

- 1 **Chapter 12**
The Eukaryotes: Fungi, Algae, Protozoa, and Helminths
- 2 **Fungi**
- 3 **Fungi**
- 4
- 5 **Molds**
 - The fungal thallus consists of hyphae; a mass of hyphae is a mycelium.
- 6 **Yeasts**
 - Unicellular fungi
 - Fission yeasts divide symmetrically
 - Budding yeasts divide asymmetrically
- 7 **Vegetative Growth**
- 8 **Fungal Dimorphism**
 - Pathogenic dimorphic fungi are yeastlike at 37°C and moldlike at 25°C
- 9 **Asexual Reproduction**
 - Conidia or conidiospores: (are asexual, non-motile spores)
- 10 **Asexual Reproduction**
 - Arthroconidia: (produced by segmentation of pre-existing fungal hyphae)
- 11 **Asexual Reproduction**
 - Blastoconidia: (unit of asexual reproduction produced by budding)
- 12 **Asexual Reproduction**
 - Chlamydoconidia:(conidium that is thick-walled)
- 13 **Asexual Reproduction**
 - Sporangiospores (fungal, or algal structure producing and containing spores)
- 14 **Sexual Reproduction**
 - Three phases:
 - Plasmogamy: Haploid donor cell nucleus (+) penetrates cytoplasm of recipient cell (-)
 - Karyogamy: + and – nuclei fuse
 - Meiosis: Diploid nucleus produces haploid nuclei (sexual spores)
- 15 **Sexual Spores**
 - Zygosporangium: Fusion of haploid cells produces one zygosporangium
- 16 **Sexual Spores**
 - Ascospore: Formed in a sac (ascus).
- 17 **Sexual Spores**
 - Basidiospore: Formed externally on a pedestal (basidium)
- 18 **Medically Important Phyla of Fungi**
 - Zygomycota
 - Ascomycota
 - Anamorphs
 - Basidiomycota
 -
- 19 **Fungal Diseases (Mycoses)**

- Systemic mycoses: Deep within body
- Subcutaneous mycoses: Beneath the skin
- Cutaneous mycoses: Affect hair, skin, and nails
- Superficial mycoses: Localized, e.g., hair shafts
- Opportunistic mycoses: Caused by normal microbiota or environmental fungi

20 **Zygomycota**

- Conjugation fungi
- Coenocytic- multinucleate
- Produce sporangiospores and zygospores
 - *Rhizopus*, *Mucor* (opportunistic, systemic mycoses)

21 **The Life Cycle of a Zygomycete**

22 **Ascomycota**

- Sac fungi
- Septate
- Teleomorphic fungi
 - Produce sexual and asexual spores
- Ascospores and frequently conidiospores
 - *Aspergillus* (opportunistic, systemic mycosis)
 - *Blastomyces dermatitidis*, *Histoplasma capsulatum* (systemic mycoses)
 - *Microsporium*, *Trichophyton* (cutaneous mycoses)

23 **The Life Cycle of an Ascomycete**

24 **Anamorphs**

- Produce asexual spores only
 - rRNA sequencing places most in Ascomycota; a few are Basidiomycota
 - *Penicillium*
 - *Sporothrix* (subcutaneous mycosis)
 - *Stachybotrys*, *Coccidioides*, *Pneumocystis* (systemic mycoses)
 - *Candida albicans* (cutaneous mycoses)

25 **Basidiomycota**

- Club fungi
- Septate
- Produce basidiospores and sometimes conidiospores
 - *Cryptococcus neoformans* (systemic mycosis)

26 **The Life Cycle of a Basidiomycete**

27 **Economic Effects of Fungi**

- *Saccharomyces cerevisiae*: Bread, wine, HBV vaccine
- *Trichoderma*: Cellulase
- *Taxomyces*: Taxol
- *Entomophaga*: Biocontrol
- *Paecilomyces*: Kills termites

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- ✓ Assume you isolated a single-celled organism that has a cell wall. How would you determine that it is a fungus and not a bacterium? 12-1
- ✓ Contrast the mechanism of conidiospore and ascospore formation. 12-2
- ✓ List the asexual and sexual spores made by Zygomycetes, Ascomycetes, and Basidiomycetes. 12-3
- ✓ Are yeasts beneficial or harmful? 12-4

✓

29 **Lichens**30 **Lichens**

- Mutualistic combination of an alga (or cyanobacterium) and fungus
- Alga produces and secretes carbohydrates; fungus provides holdfast

31 **Three Types of Lichens**32 **Lichen Thallus**33 **Economic Effects of Lichens**

- Dyes
- Antimicrobial (*Usnea*)
- Litmus

34

- ✓ What is the role of lichens in nature? 12-5
- ✓ What is the role of the fungus in a lichen? 12-6

✓

✓

35 **Algae**36 **Algae**37 **Algal Habitats**38 **Brown Alga**39 **Phaeophyta**

- Brown algae (kelp)
- Cellulose and alginic acid cell walls
- Multicellular
- Chlorophyll *a* and *c*, xanthophylls
- Store carbohydrates
- Harvested for algin

40 **Rhodophyta**

- Red algae
- Cellulose cell walls
- Most are multicellular
- Chlorophyll *a* and *d*, phycobiliproteins
- Store glucose polymer
- Harvested for agar and carrageenan

41 **Chlorophyta**

- Green algae
- Cellulose cell walls
- Unicellular or multicellular
- Chlorophyll *a* and *b*
- Store glucose polymer
- Gave rise to plants

42 **Diatoms**

- Pectin and silica cell walls
- Unicellular
- Chlorophyll *a* and *c*, carotene, xanthophylls
- Store oil
- Fossilized diatoms formed oil
- Produce domoic acid

43 **Dinoflagellates**

- Cellulose in plasma membrane
- Unicellular
- Chlorophyll *a* and *c*, carotene, xanthins
- Store starch
- Some are symbionts in marine animals
- Neurotoxins cause paralytic shellfish poisoning

44 **Oomycota**

- Water molds
- Cellulose cell walls
- Multicellular
- Chemoheterotrophic
- Produce zoospores
-

45 **Oomycota**46 **Oomycota**

- Decomposers and plant parasites
 - *Phytophthora infestans* responsible for Irish potato blight
 - *P. cinnamomi* infects *Eucalyptus*
 - *P. ramorum* causes sudden oak death

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- ✓ How do algae differ from bacteria? From fungi? 12-7
- ✓ List the cell wall composition and diseases caused by the following algae: diatoms, dinoflagellates, oomycotes. 12-8, 12-9
- ✓
- ✓
- ✓
- ✓

48 **Protozoa**49 **Protozoa**50 **Characteristics of Protozoa**

- Vegetative form is a trophozoite
- Asexual reproduction is by fission, budding, or schizogony (multiple fission of nucleus)
- Sexual reproduction by conjugation
- Some produce cysts

51 **Medically Important Phyla of Protozoa**

- Archaezoa
- Microspora
- Amoebozoa
- Apicomplexa
- Ciliophora

- Euglenozoa
- 52 **Archaezoa**
 - No mitochondria
 - Multiple flagella
 - *Giardia lamblia*
 - *Trichomonas vaginalis* (no cyst stage)
- 53 **Archaezoa**
- 54 **Microspora**
 - No mitochondria
 - Nonmotile
 - Intracellular parasites
 - *Nosema*
- 55 **Amoebozoa**
 - Move by pseudopods
 - *Entamoeba*
 - *Acanthamoeba*
- 56 **Apicomplexa**
 - Nonmotile
 - Intracellular parasites
 - Complex life cycles
 - *Plasmodium*
 - *Babesia*
 - *Cryptosporidium*
 - *Cyclospora*
- 57 **The Life Cycle of *Plasmodium vivax***
- 58 **Ciliates**
 - Move by cilia
 - Complex cells
 - *Balantidium coli* is the only human parasite
- 59 **Euglenozoa**
 - Move by flagella
 - Euglenoids
 - Photoautotrophs
 -
- 60 **Euglenozoa**
 - Move by flagella
 - Hemoflagellates
 - *Trypanosoma* spp.
 - Sleeping sickness
 -
 -
- 61
 - ✓ Identify three differences between protozoa and animals. 12-10
 - ✓ Do protozoa have mitochondria? 12-11
 - ✓ Where does *Plasmodium* undergo sexual reproduction? 12-12
 - ✓

✓

62 **Slime Molds**63 **The Life Cycle of a Cellular Slime Mold**64 **The Life Cycle of a Plasmodial Slime Mold**65

✓ Why are slime molds classified with amoeba and not fungi? 12-13

✓

✓

✓

✓

66 **Helminths**67 **Helminths**68 **Helminths (Parasitic Worms)**

- Kingdom: Animalia
 - Phylum: Platyhelminthes (flatworms)
 - Class: Trematodes (flukes)
 - Class: Cestodes (tapeworms)
 - Phylum: Nematoda (roundworms)

69 **Characteristics of Helminths**

- Reduced digestive system
- Reduced nervous system
- Reduced locomotion
- Complex reproduction

70 **Life Cycle of Helminths**

- Monoecious (hermaphroditic)
 - Male and female reproductive systems in one animal
- Dioecious
 - Separate male and female
- Egg → larva(e) → adult

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✓ Why are the drugs used to treat parasitic helminths often toxic to the host? 12-14

✓ Of what value is the complicated life cycle of parasitic helminths? 12-15

✓

✓

✓

✓

✓

✓

72 **Helminths**73 **Trematodes, or Flukes**74 **The Life Cycle of Trematodes**75 **Cestodes, or Tapeworms**76 **Human as**

77 **Humans as Intermediate Host**78 **Nematodes**79 **The Heartworm *Dirofilaria immitis***80 **Eggs Infective for Humans**81 **Larvae Infective for Humans**82

- ✓ Differentiate *Paragonimus* and *Taenia*. 12-16
- ✓ What is the definitive host for *Enterobius*? 12-17
- ✓ What stage of *Dirofilaria immitis* is infectious for dogs and cats? 12-18
- ✓ You find a parasitic worm in a baby's diapers. How would you know whether it's a *Taenia* or a *Necator*? 12-19
- ✓

83 **Arthropods as Vectors**84 **Arthropods as Vectors**

- May transmit diseases (vectors)
- Kingdom: Animalia
 - Phylum: Arthropoda (exoskeleton, jointed legs)
 - Class: Insecta (6 legs)
 - Lice, fleas, mosquitoes
 - Class: Arachnida (8 legs)
 - Mites and ticks

85 **Arthropods as Vectors**

- Mechanical transmission
- Biological transmission
 - Microbe multiplies in vector
- Definitive host
 - Microbe's sexual reproduction in vector
-

86 **Arthropods as Vectors**87 **Arthropods as Vectors**88

- ✓ Vectors can be divided into three major types, according to roles they play for the parasite. List the three types and a disease transmitted by each. 12-20
- ✓ Assume you see an arthropod on your arm. How will you determine whether it is a tick or a flea? 12-21
- ✓
- ✓
- ✓
- ✓