Chapter 24: Fungi

Fig. 24-1a, p.390

Lichen

- **Combination of fungus and photosynthetic organism(s)**
- **Organisms are symbionts**
- **Relationship is a mutualism**

Review: Mycorrhiza

- “Fungus-root”
- Mutualism between a fungus and a tree root
- Fungus gets sugars from plant
- Plant gets minerals from fungus
- Many plants do not grow well without mycorrhizae

Fungi as Decomposers

- **Break down organic compounds in their surroundings**
- Carry out extracellular digestion and absorption
- **Plants benefit because some carbon and nutrients are released**

A Variety of Roles

- Pathogens
- Spoilers of food supplies
- Used to manufacture
  - Antibiotics
  - Cheeses

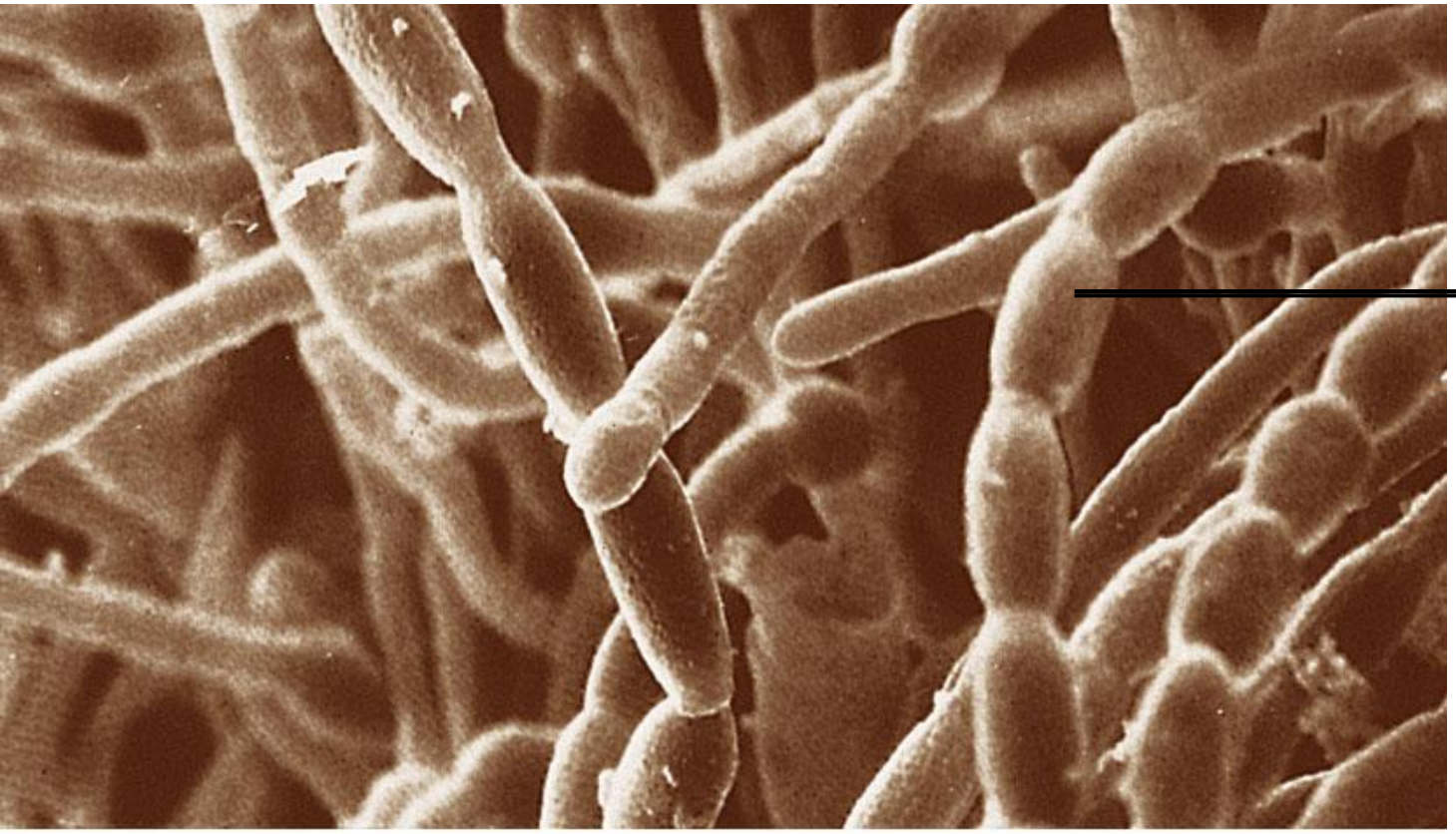
Fungi Are Heterotrophs

- Cannot carry out photosynthesis
- Must acquire organic molecules from the environment
- Most are saprobes
  - Get nutrients from nonliving organic matter
- Some are parasites
  - Extract nutrients from a living host

The Mycelium

- **Most fungi produce a multicellular feeding structure called a mycelium**
- It consists of branching tubular cells called **hyphae**
- Cell walls contain chitin

The Mycelium



Extracellular Digestion

- **Mycelium grows into food source**
- **Tips of hyphae secrete digestive enzymes**
- **Enzymes break down organic material into simple forms** that can be absorbed by hyphae

Fungal Life Cycle

- **No motile stage**
- **Asexual and sexual spores produced**
- **Spores germinate after dispersal**
- In multicelled species, spores give rise to a new mycelium

Fungal Classification

- Fungi known from 900 mya
- 56,000 known species
- **Three major lineages:**
  - **Zygomycota**
  - **Ascomycota (sac fungi)**
  - **Basidiomycota (club fungi)**
- Imperfect fungi are those not yet classified

Fungal Classification

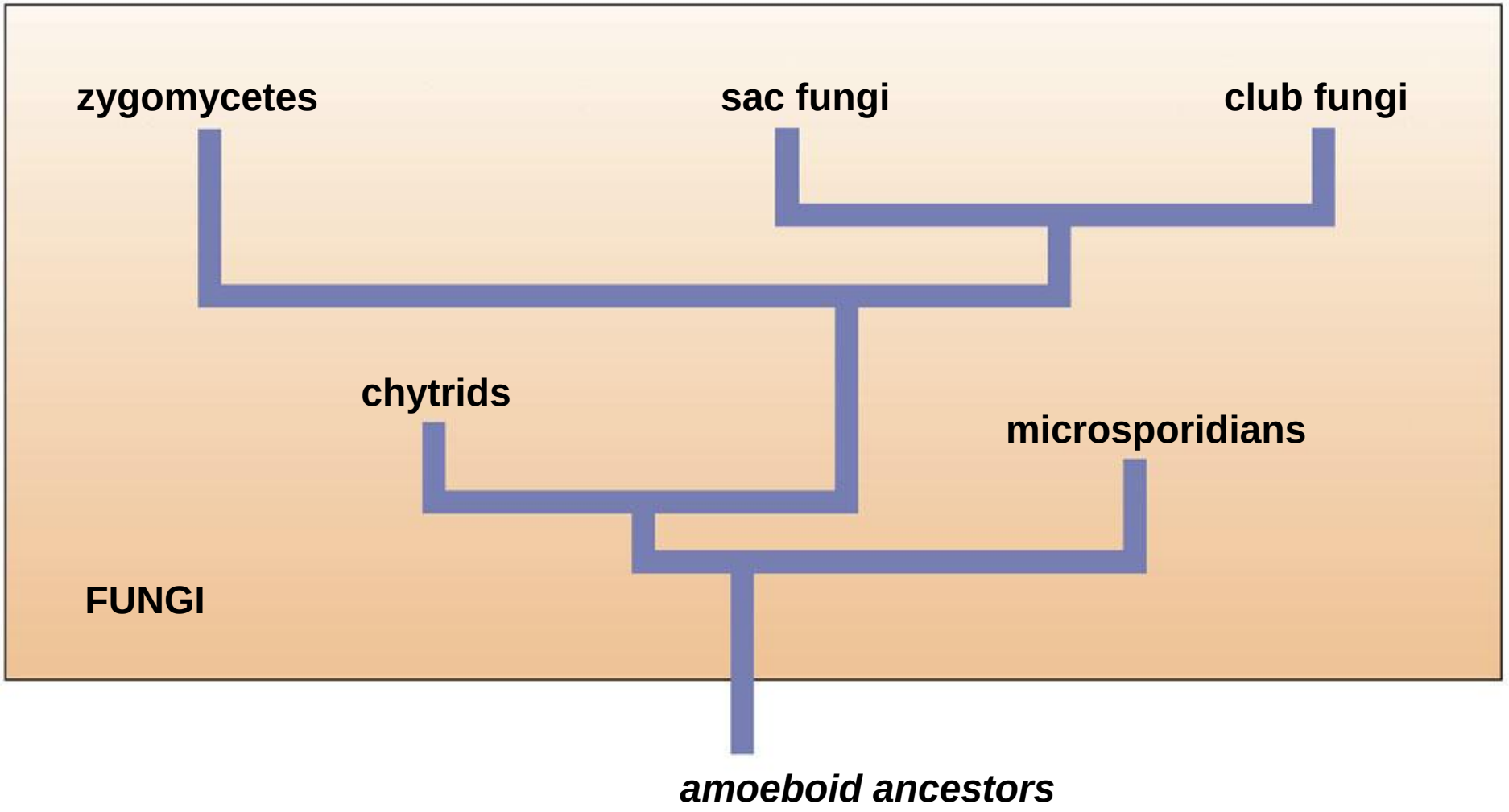


Fig. 24-2, p.392

Fungal Classification

Fig. 24-3a, p.392

Fungal Classification

Fig. 24-3b, p.392

Diversity of Club Fungi

- 25,000 species
- Mushrooms
- Shelf fungi
- Coral fungi
- Stinkhorns
- Puffballs

Diversity of Club Fungi

Fig. 24-3c, p.392

Diversity of Club Fungi

Fig. 24-3d, p.392

Diversity of Club Fungi

Fig. 24-3e, p.392

Fungal Spores

- **Made up of one or a few cells**
- Can resist dehydration
- **Remain dormant until environmental conditions favor germination**
- **Produced asexually or sexually**
- Fungal classification is based on type of sexual spores

Imperfect Fungi

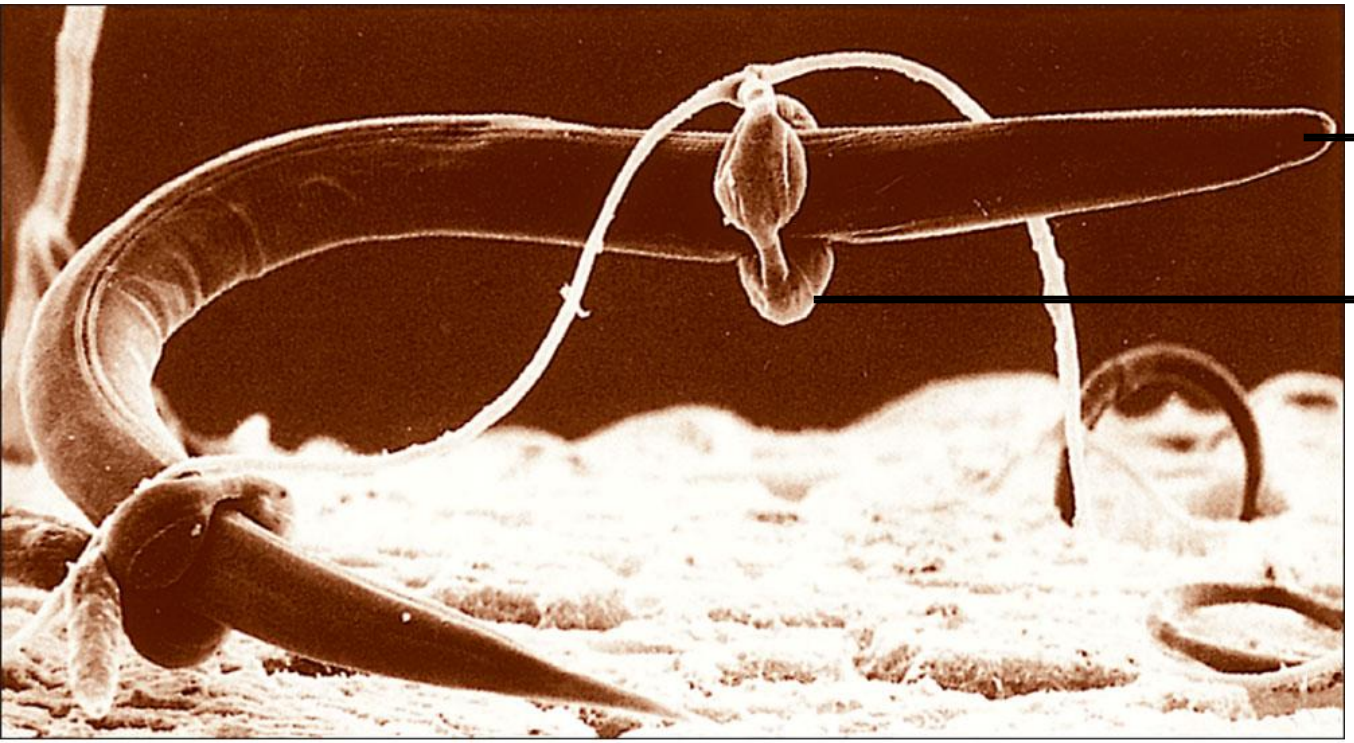


Fig. 24-5, p.393

Life Cycle of Rhizopus

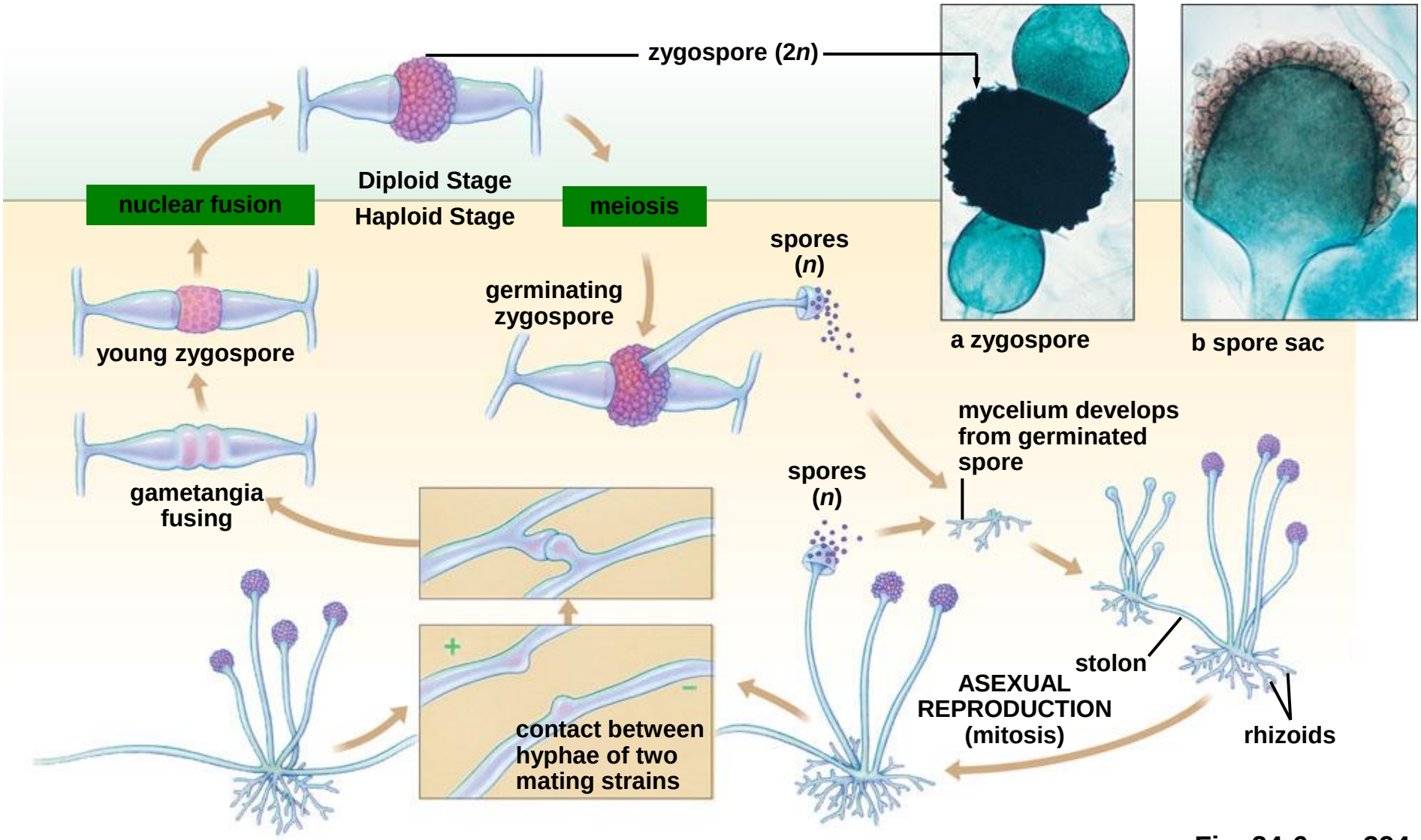


Fig. 24-6a, p.394

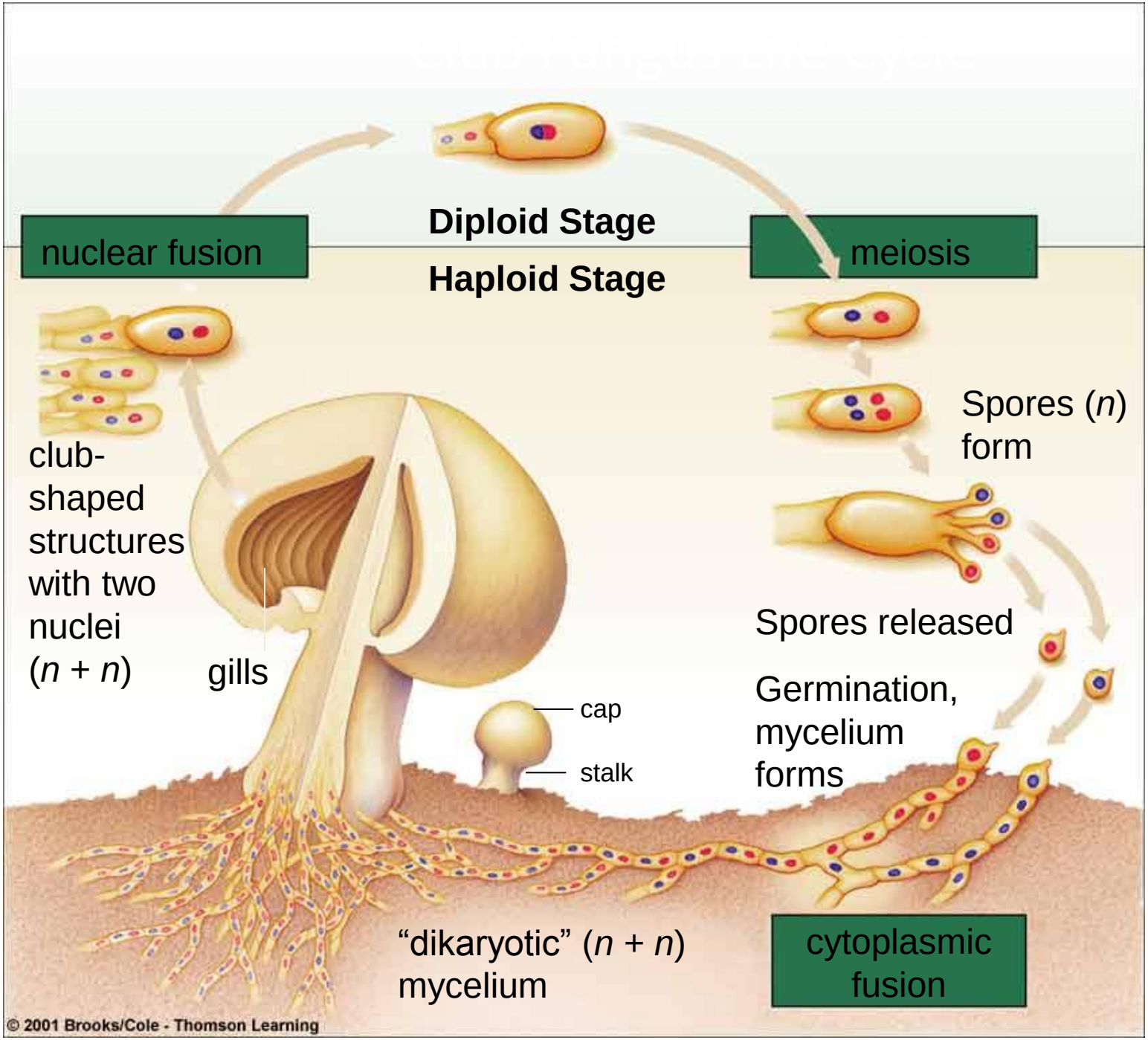

Diploid Stage
Haploid Stage
nuclear fusion
meiosis
club-shaped structures with two nuclei (n + n)
gills
cap
stalk
Spores (n) form
Spores released
Germination, mycelium forms
"dikaryotic" (n + n) mycelium
cytoplasmic fusion
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Fig. 24-7, p. 407

Sac Fungi (Ascomycota)

- Most diverse group (30,000 species)
- **Produce asexual spores called conidia**
- **Produce sexual ascospores in sac-shaped cells call asci**
- **Multicelled species form reproductive structures called ascocarps that enclose the asci**

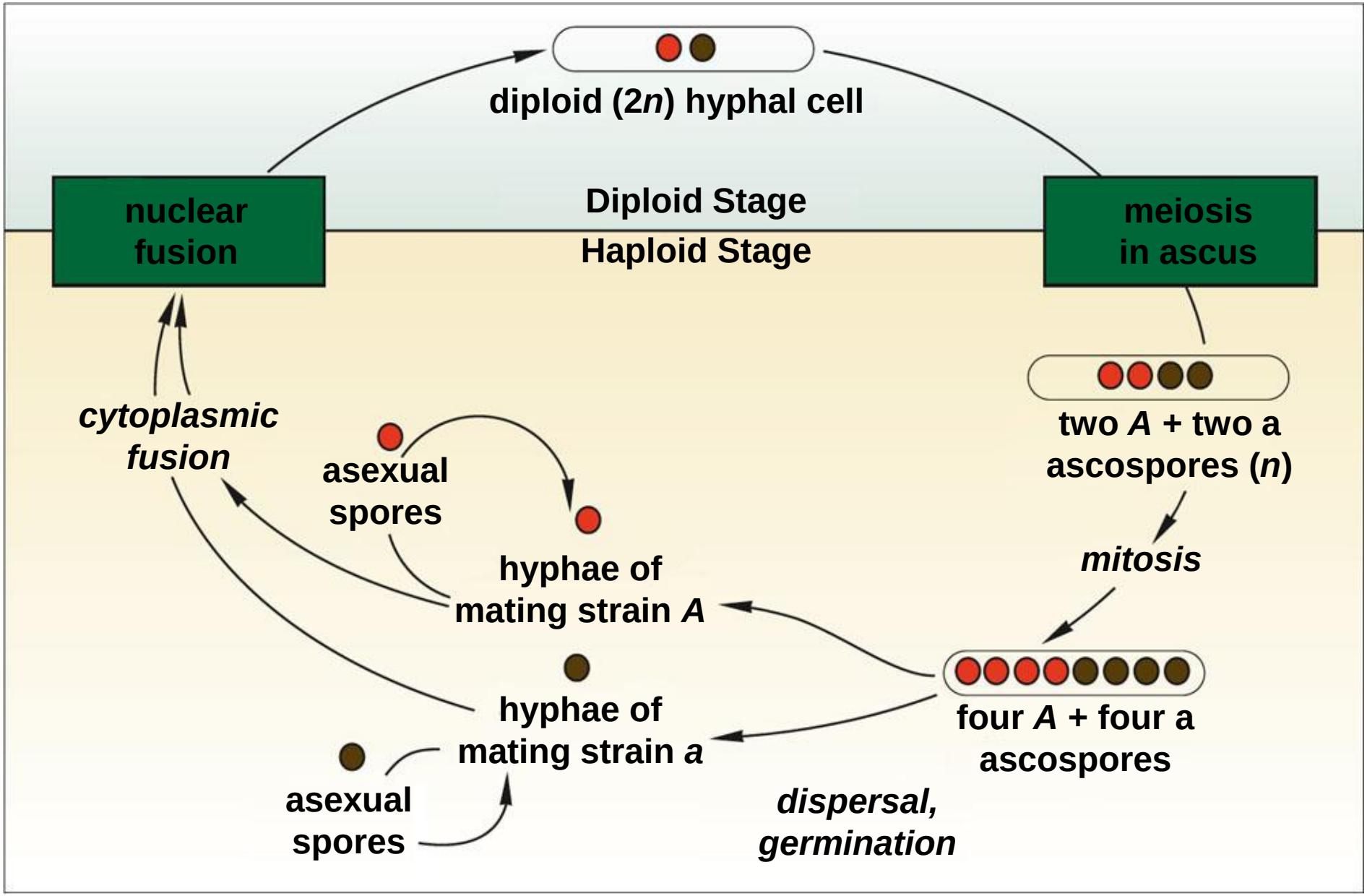
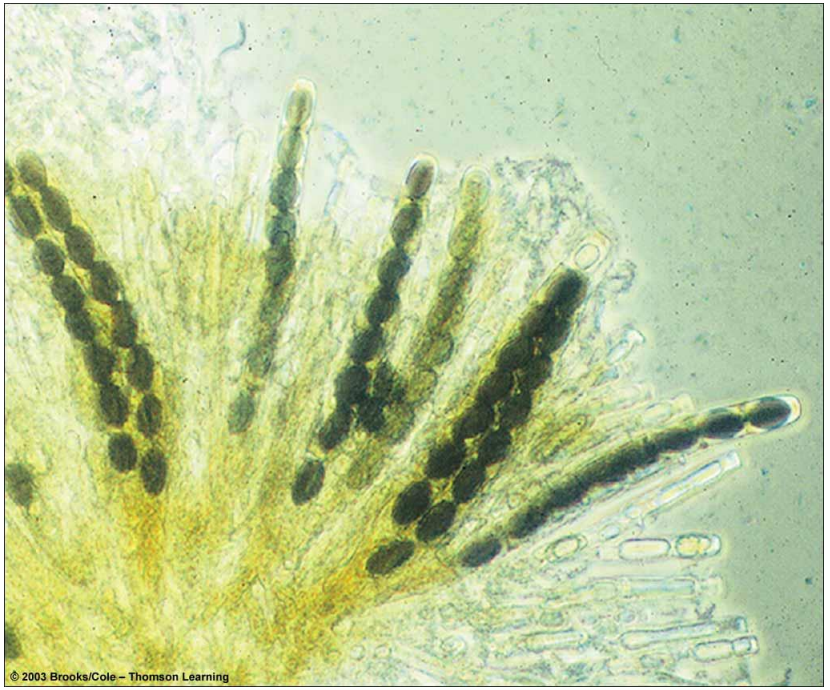


Fig. 24-8, p.396

Example of Sac Fungus

Sarcoscypha coccinia, **scarlet cup fungus**



Ascospores on the inner cup surface

Fig. 24-8, p.396

Example of Sac Fungus

Fig. 24-9b, p.396

Example of Sac Fungus

Fig. 24-9c, p.396

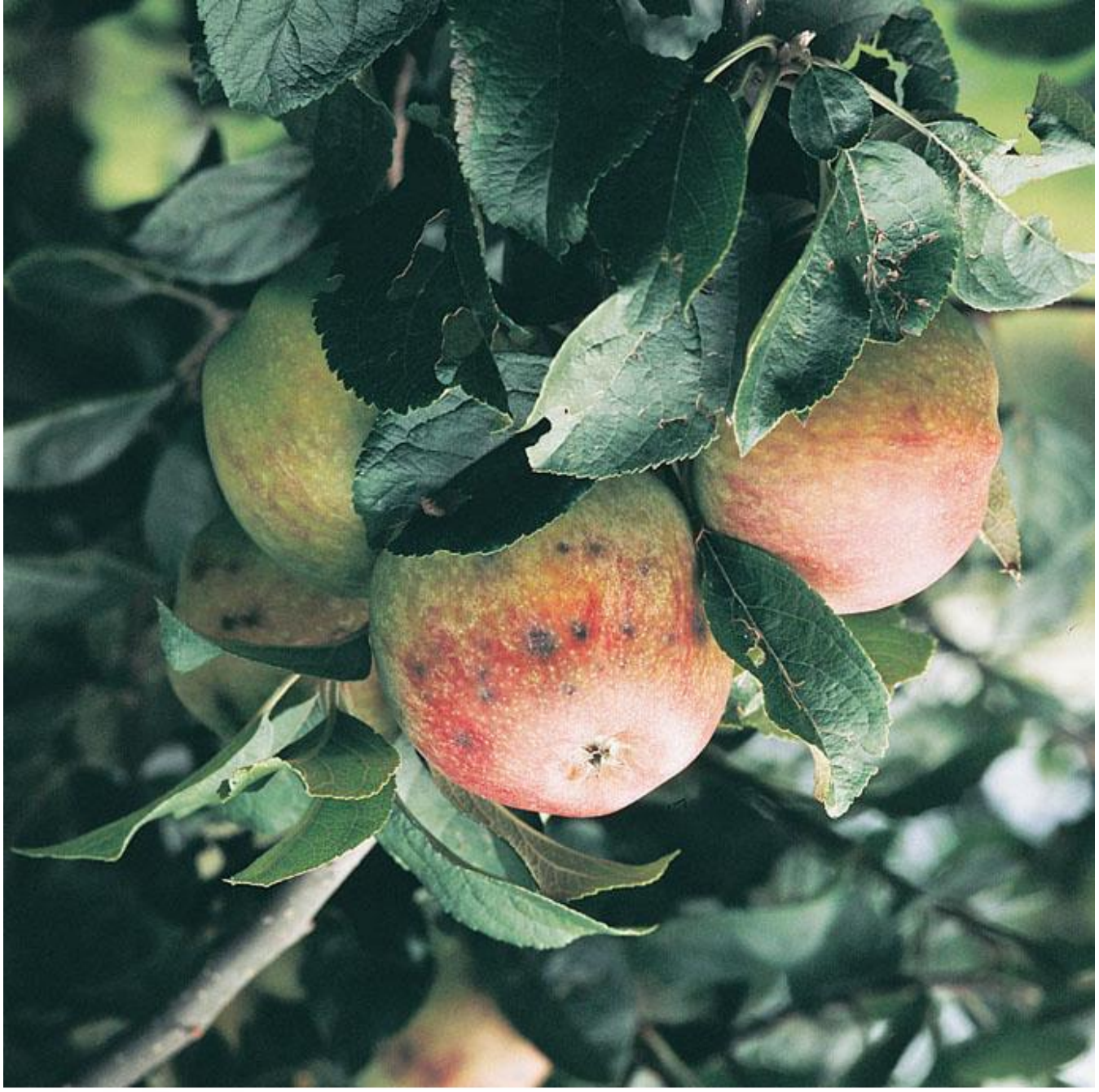


Fig. 24-10b, p.397

Human Pathogens & Toxins

- Ascomycetes cause
  - Histoplasmosis
  - Valley fever
  - *Candida* (“yeast”) infections
  - Ringworm
  - Athlete’s foot
  - Ergotism
- Eating some basidiomycetes can be fatal

Table 24.1 A Sampling of the Notorious Fungi

Chytrids	
Batrachochytrium dendrobatidis	Deadly skin disease among amphibians
Microsporidians	
Enterocytozoon bieneusi	Chronic diarrhea, especially in AIDS patients
Zygomycetes	
Rhizopus	Fruit, vegetable rot; some human diseases
Club Fungi	
Amanita (some species)	Dangerous mushroom poisoning
Puccinia graminis	Black stem wheat rust
Tilletia indica	Smut of cereal grains
Ustilago maydis	Smut of corn
Sac Fungi	
Ajellomyces capsulatus	Histoplasmosis
Aspergillus (some)	Aspergilloses (allergic reactions; sinus, ear, lung infections; *A. flavus* toxin linked to cancers)
Candida albicans	Infection of mucous membranes
Claviceps purpurea	Ergot of rye, ergotism
Coccidioides immitis	Valley fever
Cryphonectria parasitica	Chestnut blight
Microsporum, Trichophyton, Epidermophyton	Various species cause ringworms of scalp, body, nails, beard; cause athlete's foot
Monilinia fructicola	Brown rot of peaches, other stone fruits
Ophiostoma ulmi	Dutch elm disease
Pneumocystis carinii	Fungal pneumonia
Venturia inaequalis	Apple scab
Verticillium	Plant wilt

Lichen: A Composite Organism

- Fungal mycobiont plus a photosynthetic photobiont
- Fungal component usually is ascomycete
- Photobiont is cyanobacteria or green algae
- Fungus composes bulk of the structure

Lichen

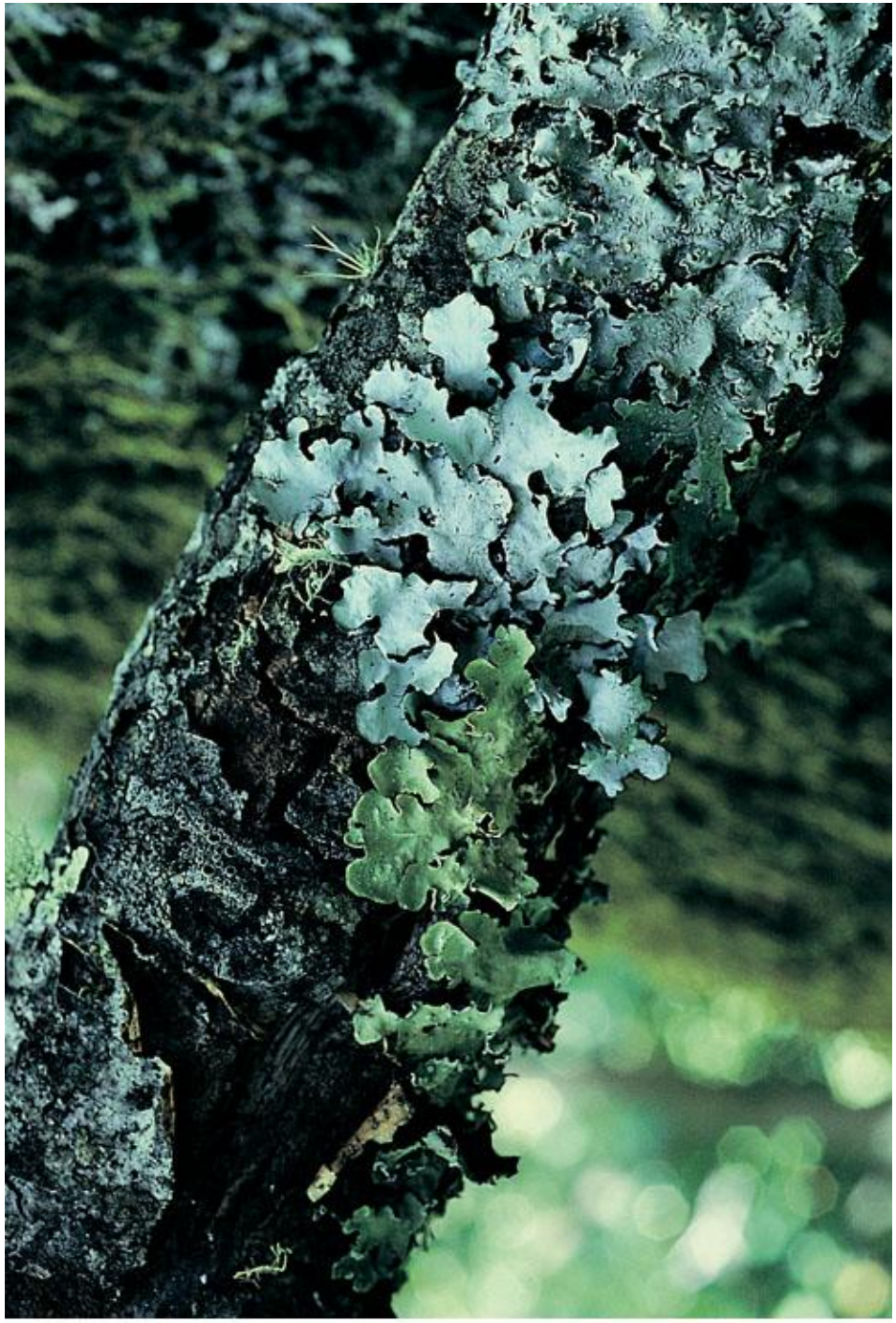


Fig. 24-11a, p.398

Lichen

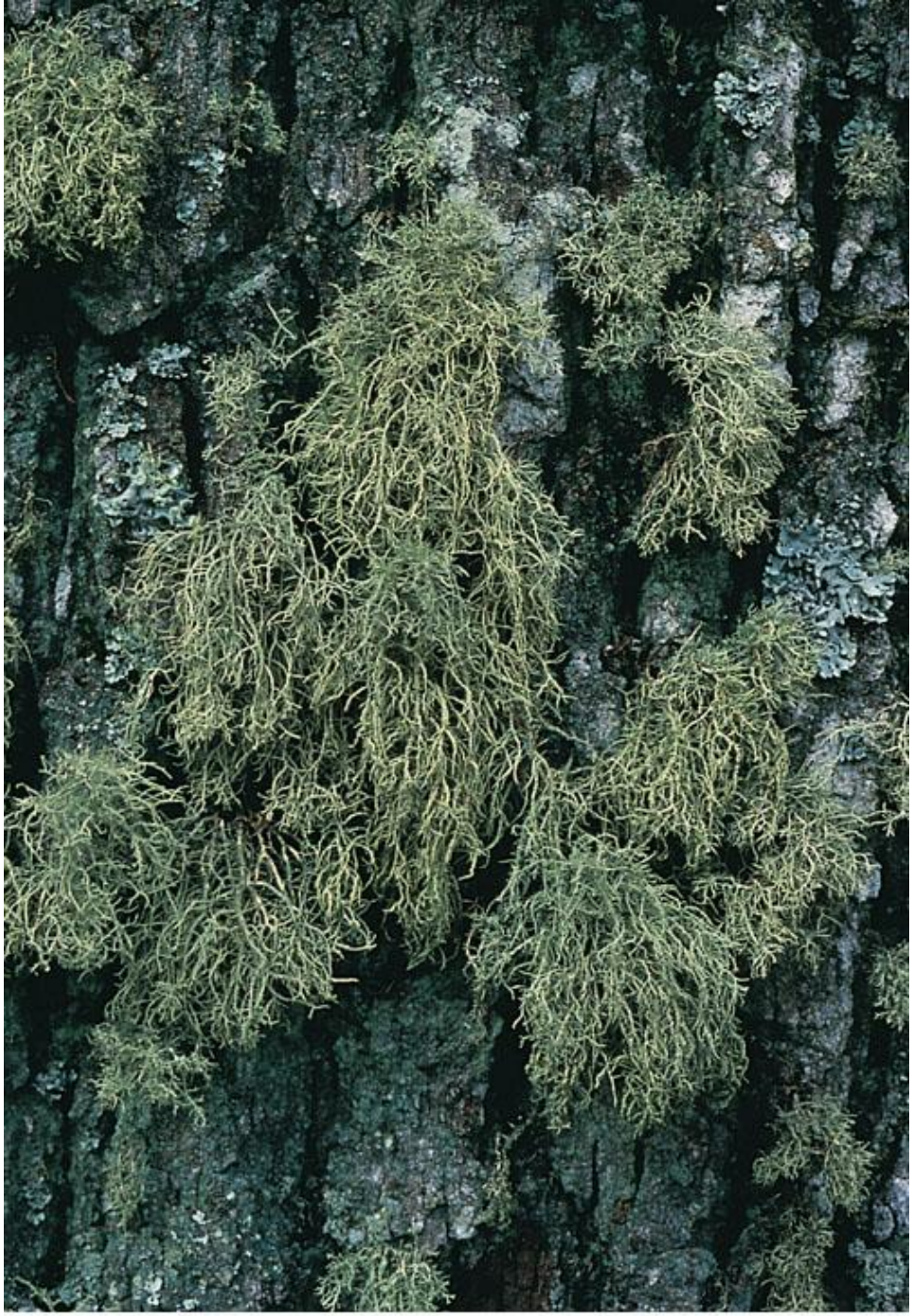


Fig. 24-11b, p.398

Lichen

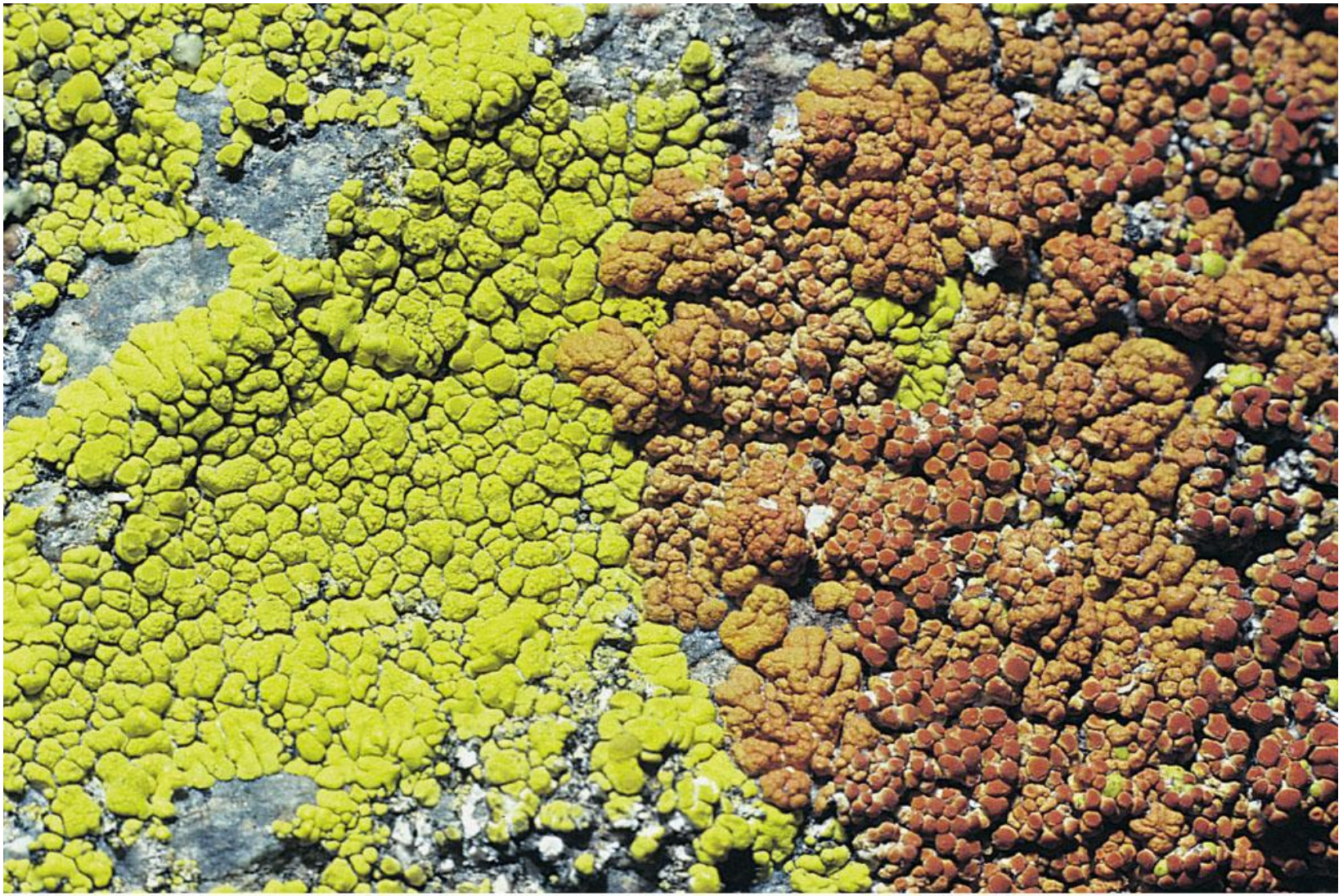


Fig. 24-11c, p.398

Lichen Cross Section

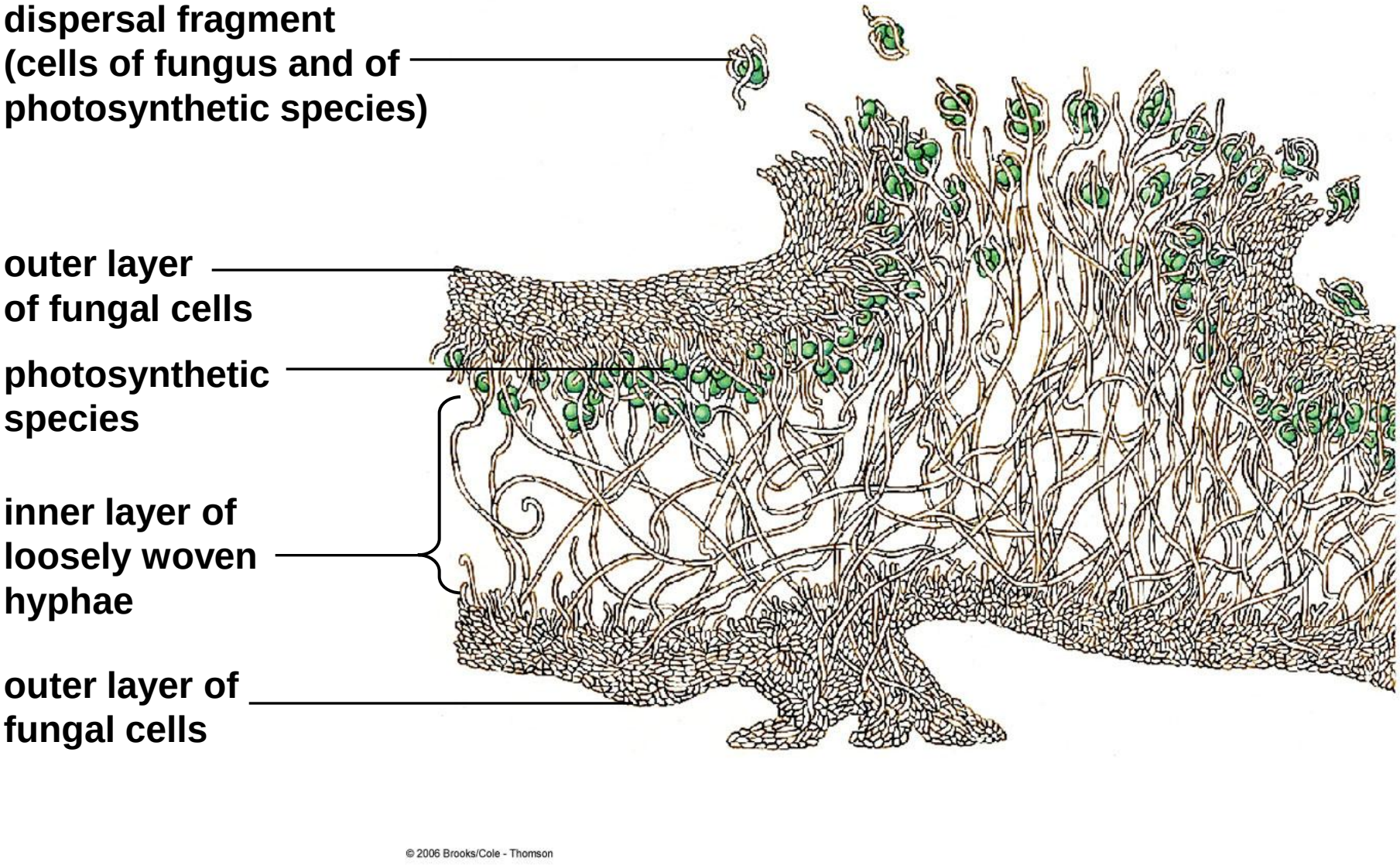


Fig. 24-11d, p.398

Mycorrhizae

- Mutualistic fungus and tree roots
- Ectomycorrhizae
  - Hyphae form net around roots
  - Common in temperate forests
- Endomycorrhizae
  - Fungus actually enters root cell
  - Form in 80% of vascular plants
  - Zygomyetes are the fungal partners

Mycorrhizae

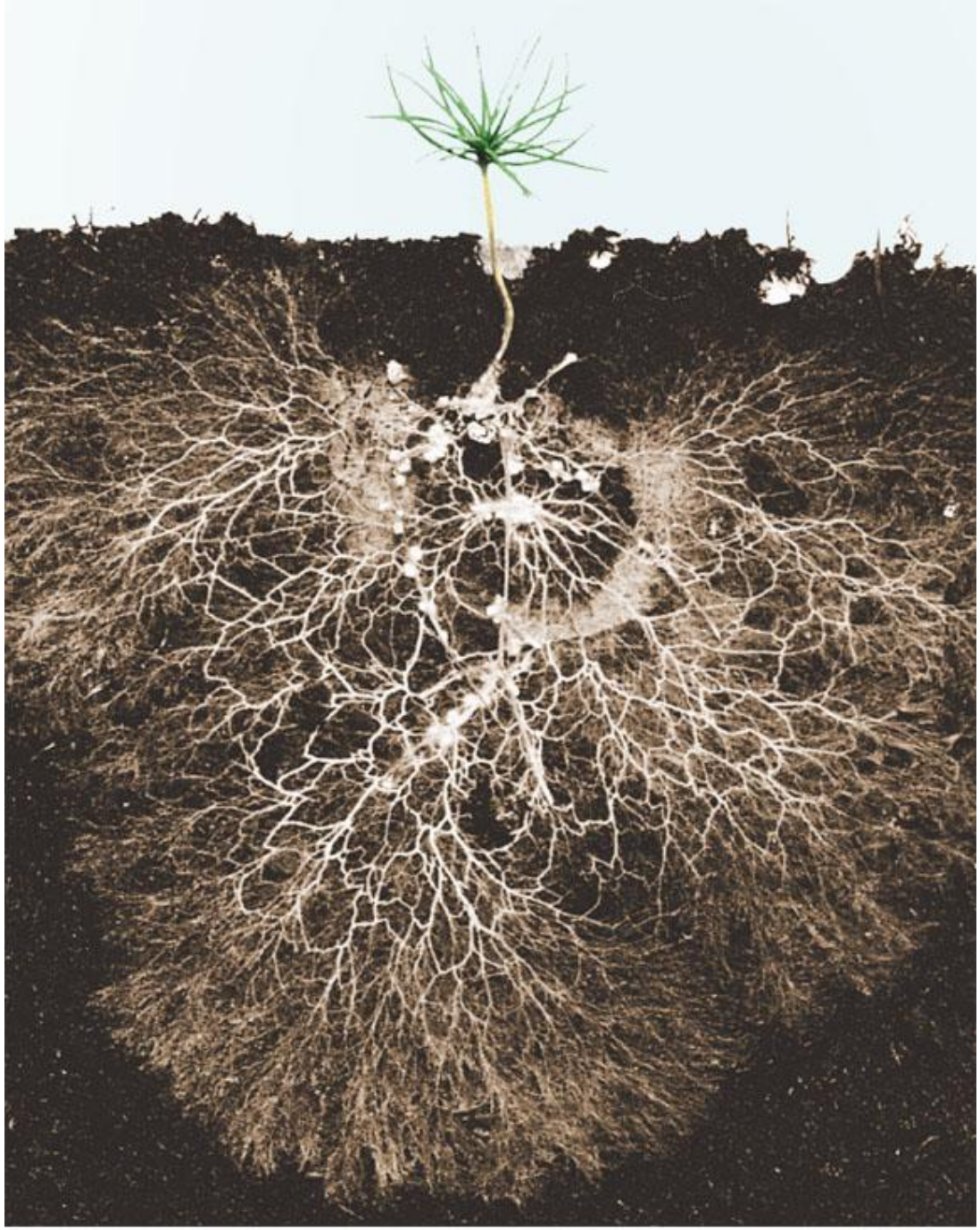


Fig. 24-12a, p.399

Mycorrhizae

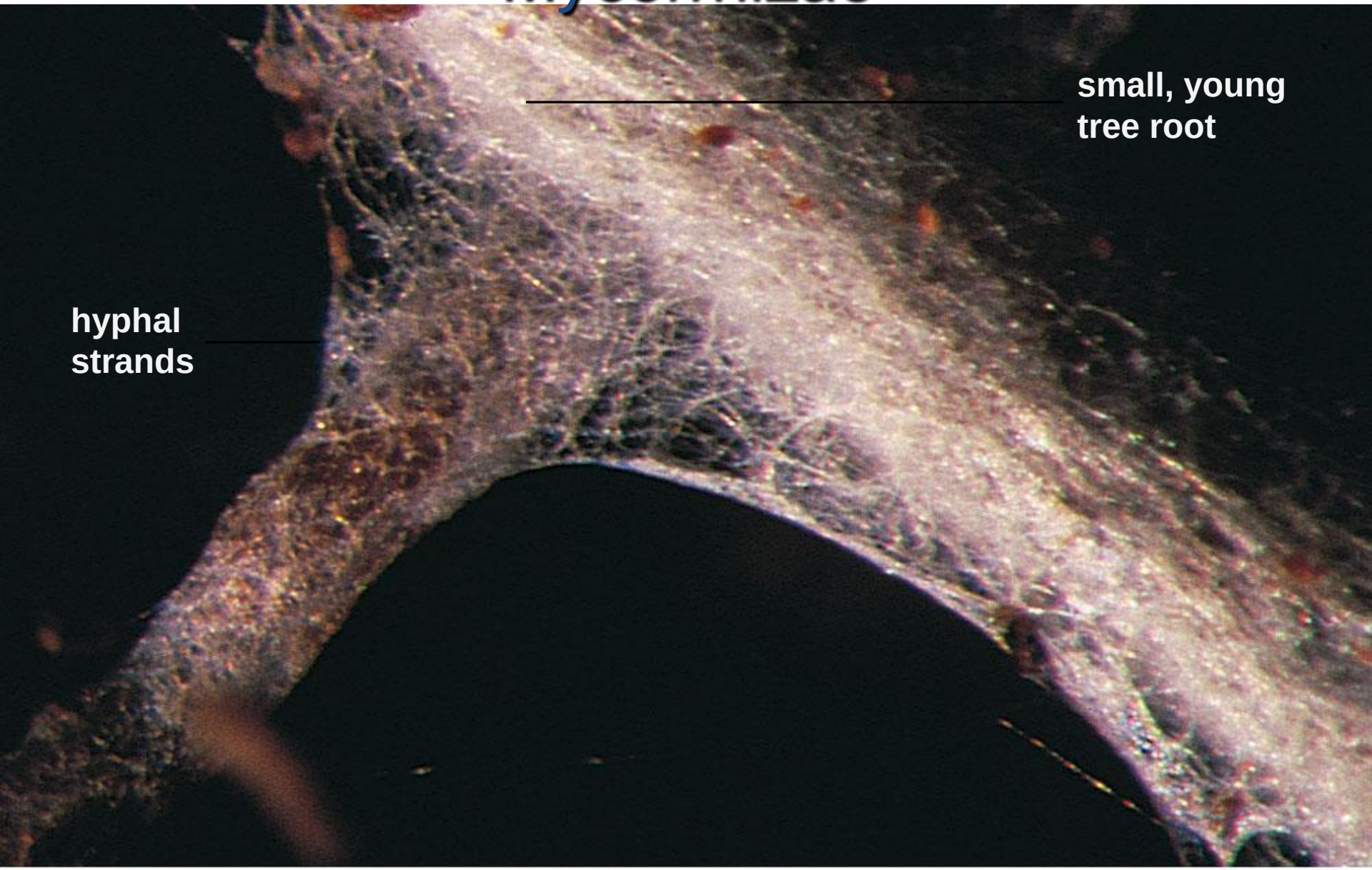


Fig. 24-12b, p.399

Mycorrhizae

Fig. 24-12c, p.399

Fungi in Decline?

- Numbers and kinds of mushrooms are declining
- **Decline correlates with rising air pollution**
- If the fungal symbionts of trees and other plants are killed, ecosystems will be disrupted

Fig. 24-13, p.401

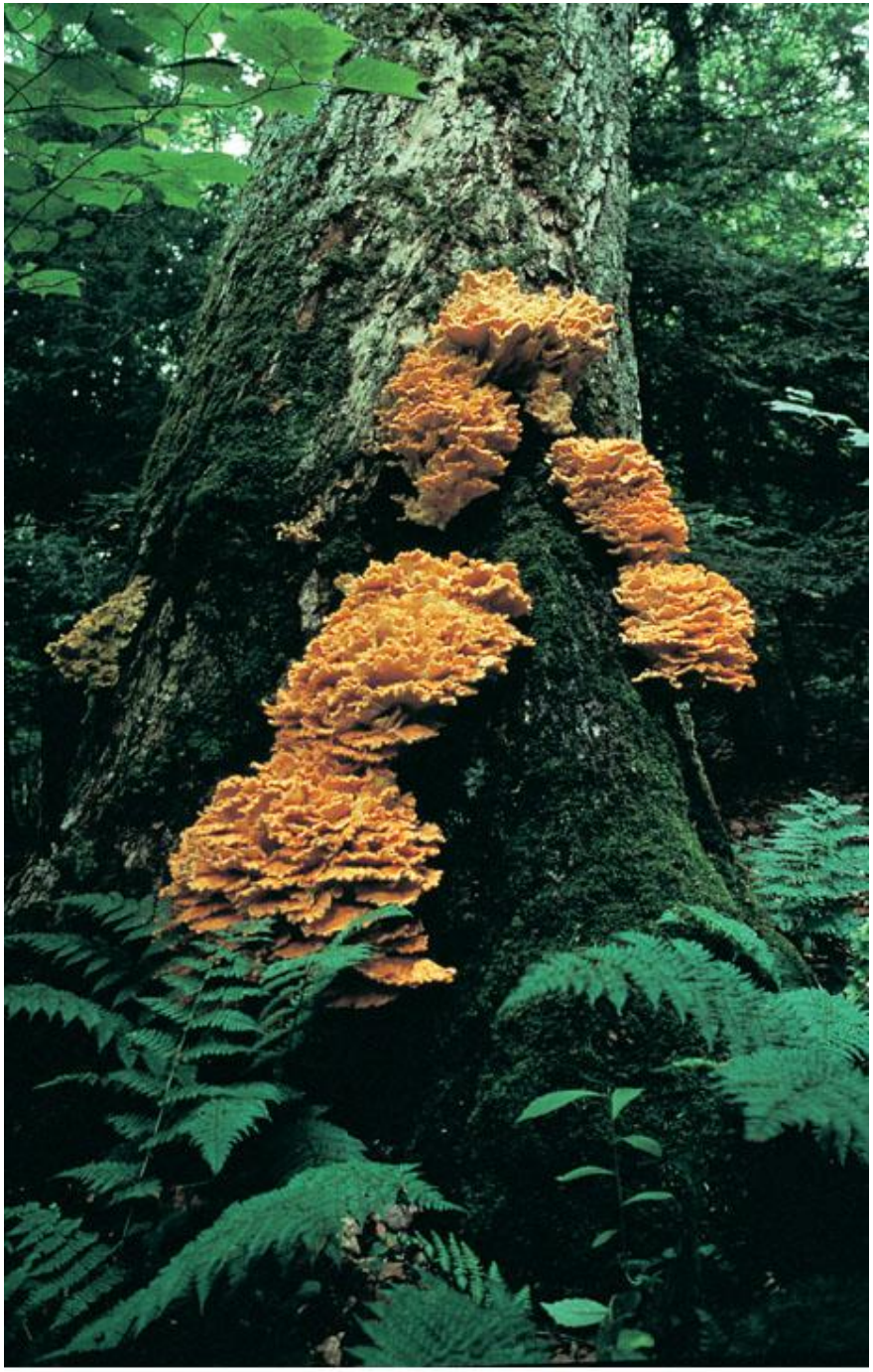


Fig. 24-14, p.401

Fig. 24-15
p.401

Fig. 24-15b, p.401