

Chapter 12 The Eukaryotic Members of the Microbial World

Summary Outline

Classification of the Eucarya

- A. Cell structure in Eucarya is different from that seen in Bacteria or Archaea.
 - B. Use of the terms algae, fungi and protozoa are not accurate classification terms when you consider the rRNA sequences of these organisms.
- 12.1. **Algae** are a diverse group of photosynthetic organisms that contain chlorophyll.
- A. **Classification of algae** is based on their major **photosynthetic pigments**. Organisms are placed on the phylogenetic tree according to **rRNA sequences**.
 - B. **Algae** are found in **fresh and salt water** as well as **soil**; **unicellular algae** make up part of the **phytoplankton**.
 - C. **Structure of algae**
 - 1. **Microscopic** or **macroscopic**.
 - 2. **Cell walls** are made of **cellulose** and materials such as agar and carrageenan.
 - 3. They have membrane **bound organelles** including a nucleus, chloroplasts and mitochondria.
 - D. **Algal reproduction** is **asexual** or sexual.
 - E. **Paralytic shellfish poisoning** is caused by toxins that are ingested by fish and shellfish.
- 12.2. **Protozoa** are **microscopic, unicellular organisms** that lack chlorophyll, are motile during at least one stage in their development and reproduce most often by binary fission.
- A. **Classification of protozoa** is based on **rRNA**.
 - 1. Protozoa have traditionally been grouped based on their mode of locomotion.
 - 2. **Sarcomastigophora** include
 - a) **Mastigophora**—the **flagellated protozoa**
 - b) **Sarcodina**—move by means of **pseudopodia**
 - 3. **Ciliophora** move by means of **cilia**.
 - 4. **Apicomplexa (sporozoa)** include *Plasmodium sp.*, the cause of **malaria**.
 - 5. **Microsporidia**, an intracellular protozoan, causes disease in immunocompromised individuals.
 - B. **Protozoa** are usually **free-living** and found in **marine and fresh water** as well as **terrestrial environments**. They are important **decomposers** and are an important part of the **food chain**.
 - C. **Structure of protozoa**
 - 1. Protozoa **lack a cell wall** but most maintain a definite shape using the underlying ectoplasm.
 - 2. **Life cycles** are often **complex** and include more than one habitat.
 - 3. **Protozoa** feed by either **phagocytosis** or **pinocytosis**.
 - D. Protozoan **reproduction** is often by **binary fission**; some reproduce by **multiple fission** or **schizogony**.
 - E. Protozoa cause some serious disease such as **malaria**, **sleeping sickness**, **toxoplasmosis** and **vaginitis**.
- 12.3. **Fungi** can cause serious disease, primarily in plants, but they also produce useful food products. They include yeast, molds and mushrooms.
- A. **Classification of fungi** includes four groups of true fungi
 - 1. **Zygomycetes**
 - 2. **Ascomycetes**

3. **Basidiomycetes**
4. **Deuteromycetes or Fungi Imperfecti**
5. **Chytridiomycetes** are close relatives.

- B. **Structure**
1. **Fungal filaments** are called **hyphae** and a group of hyphae is called a **mycelium**.
 2. **Dimorphic fungi** can grow either as a **single cell (yeast)** or a **mycelia**.
- C. **Fungi inhabit** just about every ecological niche and can spoil a large variety of food materials because they can grow in high concentrations of sugar, salt and acid.
1. Fungi can be found in **moist environments** at temperatures from **-6°C to 50°C** and **pH from 2.2 to 9.6**.
 2. Fungi are heterotrophs with enzymes that can degrade most organic materials.
- D. **Fungal disease** in humans
1. Fungi may produce an **allergic reaction**.
 2. They may produce a **toxin** that can make humans ill such as **ergot, poisonous mushrooms, or aflatoxin**.
 3. They cause mycoses such as
 - a) **Histoplasmosis**
 - b) **Coccidioidomycosis**
 - c) **Candidiasis**
- E. **Symbiotic relationships** between fungi and other organisms
1. **Lichens** result from an association of a fungus with a photosynthetic organism such as an alga or a cyanobacterium.
 2. **Mycorrhizas** are the result of an intimate association of a fungus and the roots of a plant.
- F. **Economic importance** of fungi
1. The yeast *Saccharomyces* is used in the production of **beer, wine and bread**.
 2. **Penicillin** and other fungi **synthesize antibiotics**.
 3. Fungi **spoil** many **food** products.
 4. Fungi **cause diseases of plants** such as Dutch elm disease and wheat rust.
 5. Fungi have been **useful tools in genetic and biochemical studies**.
- 12.4 **Acellular and cellular slime molds** are important links in the **terrestrial food chain**. **Oomycetes**, also known as water molds, cause some serious **diseases of plants**.
- 12.5 **Multicellular parasites**: arthropods and helminths
- A. **Arthropods**
1. Arthropods act as **vectors for disease**.
 2. **Mosquitoes** spread diseases such as **malaria** by picking up disease-causing organisms when the mosquito bites, and later injecting organisms into subsequent organisms that it bites.
 3. **Fleas** transmit disease such as **plague**, **lice** can transmit **trench fever, epidemic typhus and relapsing fever**.
 4. **Ticks** are implicated in **Rocky Mountain spotted fever** and **Lyme disease**.
 5. **Mites** cause **scabies**, and **dust mites** are responsible for **allergies** and **asthma**.
- B. **Helminths**
1. Most **nematodes** or **roundworms** are free-living, but they may cause serious disease such as **pinworm disease, whipworm disease, hookworm disease** and **ascariasis**.
 2. **Cestodes** are **tapeworms** with segmented bodies and hooks to attach to the wall of the intestine. Most tapeworm infections occur in persons who eat uncooked or undercooked meats; some tapeworms are acquired by ingesting fleas infected with dog or cat tapeworms.
 3. **Trematodes**, or **flukes**, often have complicated life cycles that necessarily involve more than one host.
 4. *Schistosoma mansonii* cercaria can **penetrate the skin** of persons wading in infected waters and cause serious disease.

Terms You Should Know

Acellular slime mold	Gametes	Neurotoxin
Alfatoxins	Germ tube	Oomycetes (water mold)
Algology	Haploid	Phytoplankton
Arthropods	Haustoria	Plasmodium
Biological vector	Helminths	Protozoology
Bladder (float)	Histoplasmosis	Pseudopodia
Blade	Holdfast	Rhizoids
Candidiasis	Hyphae	Schizogony
Cellular slime mold	Lichen	Stipe
Cercaria	Mechanical vector	Trematode
Cestode	Meiosis	Trophozoite
Coccidioidomycosis	Molds	Vector
Cyst	Mycelium	Yeast
Dimorphic fungi	Mycology	Zooplankton
Diploid	Mycorrhiza	Zoospore
Ergot	Mycoses	Zygote
Foraminifera	Nematode	

Microorganisms to Know

<i>Gymnodinium breve</i>	<i>Toxoplasma gondii</i>	<i>Puccinia graminis</i>
<i>Gonyzularia</i> species	<i>Naegleria</i> species	<i>Neurospora crassa</i>
<i>Pfiesteria piscida</i>	<i>Cryptosporidium parvum</i>	<i>Phytophthora infestans</i>
<i>Giardia lamblia</i>	<i>Coccidioides immitis</i>	<i>Pediculus humanus</i>
<i>Leishmania</i> species	<i>Aspergillus</i>	<i>Phthirus pubis</i>
<i>Trichomonas vaginalis</i>	<i>Histoplasma capsulatum</i>	<i>Dermacentor andersoni</i>
<i>Trypanosoma brucei</i>	<i>Candida albicans</i>	<i>Ixodes scapularis</i>
<i>Entamoeba histolytica</i>	<i>Saccharomyces</i>	<i>Demodex folliculorum</i>
<i>Balantidium coli</i>	<i>Penicillium</i>	<i>Demodex brevis</i>
<i>Plasmodium</i>	<i>Rhizopus</i>	<i>Sarcoptes scabiei</i>
<i>Anopheles</i> mosquito	<i>Ceratocystis ulmi</i>	<i>Schistosoma mansoni</i>

Learning Activities

1. List five characteristics of algae.

1.
2.
3.
4.
5.

2. Match the organism with the appropriate group.

	Organism	Group
	1. <i>Entamoeba</i>	A. Fungi
	2. <i>Enterobius vermicularis</i> (Pinworm)	B. Protozoans
	3. <i>Trypanosoma</i>	C. Algae
	4. Mosquito (<i>Aedes</i> , <i>Anopheles</i> , <i>Culex</i>)	D. Cestodes
	5. Housefly	E. Trematodes
	6. Mushroom and Puffball	F. Nematodes
	7. Tapeworm (<i>Taenia</i> sp.)	G. Arachnida
	8. <i>Plasmodium</i>	H. Insecta
	9. Yeast	
	10. Lice (<i>Pediculus</i>)	
	11. Mold	
	12. Fleas (Ex. <i>Xenopsylla</i>)	
	13. <i>Trichinella spiralis</i>	
	14. Ticks (<i>Dermacentor</i> , <i>Ixodes</i> , <i>Ornithodoros</i>)	
	15. <i>Gonyaulax</i>	
	16. <i>Giardia lamblia</i>	

3. List two major beneficial functions of algae.

1.
2.

4. Finish the table indicating the characteristics of the four groups of fungi and list an example of each group.

Group	Asexual reproduction	Sexual reproduction	Distinguishing characteristics	Example
Zygomycetes				
Basidiomycetes				
Ascomycetes				
Deuteromycetes				

5. Finish the following table giving the disease, if any, caused by the protozoan listed.

	Protozoan	Disease
1.	<i>Trypanosoma</i>	
2.	<i>Giardia</i>	
3.	<i>Trichomonas</i>	
4.	<i>Leishmania</i>	
5.	<i>Entamoeba</i>	
6.	<i>Balantidium coli</i>	
7.	<i>Plasmodium</i>	
8.	<i>Toxoplasma gondii</i>	
9.	<i>Cryptosporidium</i>	
10.	<i>Microsporidium</i>	

6. Name the major diseases caused by the following fungi.

Fungi	Disease
<i>Candida albicans</i>	
<i>Coccidioides immitis</i>	
<i>Filbasidiella neoformans</i>	
<i>Histoplasma capsulatum</i>	
<i>Pneumocystis carinii</i>	
<i>Sporothrix schenckii</i>	

7. Explain how Deuteromycetes is different from all of the other groups of fungi.

8. What is the most common route for the transmission of helminthic diseases to humans?

9. For the following helminths list the disease that they cause, if any, and the characteristics of that disease.

Organism	Disease	Disease Characteristics
<i>Enterobius vermicularis</i>		
<i>Trichuris trichiura</i>		
<i>Necator americanus</i>		
<i>Ancylostoma duodenale</i>		
<i>Strongyloides stercoralis</i>		
<i>Ascaris lumbricoides</i>		
<i>Trichinella spiralis</i>		
<i>Wuchereria bancrofti</i>		
<i>Taenia saginata</i> or <i>Taenia solium</i>		
<i>Diphyllobothrium latum</i>		
<i>Schistosoma mansoni</i>		

10. You would not like to have a tapeworm for your very own. List three ways that you could prevent acquisition of a tapeworm. (Include altering the life cycle of the parasite.)

1.	
2.	
3.	

11. Identify the following arthropods as mechanical or biological vectors and name a disease with which they are associated.

Arthropod	Type of vector	Disease
Housefly		
Louse		
Flea		
Mosquito		
Tick		

Self Test

- Which of the following statements describe algae?
 - They are eukaryotes.
 - They may be either microscopic or macroscopic.
 - They are classified according to their photosynthetic pigments.
 - All of the above statements are correct.
 - Only a and b are correct statements.
- Which of the following is the most likely way to get an infection of *Giardia lamblia*?
 - injection
 - ingestion of a cyst
 - mosquito bite
 - inhalation of an endospore
 - ingestion of a trophozoite
- Malaria is caused by which of the following organisms?
 - Toxoplasma*
 - Trypanosoma*
 - Trichomonas*
 - Giardia*
 - Plasmodium*
- Malaria is transmitted to humans by
 - ingesting cysts in water or food.
 - inhaling trophozoites.
 - mosquito bites.
 - dirty fingers.
 - handling cats.
- A unique feature of sporozoans is that they
 - divide by transverse binary fission.
 - reproduce exclusively by sexual means.
 - are not motile in the adult form.
 - reproduce exclusively by asexual means.
 - have two types of nuclei.
- Which of the following genera causes vaginitis?
 - Toxoplasma*
 - Giardia*
 - Plasmodium*
 - Trichomonas*
 - Trypanosoma*
- Which of the following statements describe protozoans?
 - They are eukaryotes.
 - They can be grouped on the basis of their means of motility.
 - They reproduce only by asexual means.
 - All of the above are correct statements.
 - Only a and b are correct.
- Which of the following statements about the Deuteromycetes are true?
 - Their usual habitat is aquatic.
 - Sexual reproduction is absent or unknown.
 - Their cell walls are cellulose.
 - All of the above statements are correct.
 - Only a and b are correct statements.
- Which of the following statements describe fungi?
 - They are eukaryotes.
 - Most fungi are anaerobic.
 - They reproduce only by sexual means.
 - All of the above statements are correct.
 - Only a and b are correct statements.
- Fungal infections of the skin are called
 - systemic mycoses.
 - superficial psychoses.
 - intermediate mycoses.
 - superficial mycoses.
 - yeasts.

