Plants, Fungi, and the Colonization of Land

• Citrus growers face a dilemma
  – They use chemicals to control disease-causing fungi
  – But these also kill beneficial mycorrhizae

Plants and Fungi—A Beneficial Partnership

• Mutually beneficial associations of plant roots and fungi are common
  – These associations are called mycorrhizae
  – They may have enabled plants to colonize land

17.1 What is a plant?

• Plants are multicellular photosynthetic eukaryotes
  – They share many characteristics with green algae
  – However, plants evolved unique features as they colonized land

• Unlike algae, plants have vascular tissue
  – It transports water and nutrients throughout the plant body
  – It provides internal support
17.2 Plants evolved from green algae called charophyceans

- Molecular studies indicate that green algae called charophyceans are the closest relatives of plants

17.3 Plant diversity provides clues to the evolutionary history of the plant kingdom

- Two main lineages arose early from ancestral plants

- One lineage gave rise to bryophytes
  - These are plants that lack vascular tissue
  - Bryophytes include mosses, which grow in a low, spongy mat

- Sphagnum moss

- Cooksonia was one of the earliest vascular land plants
• “Leafy” liverwort, *Porella*

- Vascular plants are the other ancient lineage
- Ferns and seed plants were derived from early vascular plants and contain
  - xylem and phloem
  - well-developed roots
  - rigid stems

• Ferns are seedless plants whose flagellated sperm require moisture to reach the egg

- Mature fern

- A major step in plant evolution was the appearance of seed plants
  - Gymnosperms
  - Angiosperms
- These vascular plants have pollen grains for transporting sperm
- They also protect their embryos in seeds
• Gymnosperms, such as pines, are called naked seed plants
  – This is because their seeds do not develop inside a protective chamber
• The seeds of angiosperms, flowering plants, develop in ovaries within fruits

• Douglas fir
• Frasier fir,

ALTERNATION OF GENERATIONS AND PLANT LIFE CYCLES
17.4 Haploid and diploid generations alternate in plant life cycles
• The haploid gametophyte produces eggs and sperm by mitosis
  – The eggs and sperm unite, and the zygote develops into the diploid sporophyte
  – Meiosis in the sporophyte produces haploid spores, which grow into gametophytes

17.5 Mosses have a dominant gametophyte
• Most of a mat of moss consists of gametophytes
  – These produce eggs and swimming sperm
  – The zygote stays on the gametophyte and develops into the less conspicuous sporophyte
17.6 Ferns, like most plants, have a dominant sporophyte

- Ferns, like mosses, have swimming sperm
- The fern zygote remains on the small, inconspicuous gametophyte
  – Here it develops into the sporophyte

17.7 Seedless plants formed vast “coal forests”

- Ferns and other seedless plants once dominated ancient forests
  – Their remains formed coal

- Fern sporophytes emerging from gametophytes

- Lycophyte

- Horsetail
• Gymnosperms that produce cones, the conifers, largely replaced the ancient forests of seedless plants
  – These plants remain the dominant gymnosperms today

17.9 The flower is the centerpiece of angiosperm reproduction

• Most plants are angiosperms
  – The hallmarks of these plants are flowers

17.10 The angiosperm plant is a sporophyte with gametophytes in its flowers

• The angiosperm life cycle is similar to that of conifers
  – But it is much more rapid
  – In addition, angiosperm seeds are protected and dispersed in fruits, which develop from ovaries

17.11 The structure of a fruit reflects its function in seed dispersal

• Fruits are adaptations that disperse seeds

• Seed dispersal
17.12 Connection: Agriculture is based almost entirely on angiosperms

- Gymnosperms supply most of our lumber and paper
- Angiosperms provide most of our food
  - Fruits, vegetables, and grains
- Angiosperms also provide other important products
  - Medications, fiber, perfumes

17.13 Interactions with animals have profoundly influenced angiosperm evolution

- Angiosperms are a major source of food for animals
  - Animals also aid plants in pollination and seed dispersal

17.14 Connection: Plant diversity is a nonrenewable resource

- 20% of the tropical forests worldwide were destroyed in the last third of the 20th century
- The forests of North America have shrunk by almost 40% in the last 200 years

- Deforestation

- Some plants in these forests can be used in medicinal ways
  - More than 25% of prescription drugs are extracted from plants
Plants probably moved onto land along with mycorrhizal fungi

- These fungi help plants absorb water and nutrients
- They are mutualistic organisms

Other fungi are

- parasites
- predators
- decomposers of dead organisms

Fungi are heterotrophic eukaryotes

- They digest their food externally and absorb the nutrients