# The Hidden Life of Truffles

Not just for gourmands, truffles play an essential role in the health of ecosystems

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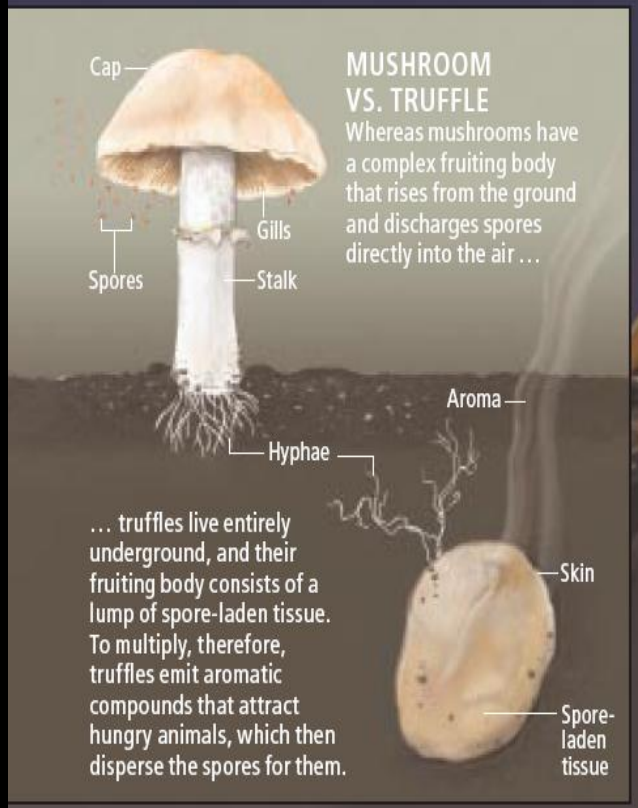
[ECOLOGICAL SIGNIFICANCE]

# Fundamental Fungus

Truffles figure importantly in many ecosystems, benefiting both plants and animals. In the forests of the Pacific Northwest, for example, *Rhizopogon* truffles help Douglas fir trees to obtain the water and nutrients they need. They also serve as a key source of food for the northern flying squirrel, which in turn is a favorite prey species of the endangered northern spotted owl. Protecting the owl's habitat, then, requires ensuring conditions favorable to truffles.



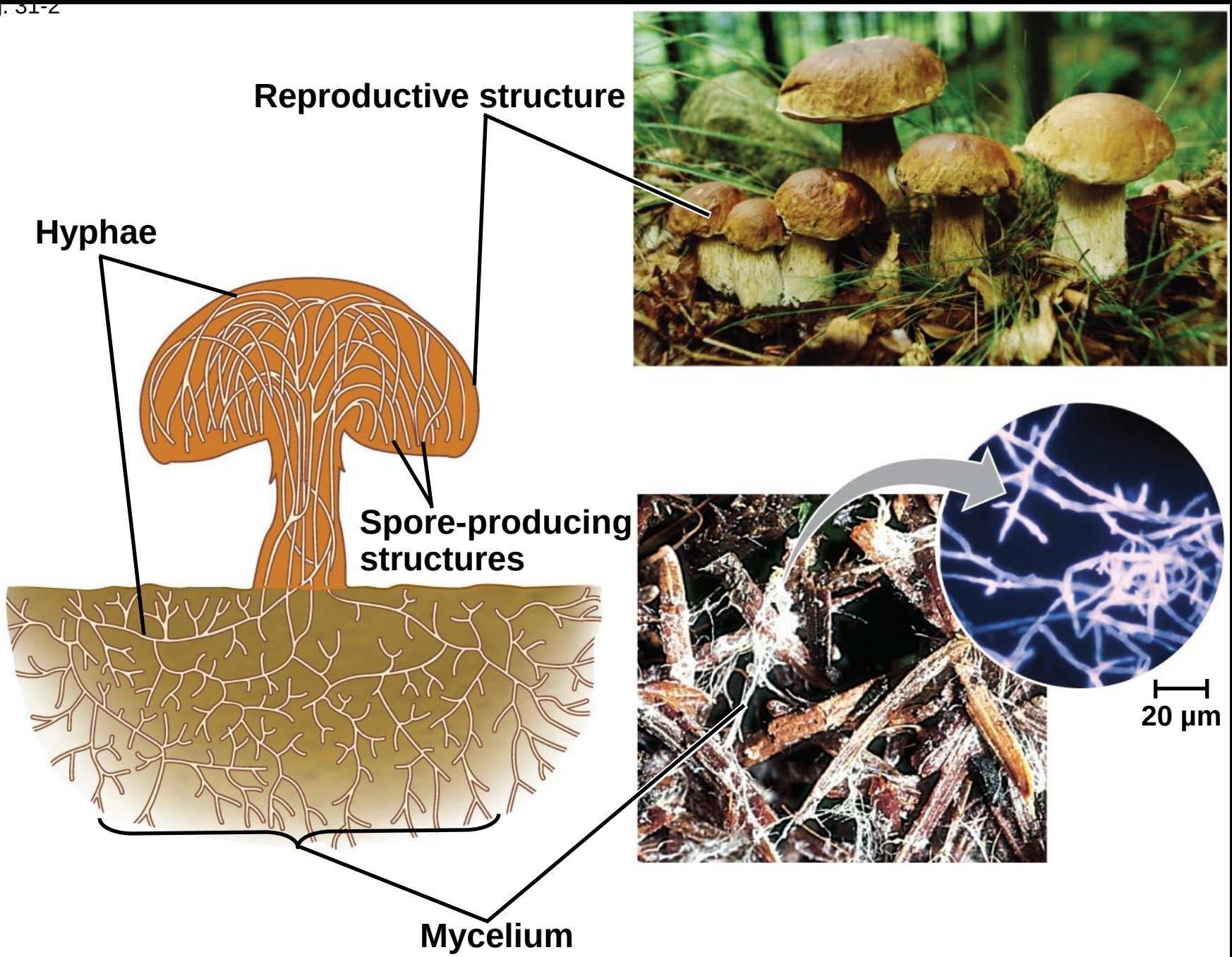

## MUSHROOM VS. TRUFFLE

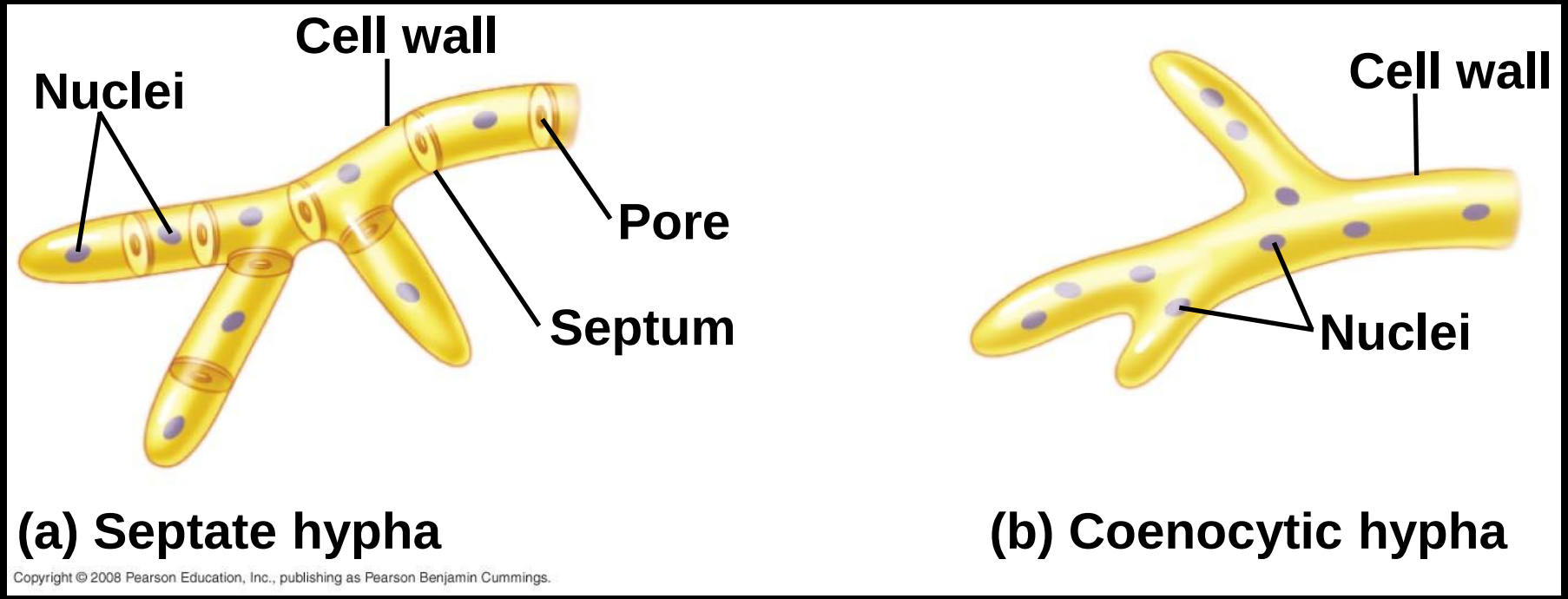
Whereas mushrooms have a complex fruiting body that rises from the ground and discharges spores directly into the air …

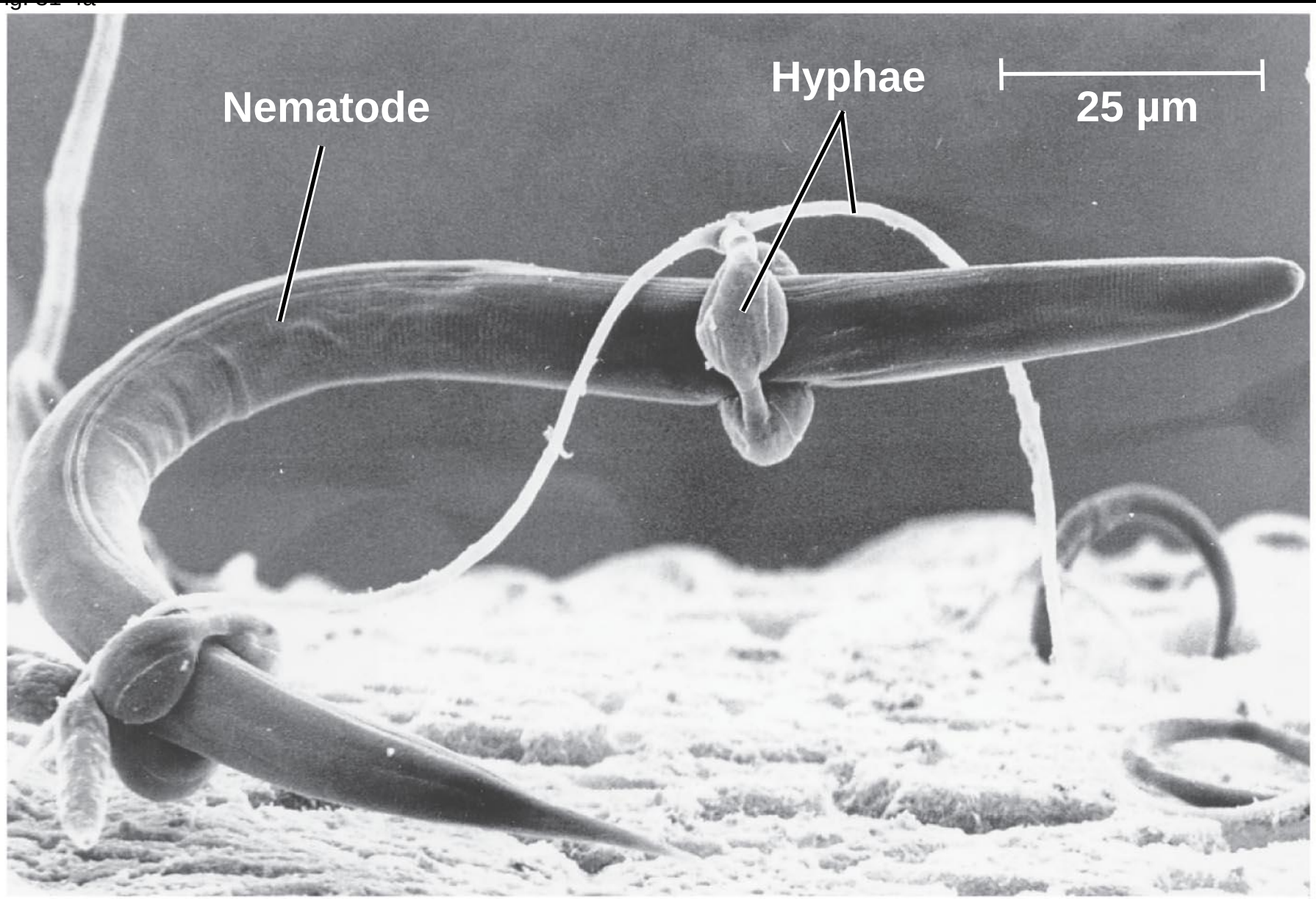
… truffles live entirely underground, and their fruiting body consists of a lump of spore-laden tissue. To multiply, therefore, truffles emit aromatic compounds that attract hungry animals, which then disperse the spores for them.


## TWO-WAY STREET

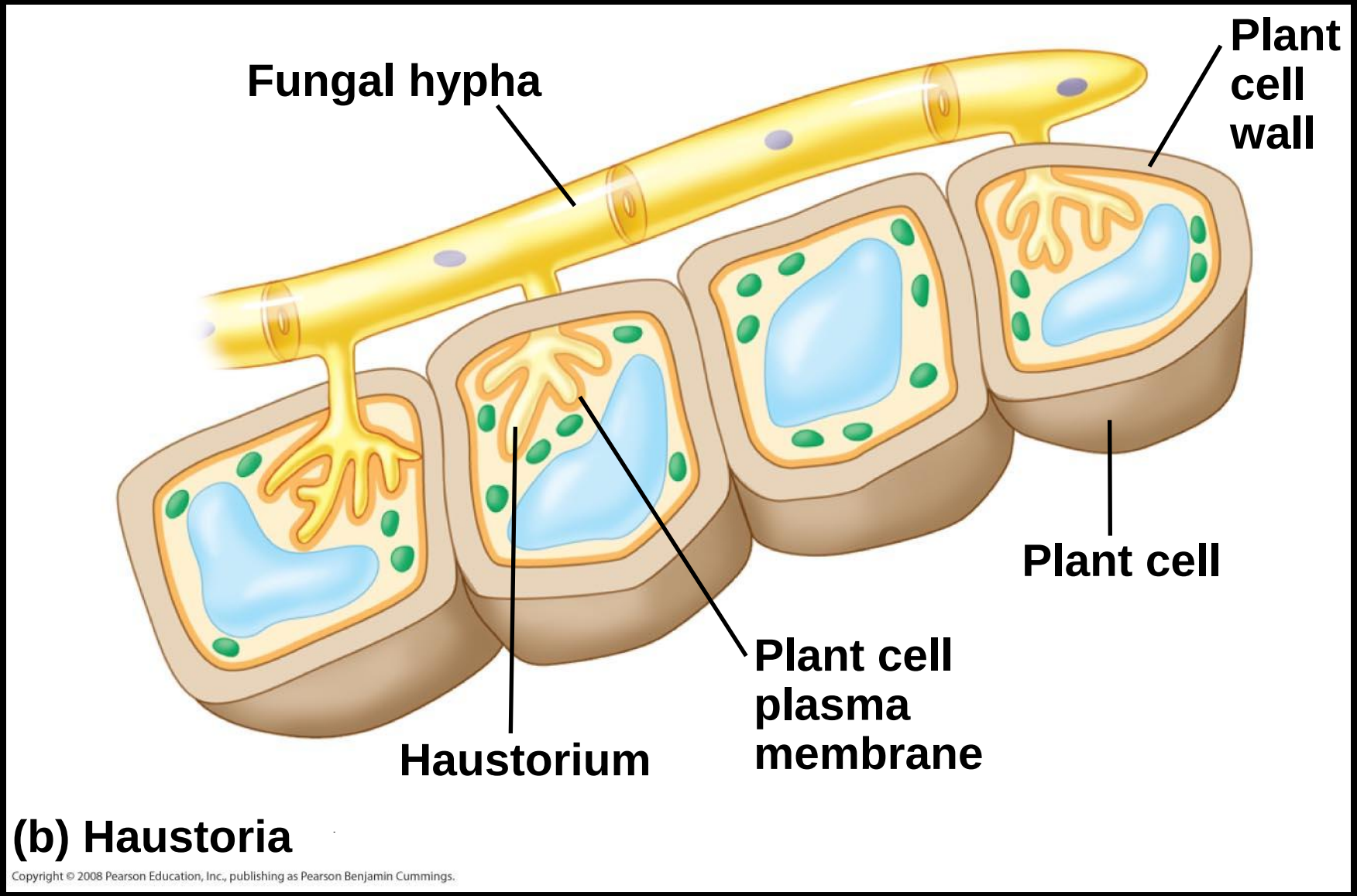
Truffles form symbiotic relationships with plants by way of a network of microfibers called hyphae that grows among plant roots to form a shared organ called an ectomycorrhiza that enables each partner to provide the other with nutrients it cannot obtain for itself.



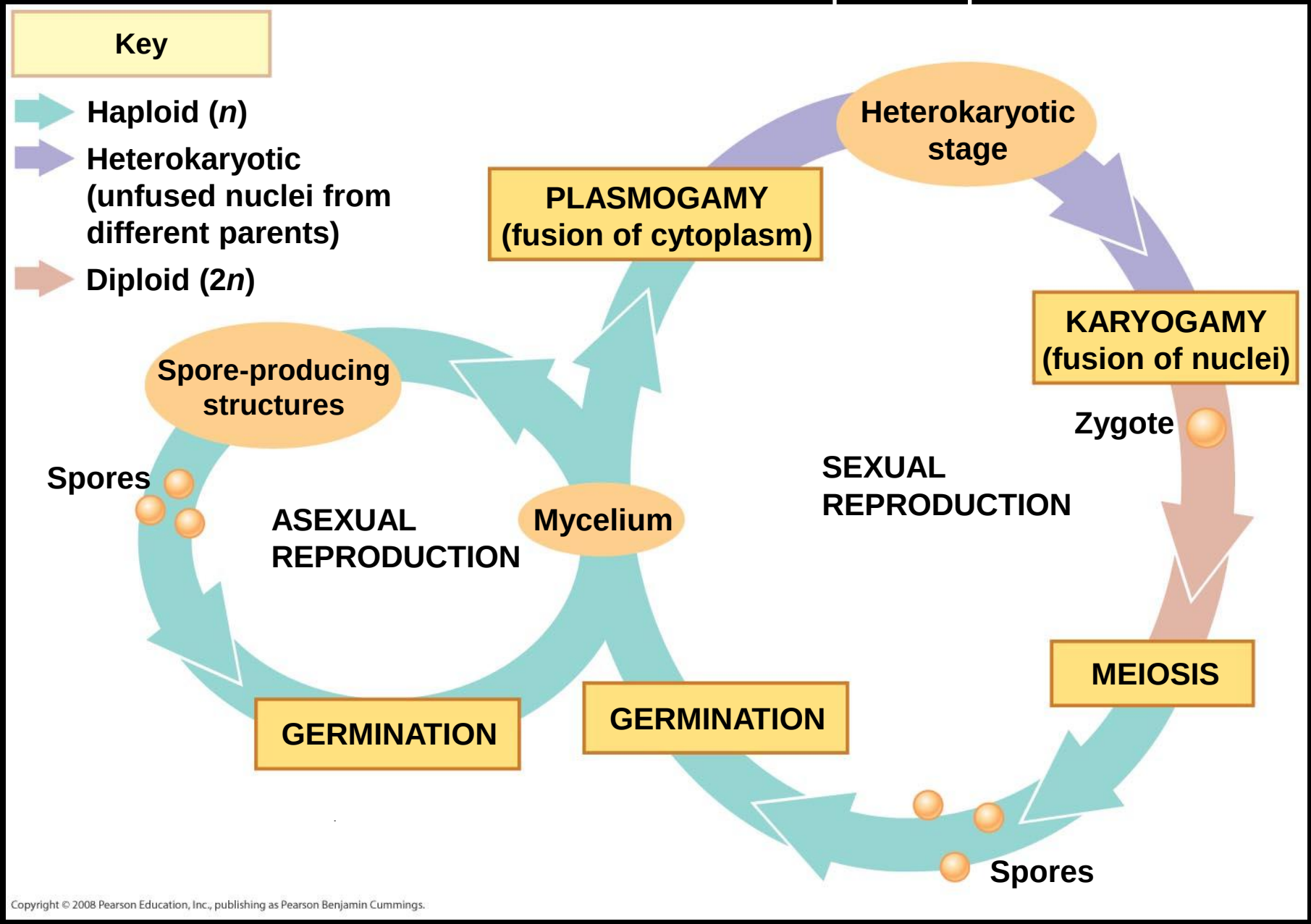


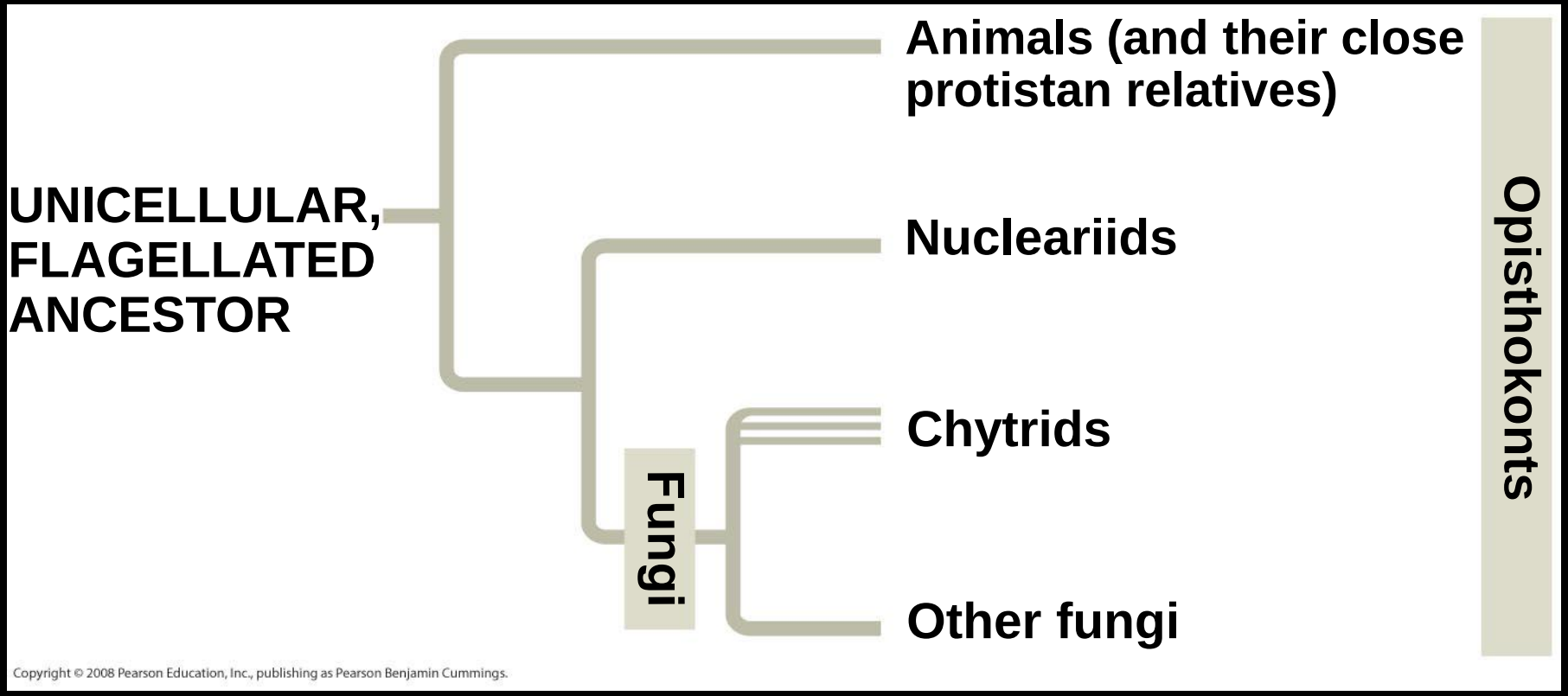


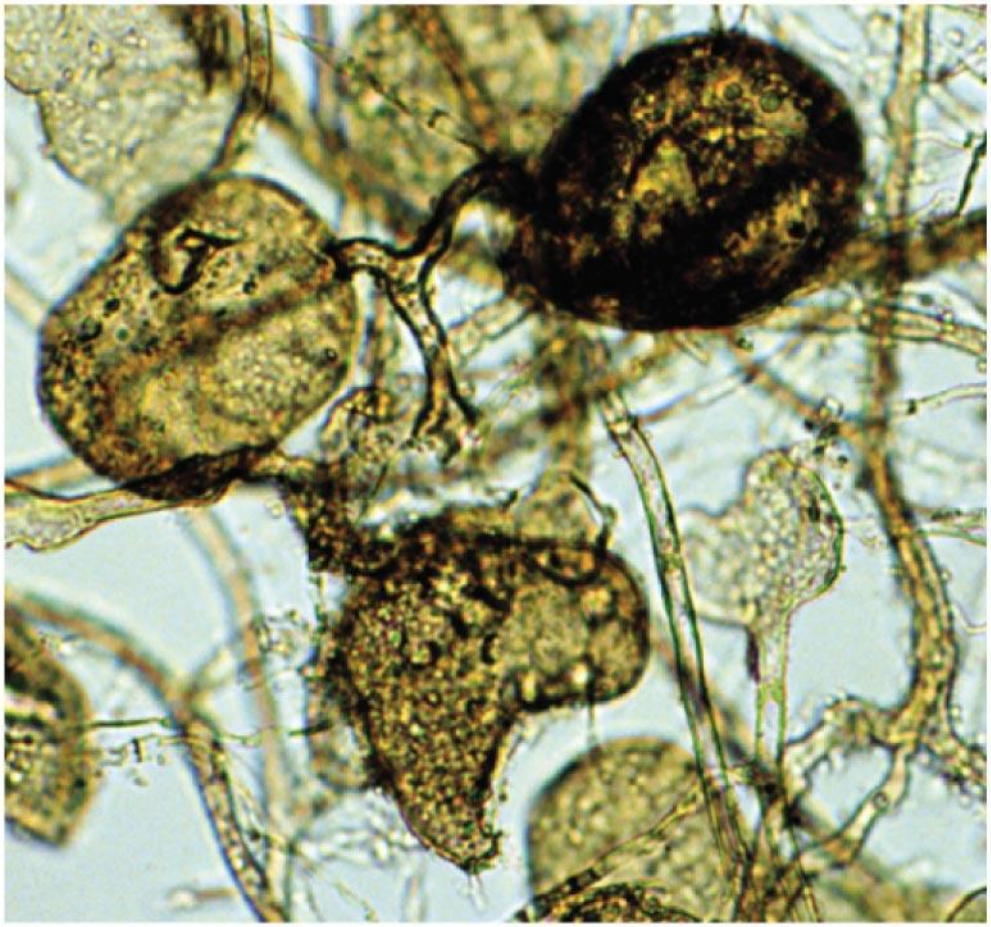

**(a) Hyphae adapted for trapping and killing prey**

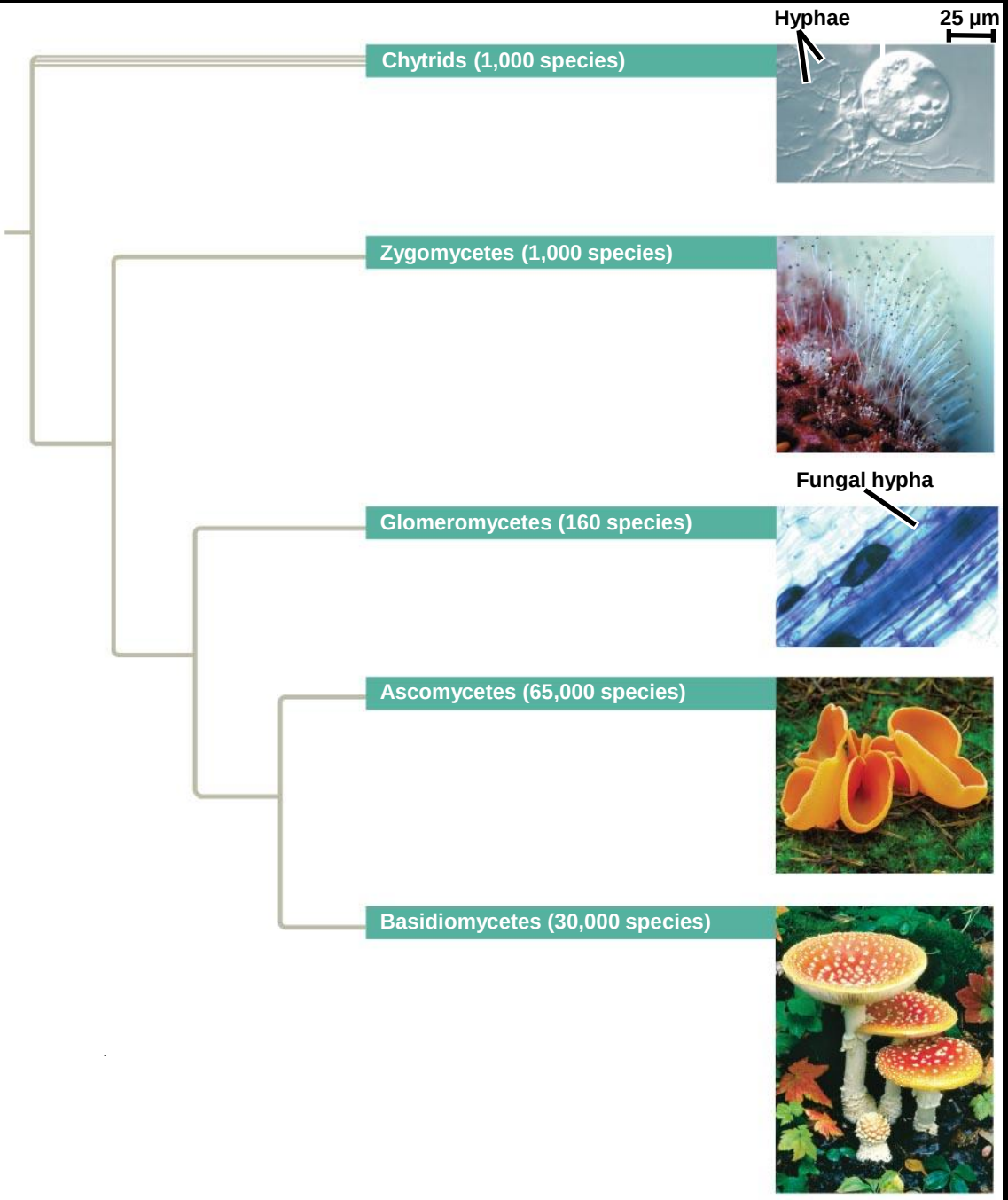



(b) Haustoria









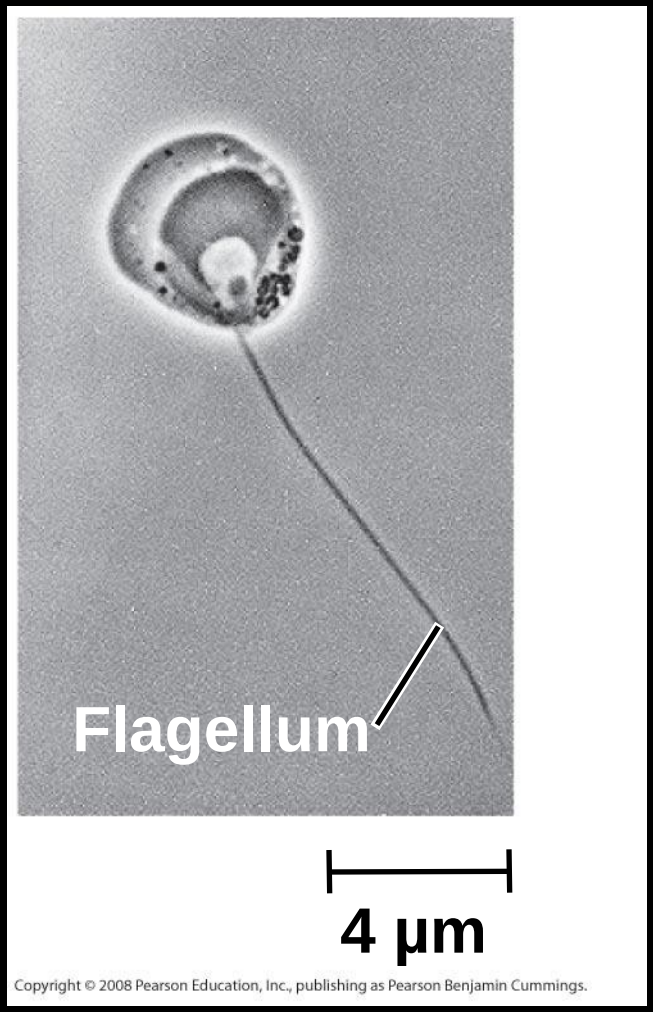


Fig. 31-13-4

*Rhizopus* growing on bread

Key

Haploid (*n*)

Heterokaryotic (*n* + *n*)

Diploid (2*n*)

SEXUAL REPRODUCTION

Mating type (+)

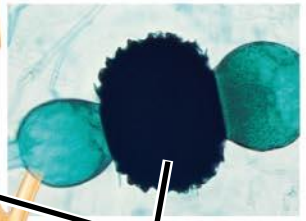
Mating type (–)

Gametangia with haploid nuclei

PLASMOGAMY

Young zygosporangium (heterokaryotic)

100 µm



Zygosporangium

KARYOGAMY

Diploid nuclei

MEIOSIS

Sporangium

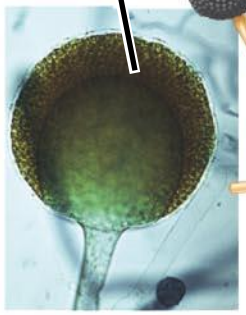
Spores

Dispersal and germination

Dispersal and germination

ASEXUAL REPRODUCTION

Sporangia

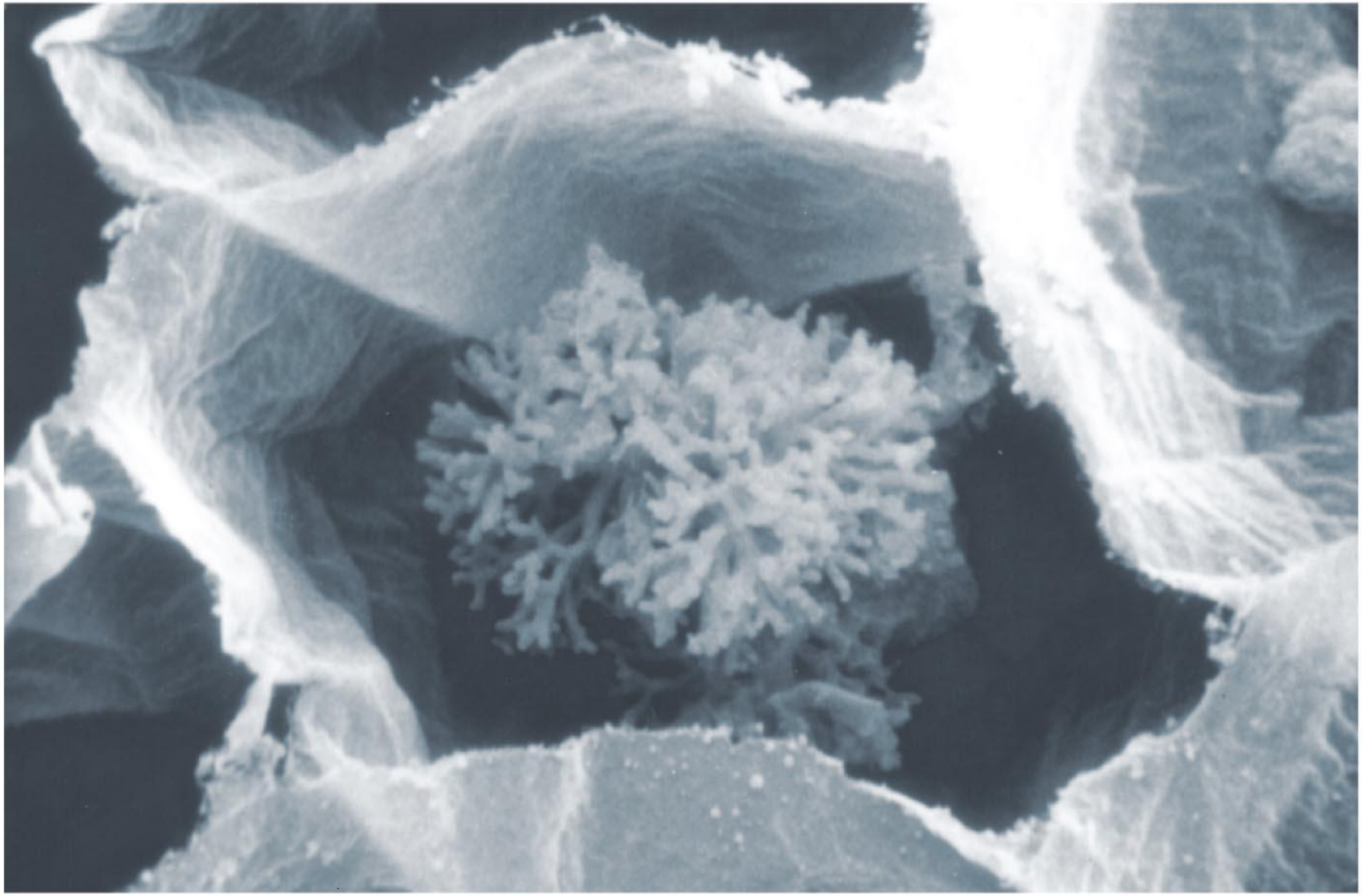


50 µm

Mycelium

# Glomeromycetes

- The **glomeromycetes** (phylum Glomeromycota) were once considered zygomycetes
- They are now classified in a separate clade
- Glomeromycetes form arbuscular mycorrhizae

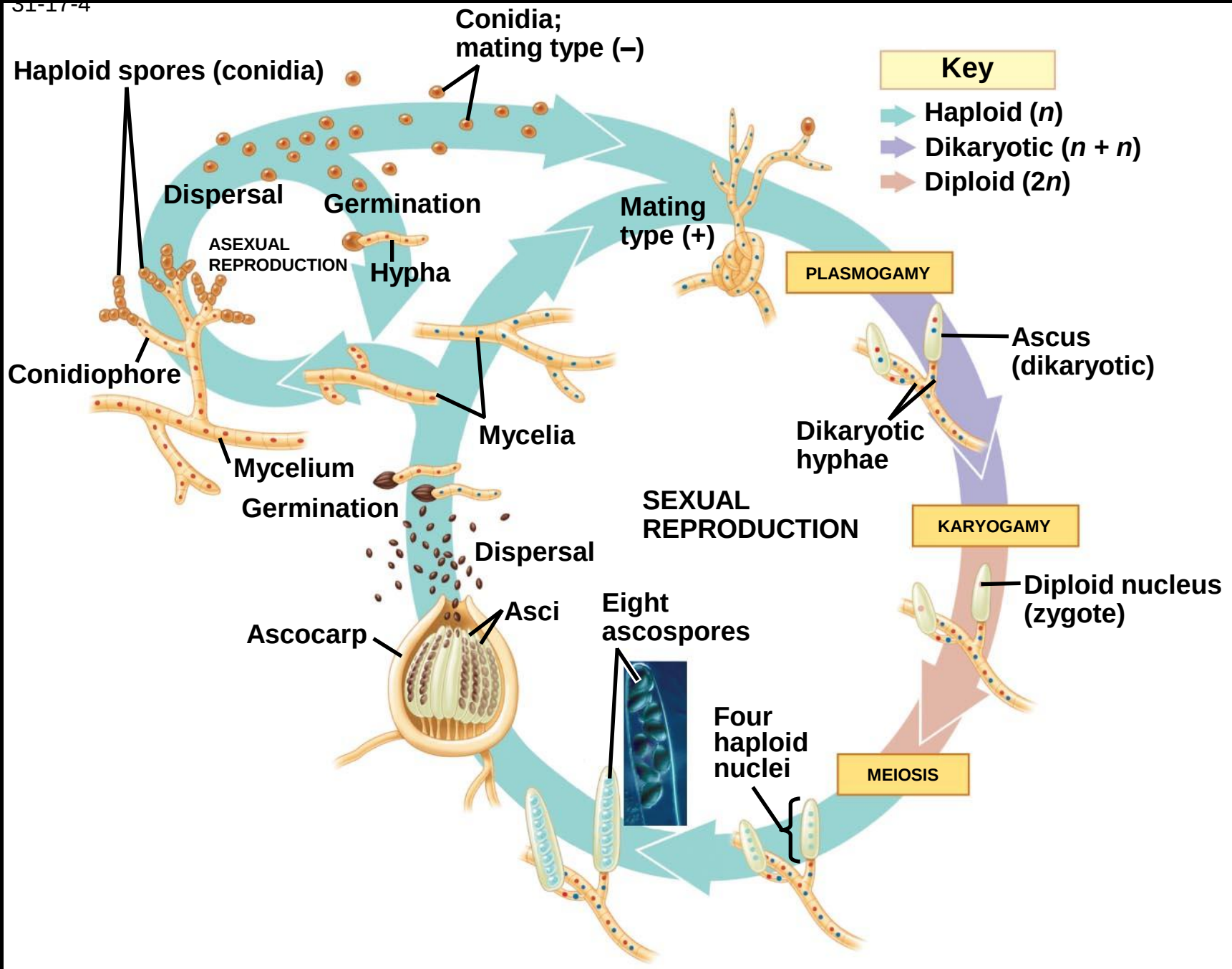


# Ascomycetes

- **Ascomycetes** (phylum Ascomycota) live in marine, freshwater, and terrestrial habitats
- The phylum is defined by production of sexual spores in saclike **asci**, usually contained in fruiting bodies called **ascocarps**
- Ascomycetes are commonly called **sac fungi**
- Ascomycetes vary in size and complexity

***Morchella esculenta,***
**the tasty morel**

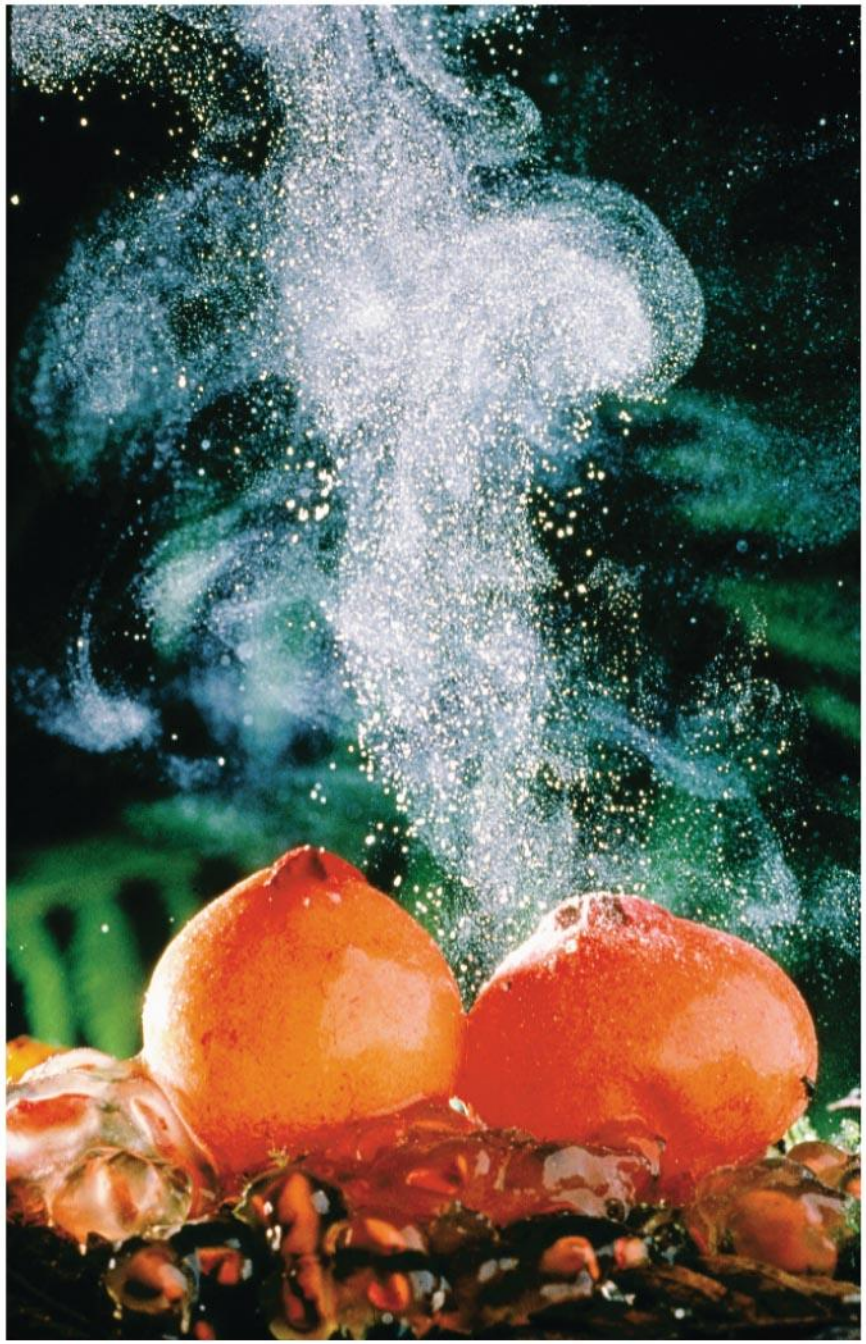
***Tuber melanosporum,* a truffle**



# Basidiomycetes

- **Basidomycetes** (phylum Basidiomycota) include mushrooms, puffballs, and shelf fungi, mutualists, and plant parasites
- The phylum is defined by a clublike structure called a **basidium**, a transient diploid stage in the life cycle
- The basidiomycetes are also called **club fungi**

- **Maiden veil fungus (*Dictyphora*), a fungus with an odor like rotting meat**





- **Puffballs emitting spores**

- **Shelf fungi, important decomposers of wood**

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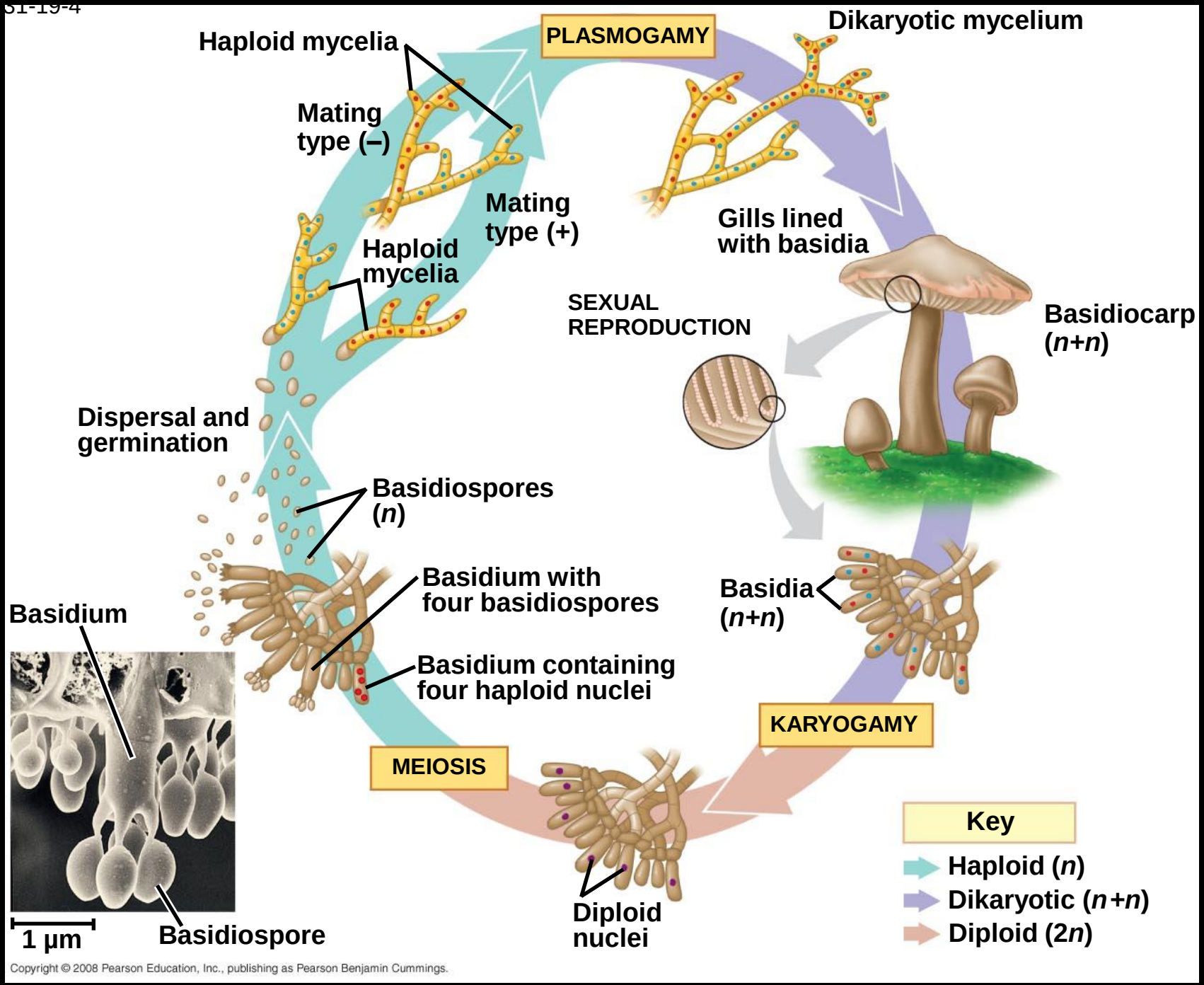


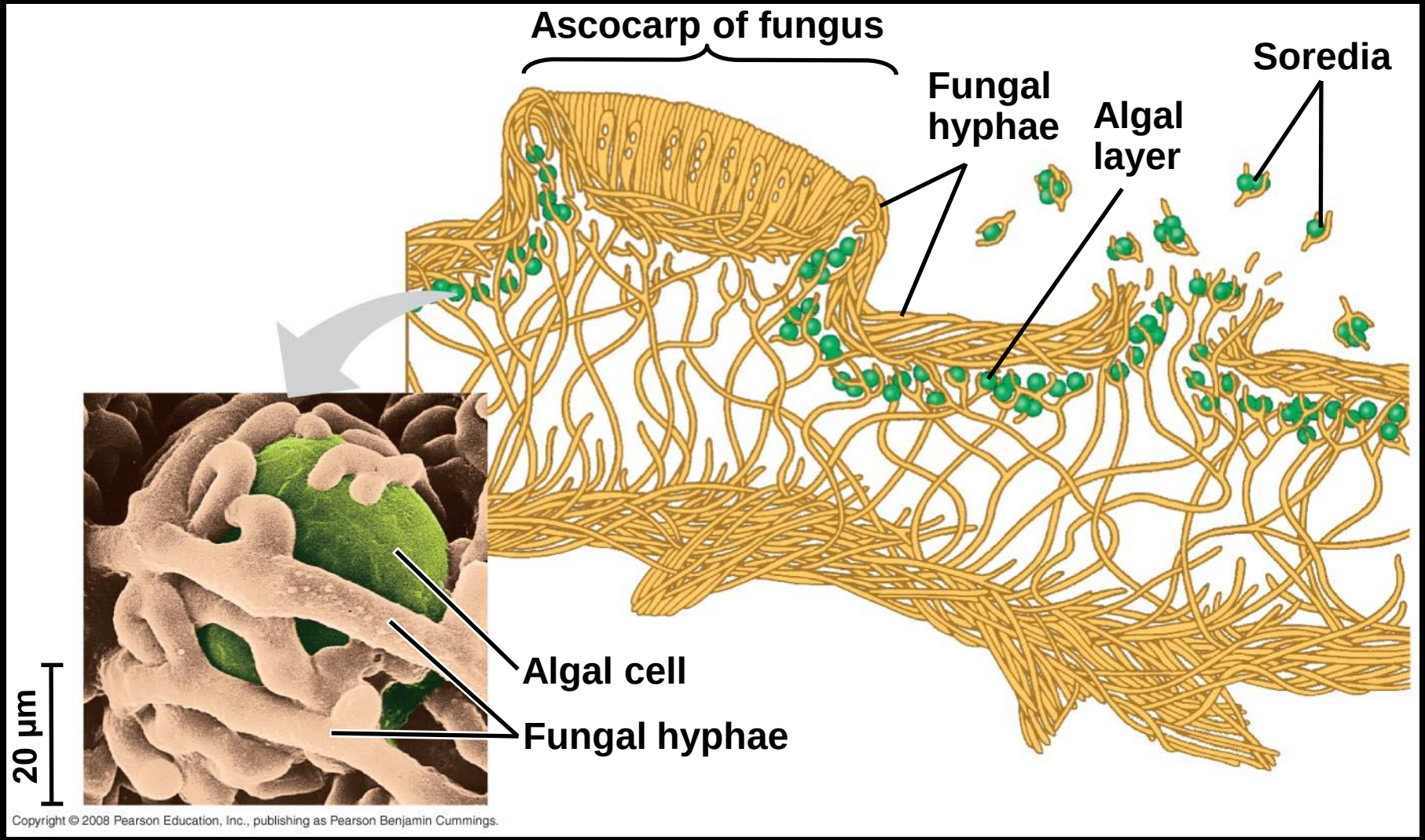
# *Fungus-Plant Mutualisms*

- Mycorrhizae are enormously important in natural ecosystems and agriculture
- Plants harbor harmless symbiotic **endophytes** that live inside leaves or other plant parts
- Endophytes make toxins that deter herbivores and defend against pathogens

▼ A fruticose (shrublike) lichen

◀ Crustose (encrusting) lichens

▼ A foliose (leaflike) lichen



(a) Corn smut on corn

(b) Tar spot fungus on maple leaves

(c) Ergots on rye