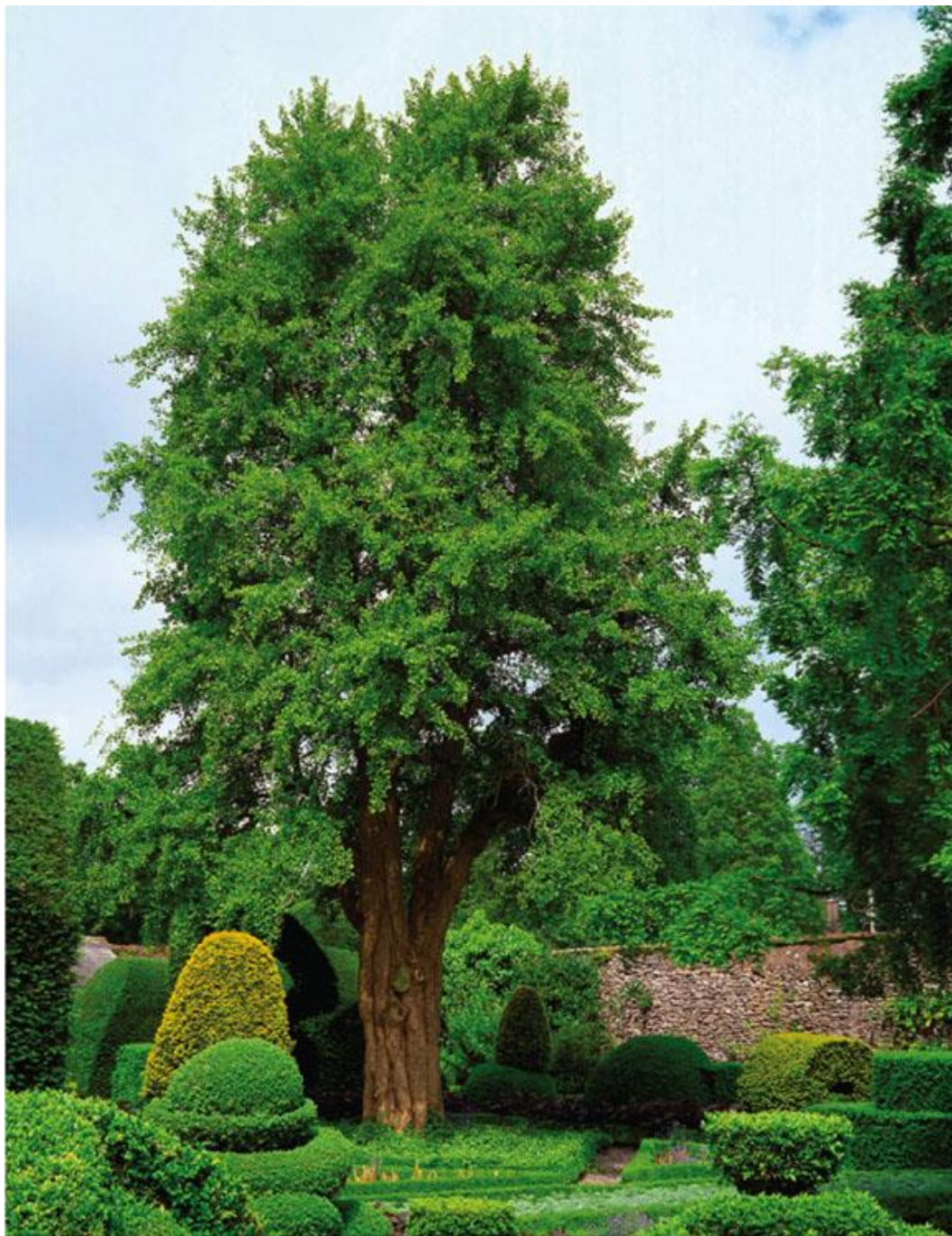
Ginkgo



© 2007 Thomson Higher Education







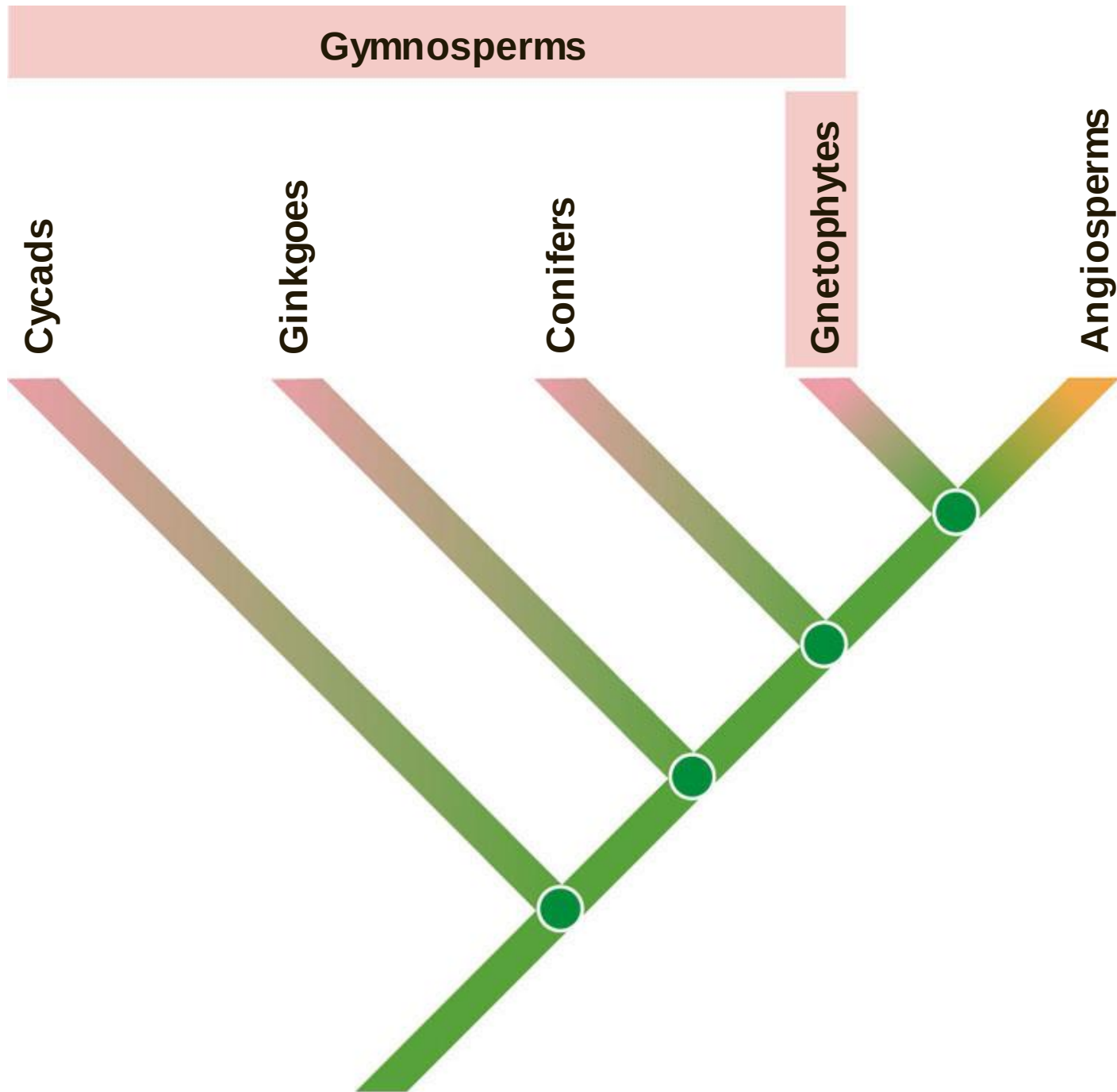
© 2007 Thomson Higher Education

Fig. 28-7b, p. 606

Gnetophytes (Phylum Gnetophyta)

- Share some traits with angiosperms





Gnetophytes



© 2007 Thomson Higher Education



© 2007 Thomson Higher Education



© 2007 Thomson Higher Education

Learning Objective 5

- What features distinguish flowering plants from other plants?

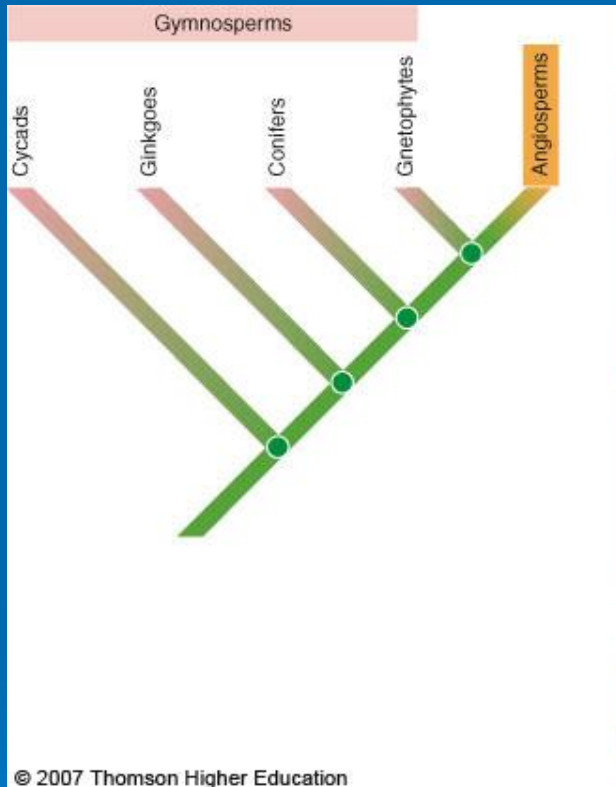


Flowering Plants

- Angiosperms (phylum Anthophyta)
- Vascular plants that produce flowers and seeds enclosed within a **fruit**
- Most diverse and successful plant group



Flowering Plants



Flowering Plants

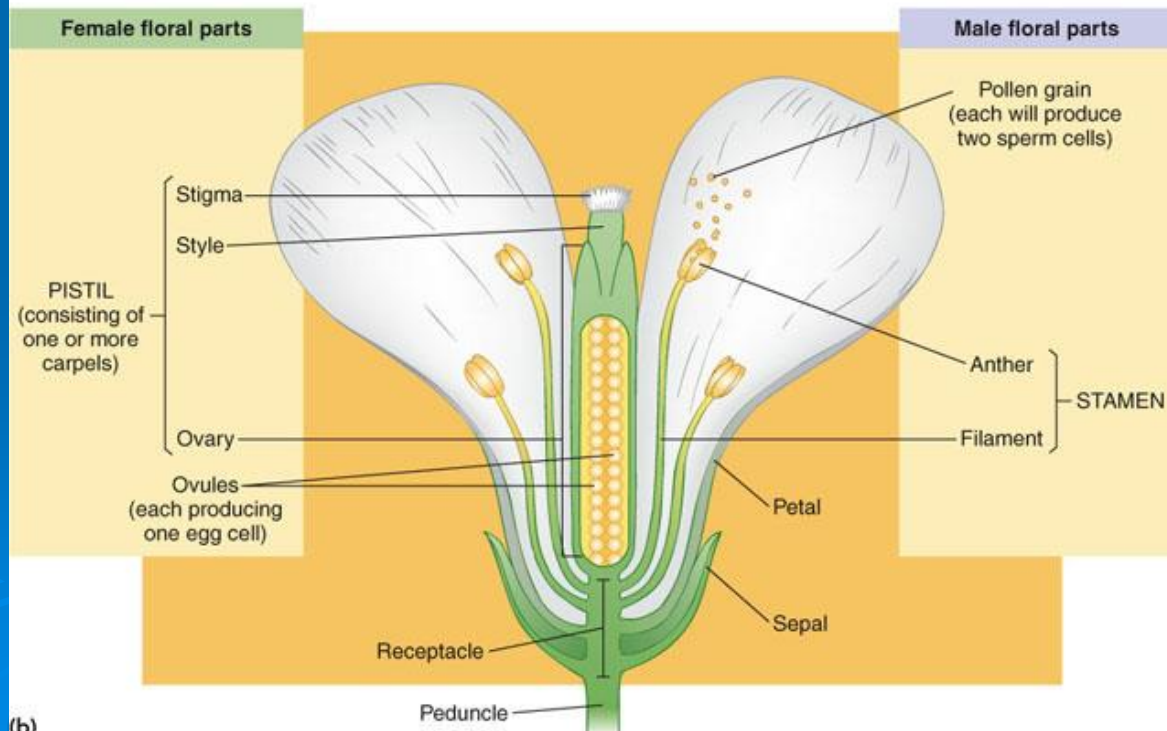
- Flower
 - sepals, petals, stamens, carpels
 - functions in sexual reproduction
- Ovules enclosed within ovary
 - unlike gymnosperms
- After fertilization
 - ovules become seeds
 - ovary develops into fruit



Floral Structure



(a)

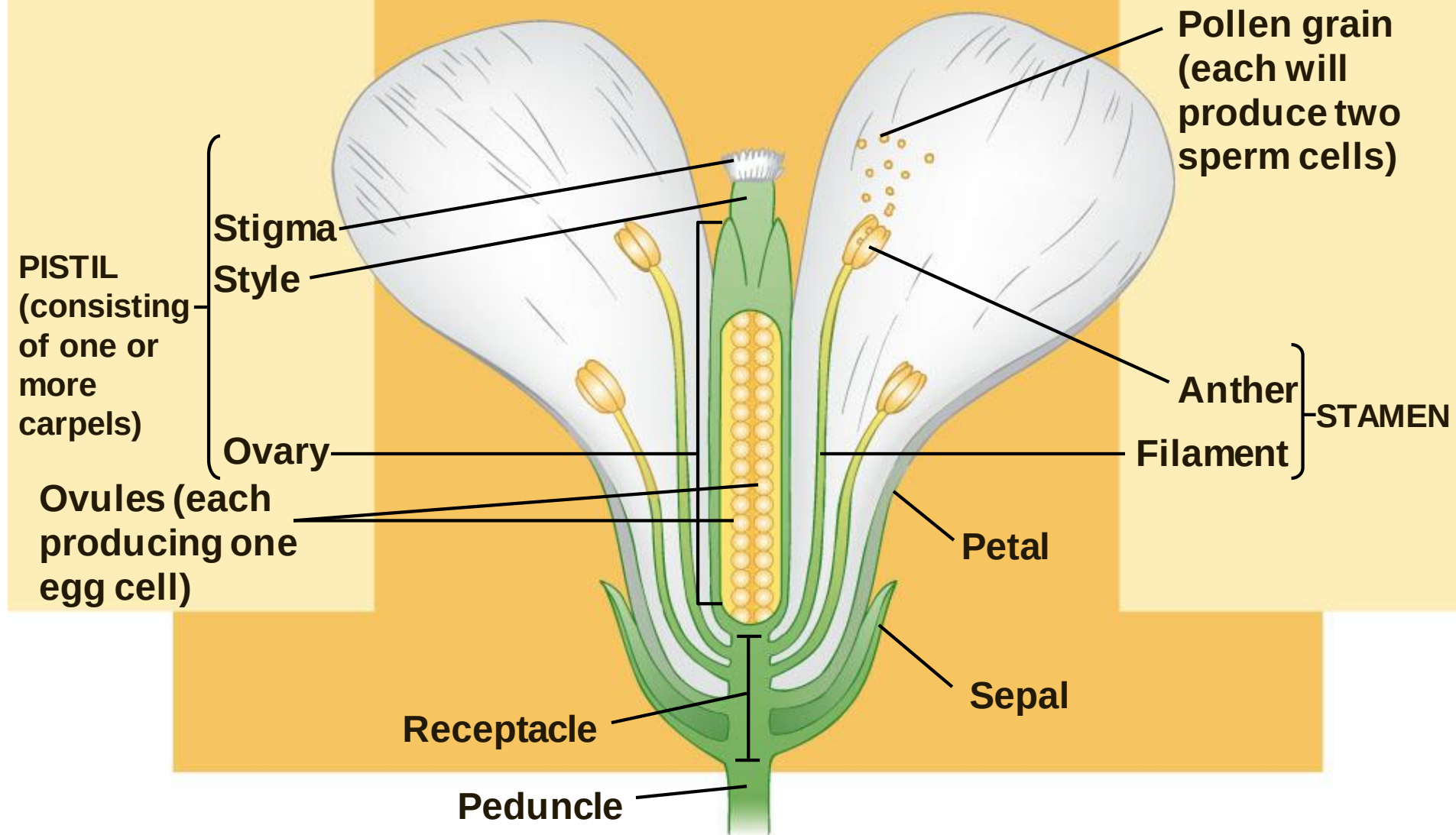


(b)

© 2007 Thomson Higher Education

Female floral parts

Male floral parts

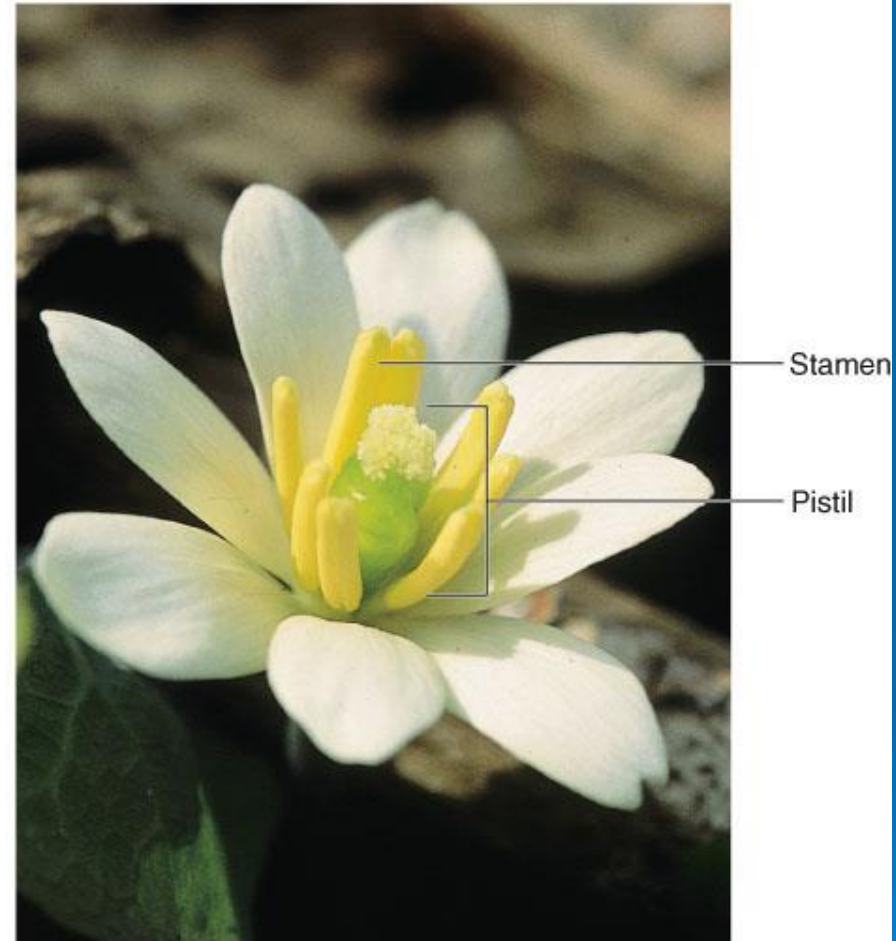


© 2007 Thomson Higher Education

STUDENTS-HUB.com

Fig. 28-10b, p. 609

Parts of a Flower



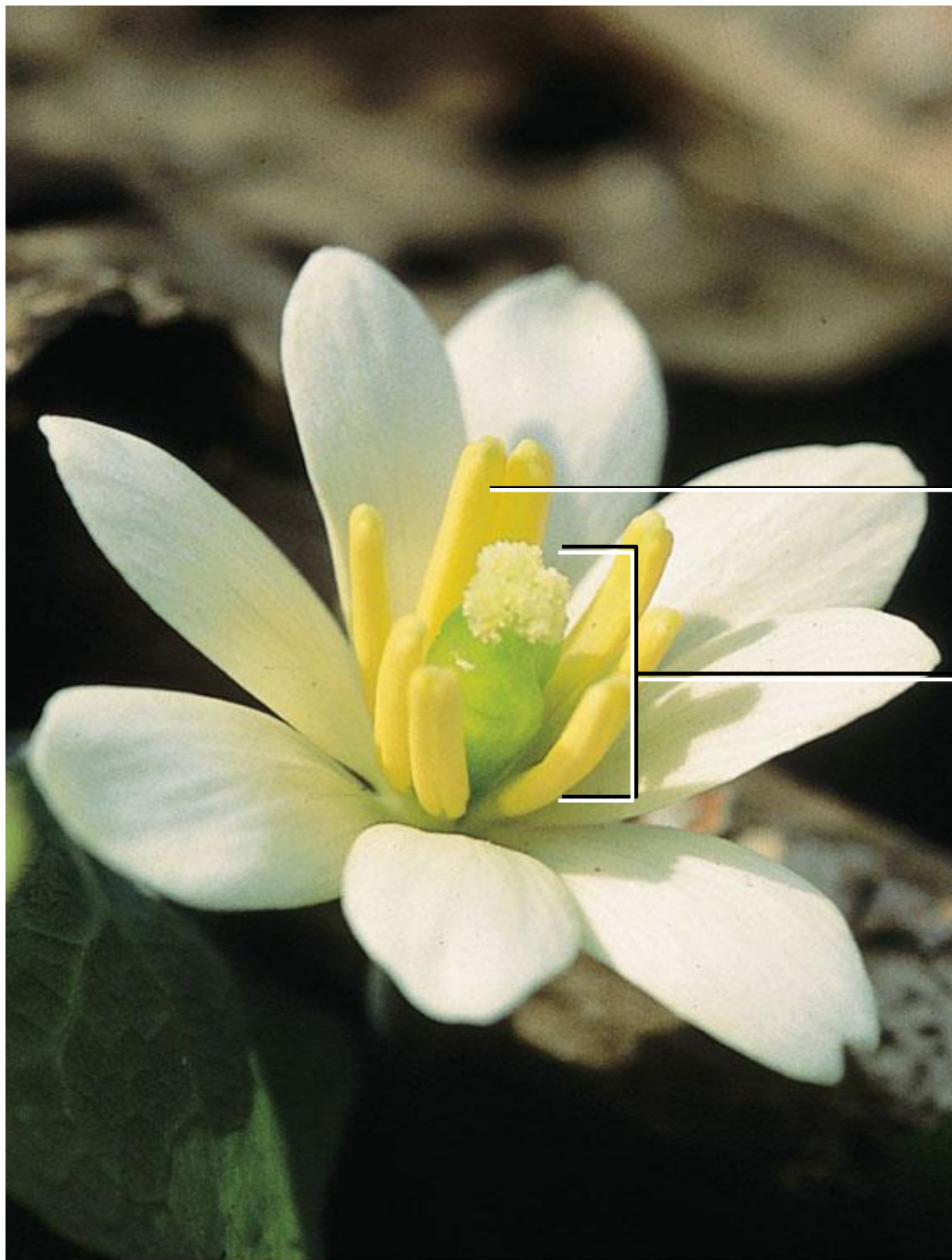
© 2007 Thomson Higher Education

Petals

Sepals



© 2007 Thomson Higher Education

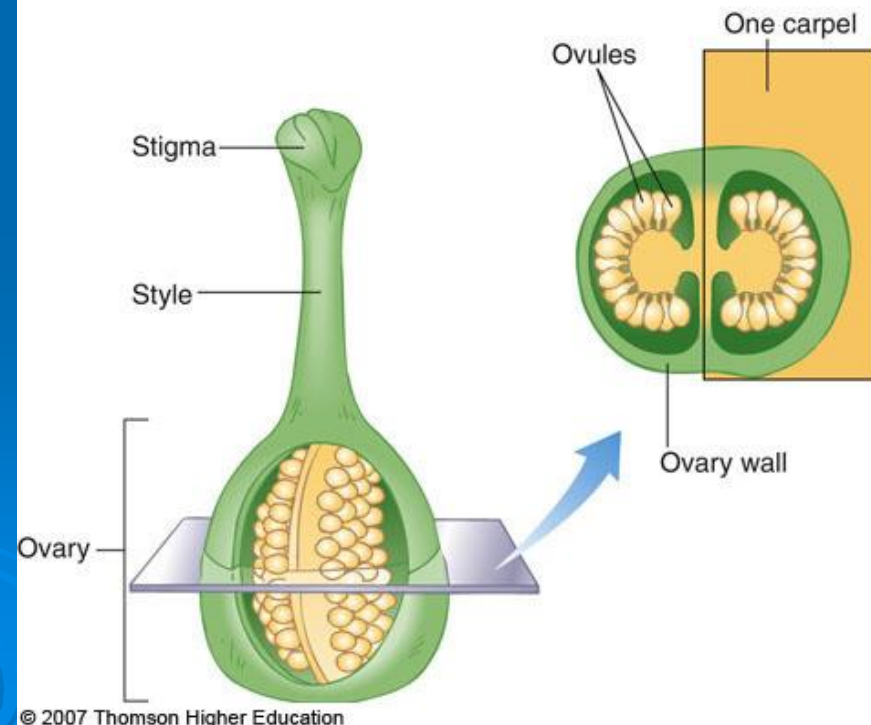
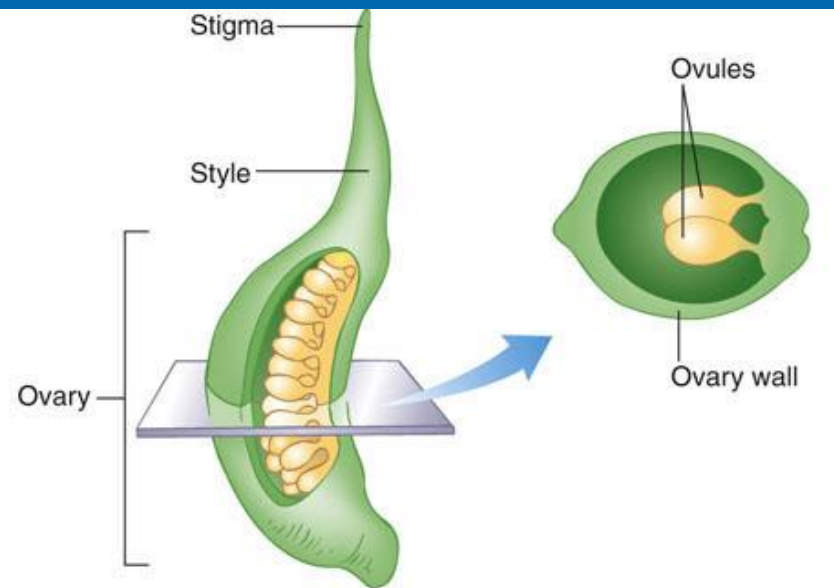


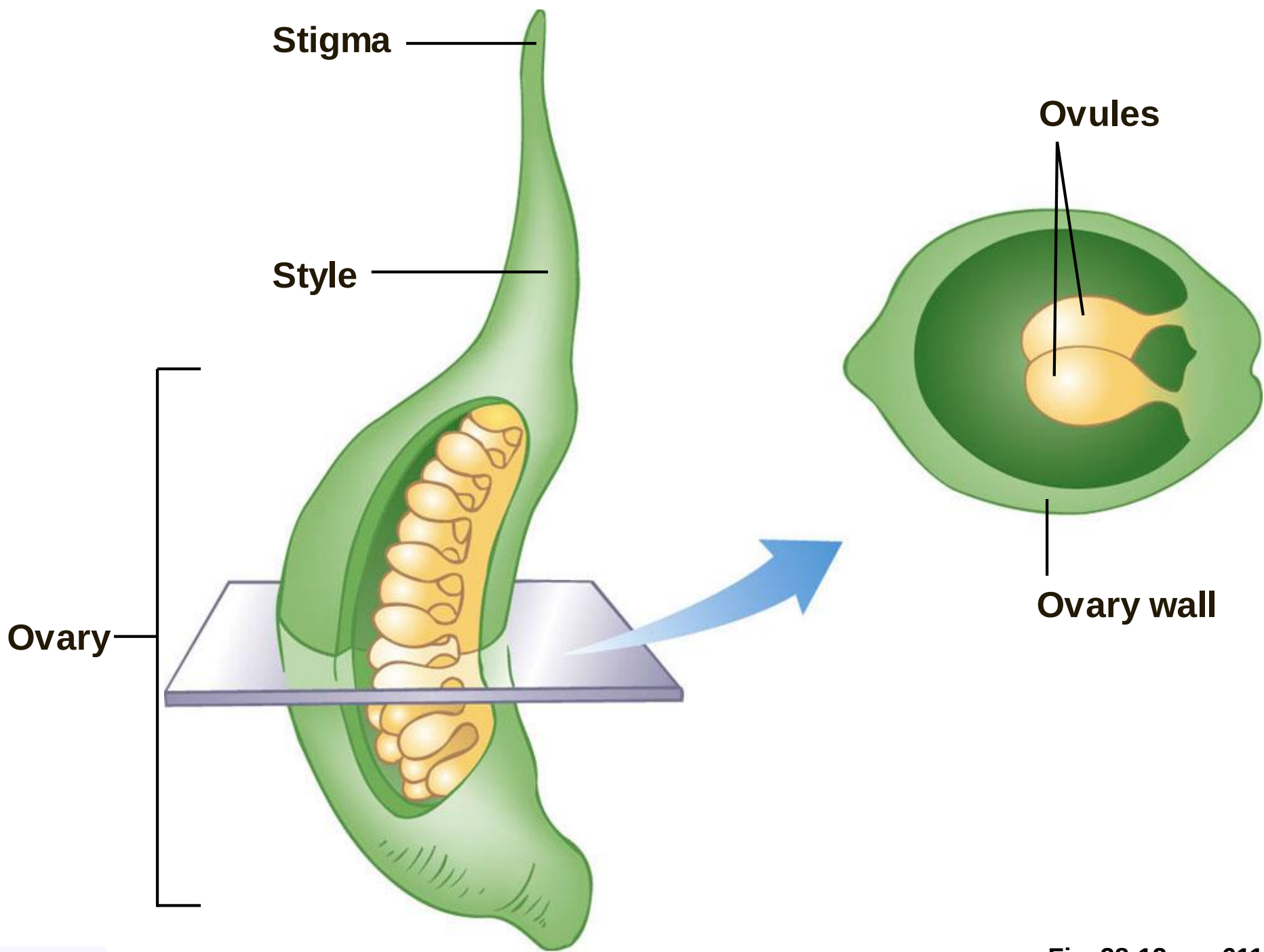
Stamen

Pistil

Fig. 28-11b, p. 610

Simple and Compound Pistils





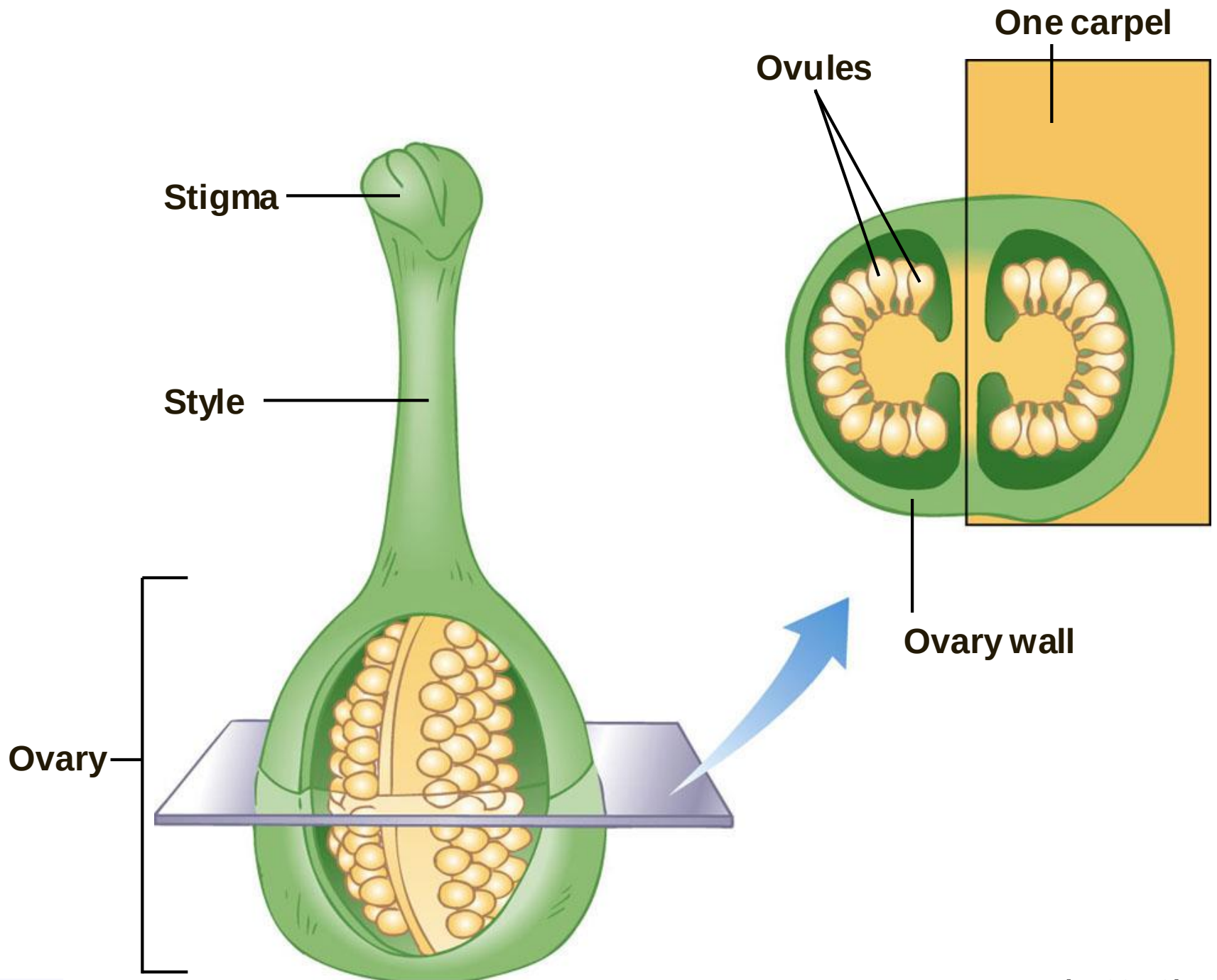


Fig. 28-12b, p. 611

KEY CONCEPTS

- *Angiosperms produce ovules enclosed within carpels; following fertilization, seeds develop from the ovules, and the ovaries of carpels become fruits*



Learning Objective 6

- Explain the life cycle of a flowering plant
- Describe double fertilization



Flowering Plant Life Cycle 1

- Sporophyte generation dominant
- Gametophytes extremely reduced in size
 - nutritionally dependent on sporophyte generation
- Heterosporous
 - produce microspores, megaspores in flower



Flowering Plant Life Cycle 2

- **Microspore** develops into a pollen grain (immature male gametophyte)
- One of each four **megaspores** (meiosis) develops into **embryo sac** (female gametophyte)

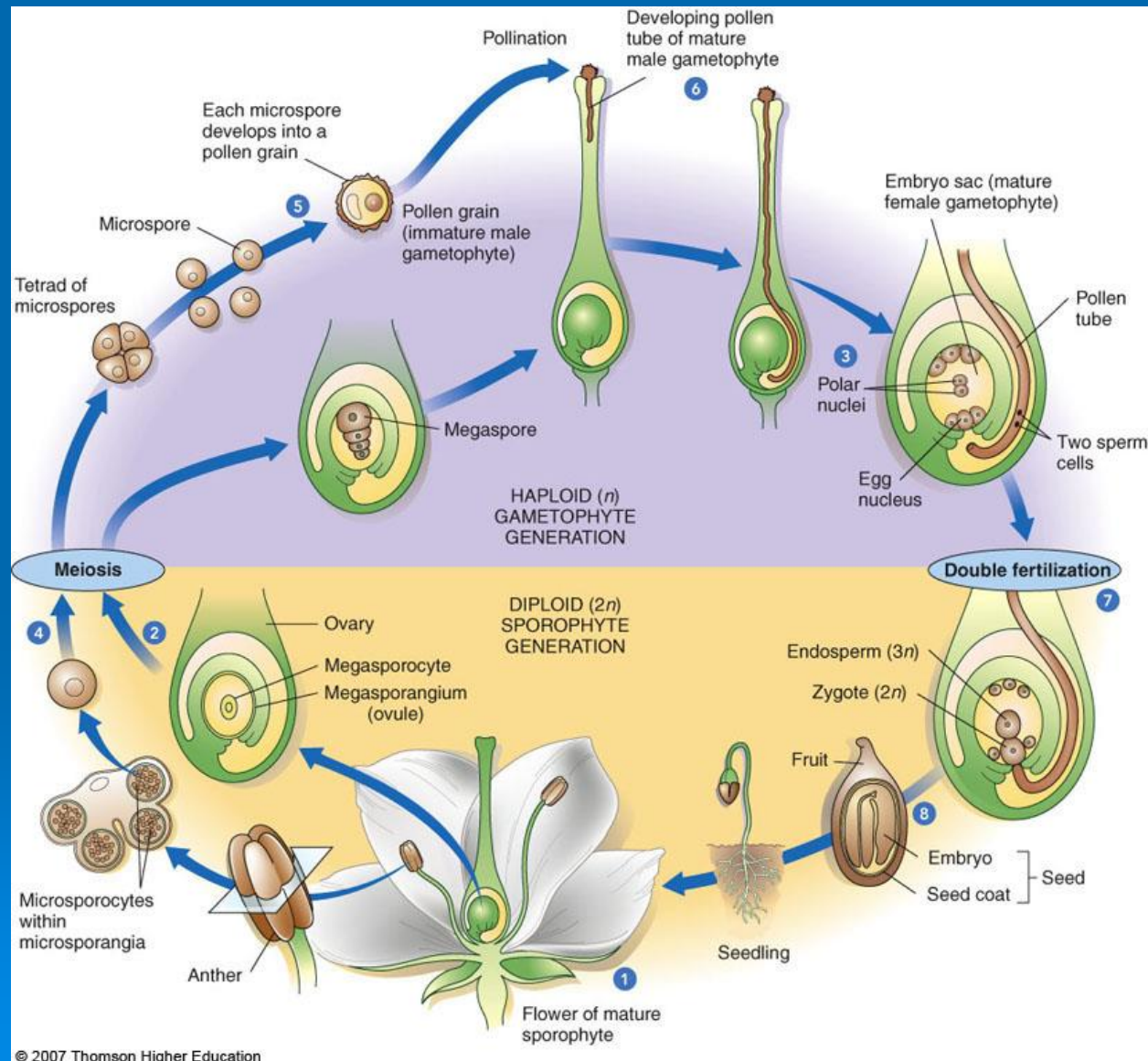


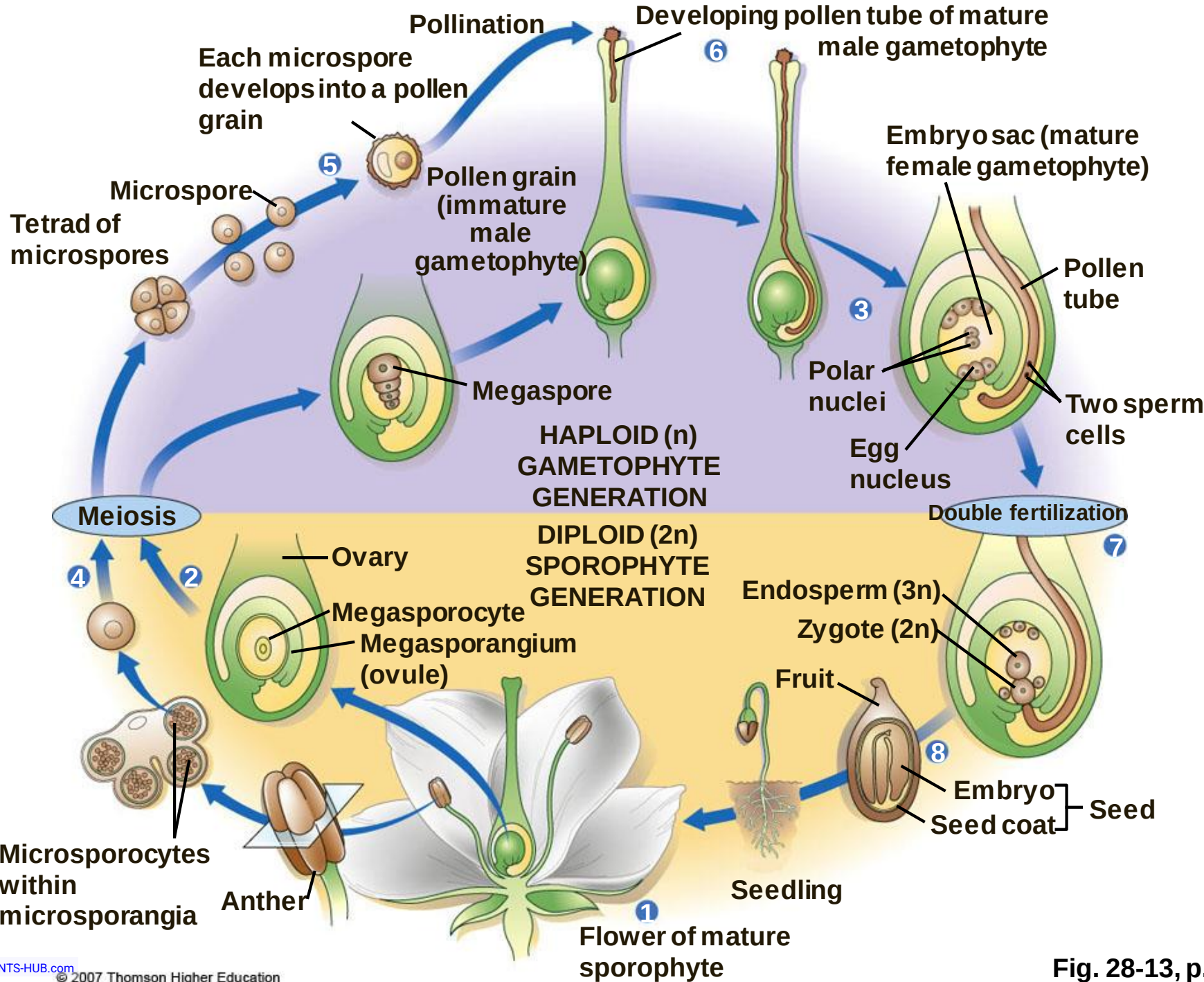
Flowering Plant Life Cycle 3

- Embryo sac contains seven cells with eight nuclei
- Egg cell and central cell with two polar nuclei participate in fertilization



Flowering Plant Life Cycle





Double Fertilization

- Characteristic of flowering plants
- Results in formation of
 - diploid zygote
 - triploid endosperm



Learning Objective 7

- Contrast **eudicots** and **monocots**, the two largest classes of flowering plants



Monocots (Class Monocotyledones)

- Most have floral parts in threes
- Seeds each contain **1 cotyledon**
- **Endosperm**
 - nutritive tissue in mature seeds



Eudicots (Class Eudicotyledones)

- Usually have floral parts in fours or fives
 - or multiples thereof
- Seeds each contain 2 cotyledons
- Cotyledons
 - nutritive organs in mature seeds
 - absorbed nutrients in endosperm

Monocot and Eudicot



Learning Objective 8

- What are the evolutionary adaptations of flowering plants?



Reproduction

- Flowering plants reproduce sexually by forming **flowers**
- After **double fertilization**, seeds form within **fruits**
- Wind, water, insects, animals transfer pollen grains

Structures

- Efficient water-conducting vessel elements in xylem
- Efficient carbohydrate-conducting sieve tube elements in phloem



KEY CONCEPTS

- *Angiosperms, which compose a single phylum, dominate the land and exhibit great diversity in both vegetative and reproductive structures*

Learning Objective 9

- Summarize the evolution of gymnosperms from seedless vascular plants
- Trace the evolution of flowering plants from gymnosperms



Evolution 1

- Seed plants arose from seedless vascular plants
- Progymnosperms
 - seedless vascular plants
 - had megaphylls and “modern” woody tissue
 - probably gave rise to conifers and seed ferns

- Progymnosperm

- Seed Fern



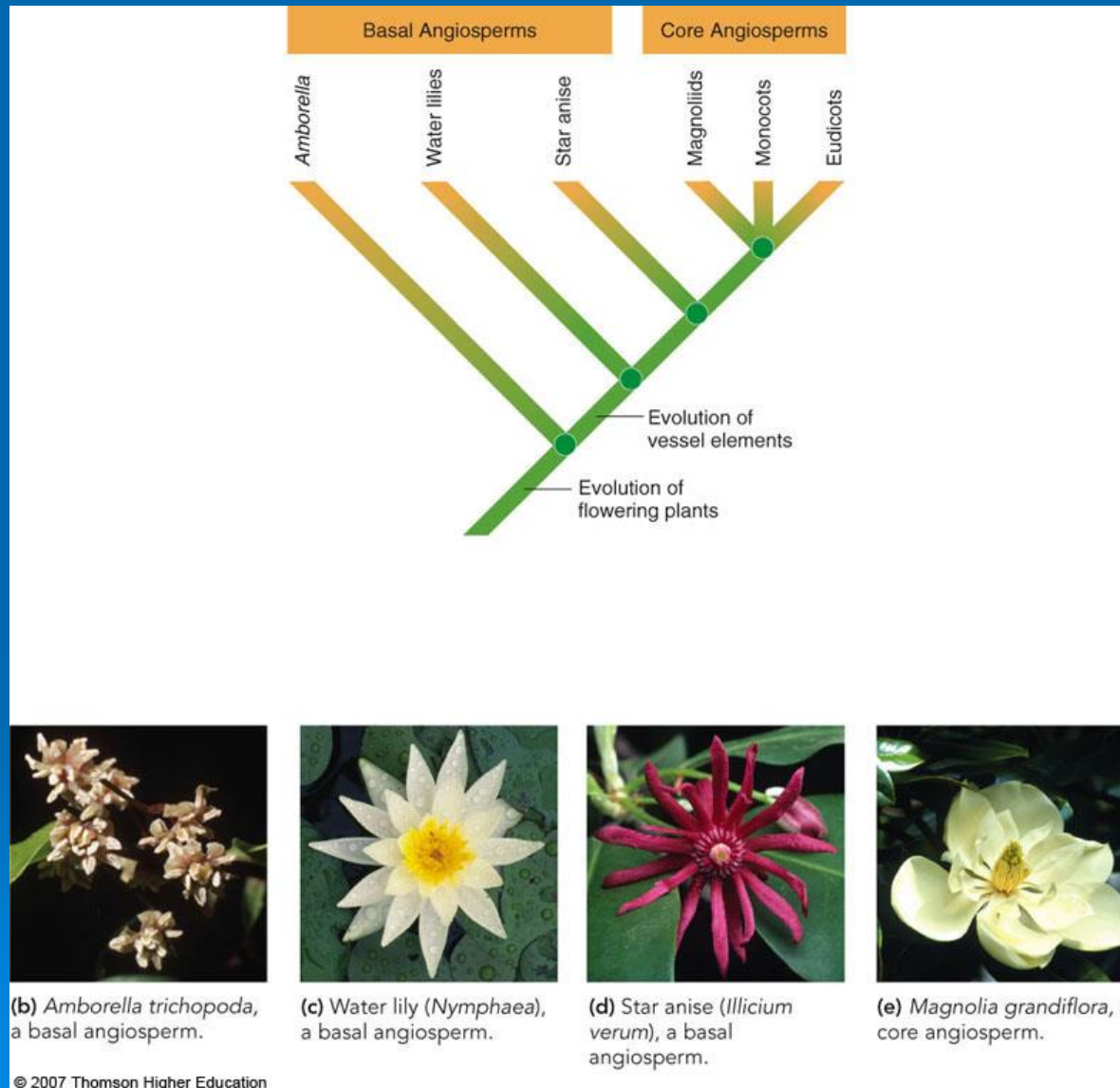
© 2007 Thomson Higher Education

Evolution 3

- **Flowering plants** probably descended from gymnosperms with specialized features
 - leaves with broad, expanded blades
 - closed carpels
- **Flowering plants** likely arose only once



Evolution of Flowering Plants



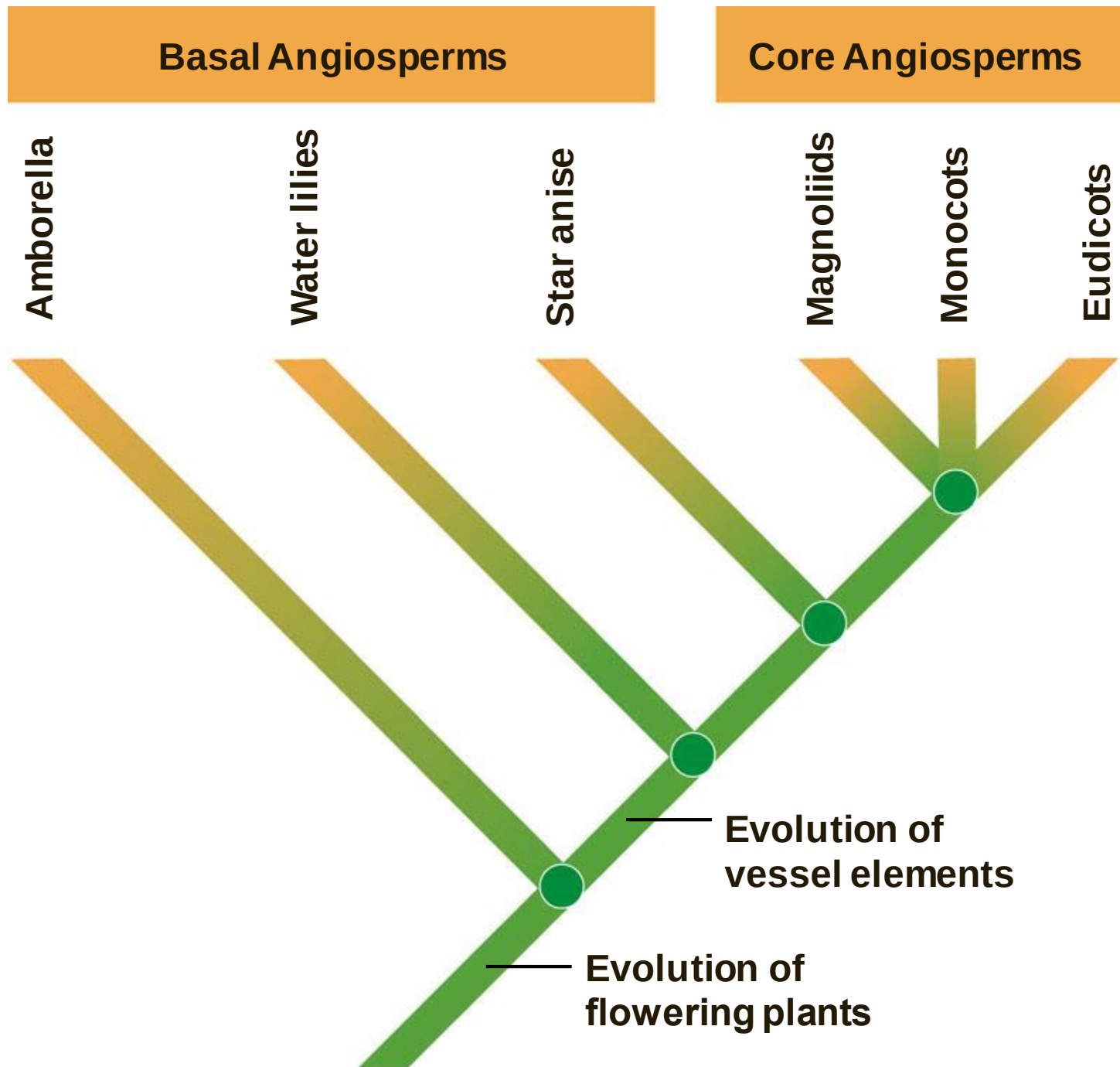


Fig. 28-19a, p. 616

KEY CONCEPTS

- *Gymnosperms and angiosperms evolved from ancestral seedless vascular plants*

