

PowerLecture:

Chapter 22

“Protists” – The Simplest Eukaryotes

Section 22.0: Weblinks and InfoTrac

See the **latest Weblinks and InfoTrac articles** for this chapter online

Videos: CNN

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➤ Biology, 2002, Vol. 6, *Sudden Oak Death* (1:56)

Impacts, Issues: **Tiny Critters, Big Impacts**

➤ Protists – structurally the simplest of all eukaryotes

➤ Foraminiferans and coccolithophores have shells or plates hardened with calcium carbonate

➤ Dover, England’s white chalk cliffs are the remains of coccolithophores that died and became compressed over millions of years

➤ Hagar Qim temple built from foraminiferan-rich limestone

Impacts, Issues: **Tiny Critters, Big Impacts**

➤ *P. ramorum* started an epidemic of sudden oak death in California costing the lives of tens of thousands of oaks

➤ The pathogen has now jumped to madrone, redwoods, and other novel hosts

Impacts, Issues Video

Section 22.1: Weblinks and InfoTrac

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Protists are Unlike Prokaryotes

➤ Have a nucleus and organelles

➤ Have proteins associated with DNA

➤ Use microtubules in a cytoskeleton, spindle apparatus, and cilia and flagella

➤ May contain chloroplasts

➤ May divide by mitosis and meiosis

Prokaryotes Vs Eukaryotes

Difficult to Classify

- Historically a catch-all kingdom
- Differ enormously from one another in morphology and life-styles
- Molecular and biochemical comparisons are clarifying the evolutionary picture
- Protistans are not a monophyletic group

Evolutionary Tree

Section 22.2: Weblinks and InfoTrac

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Trichomonads (Parabasalids)

Trichomonas vaginalis causes trichomoniasis, a sexually transmitted disease

Giardia (a Diplomonad)

- Internal parasite of humans, animals
- Survives outside of body as cysts
- Ingested cysts release trophozoites that attach to intestinal lining
- Causes giardiasis

Section 22.3: Weblinks and InfoTrac

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Euglenoids:

Evolutionary Puzzle

- Some heterotrophs
- Most have chloroplasts like green algae and plants
- Have flagella like flagellated protozoans
- Related to flagellated protozoans
- Acquired chloroplasts by endosymbiosis

Euglenoid Body Plan

Euglenoid Body Plan

Body plan of *Euglena*

Euglenoids Are a

Monophyletic Group

- Members share a common ancestor and derived traits that are present in no other group
- Unique traits
 - A storage carbohydrate
 - Type of eyespot

Trypanosomes (Kinetoplastids)

Section 22.4: Weblinks and InfoTrac

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Amoeboid Protozoans (Sarcodina)

- Move by means of cytoplasmic streaming and pseudopods
- Naked amoebas
- Foraminiferans
- Heliozoans
- Radiolarians

Naked Amoebas

- Change shape constantly
- Most are free-living cells that engulf their prey
- Some are symbionts in animal guts
- A few are opportunistic pathogens

Other Amoeboid Protozoans

- Foraminiferans
 - Calcium carbonate shell
- Radiolarians and Heliozoans
 - Shells of silica

Section 22.5: Weblinks and InfoTrac

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Alveolates

- Have tiny, membrane-bound sacs (alveoli) underneath their outer membranes
- Ciliates
- Sporozoans
- Dinoflagellates

Ciliates (Ciliphora)

- All heterotrophs
- Arrays of cilia allow movement and direct food into oral cavity
- Diverse life-styles

Body Plan of *Paramecium*

Ciliate Conjugation

- Most ciliates have two different nuclei
 - Large macronucleus
 - Smaller micronucleus
- Micronucleus participates in sexual reproduction (conjugation)
 - Partners exchange micronuclei

Ciliate Conjugation

Paramecium body plan

Ciliate Conjugation

Ciliate conjugation

Section 22.6: Weblinks and InfoTrac

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Videos: CNN

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- Biology, 2003, Vol. 7, *How Pfiesteria Kills* (2:30)

Flagellated Protozoans

- Have one or more flagella
- All are heterotrophs
- Euglenoids
- Kinetoplastids (include trypanosomes)
- Parabasalids (include trichomonads)
- Diplomonads (include *Giardia*)

Dinoflagellates

- Most are single photosynthetic cells

 - Important component of phytoplankton

 - Each has two flagella

 - Algal bloom is population explosion of dinoflagellates
- Pfiesteria piscicida***
- Associated with large fish kills
 - Complicated life cycle
 - Population explosions tied to water pollution

Apicomplexans

- Parasitic
- Complete part of the life cycle inside specific cells of a host organism
- Many have elaborate life cycles that require different hosts
- Many cause serious human disease

Section 22.7: Weblinks and InfoTrac

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Videos: CNN

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- Biology, 2003, Vol. 7, *Deadly Animals* (1:48)

Malaria

- Most prevalent in tropical and subtropical parts of Africa
- Kills a million Africans each year
- Caused by four species of *Plasmodium*
- Transmitted by *Anopheles* mosquitoes

Plasmodium Life Cycle

Apicomplexan life cycle

Cryptosporidium

- Motile infective stage (sporozoite) invades intestinal epithelium
- Causes cramps, watery diarrhea
- Commonly transmitted by water contaminated with cysts

Toxoplasma

- Cysts may be ingested with raw or undercooked meat
- Exposure to cysts from cat feces
- Symptoms are usually mild in people with normal immune function
- Infection during pregnancy can kill or damage the embryo

Section 22.8: Weblinks and InfoTrac

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Stramenopiles

- Unique trait is one of their two flagella has thin filaments projecting from it
- Cells have four outer membranes
- Include
 - Oomycetes
 - Chrysophytes
 - Brown algae

Chrysophytes (Chrysophyta)

- Mainly free-living photosynthetic cells
- Contain chlorophylls *a*, *c*₁, and *c*₂
- Four groups:
 - Golden algae
 - Diatoms

- Yellow-green algae - Coccolithophores

Diatoms

Coccolithophores

Brown Algae (Phaeophyta)

Section 22.9: Weblinks and InfoTrac

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Phytophthora

➤ Plant pathogens

➤ *Phytophthora infestans*

Late blight of potatoes

➤ *Phytophthora ramorum*

Sudden oak death

Phytophthora

Phytophthora

Oomycetes

➤ Large egg cell forms inside oogonium

➤ Saprobic decomposers, parasites, pathogens

• Water molds

• Downy mildews

• White rusts

• *Phytophthora*

Saprolegnia

Saprolegnia

Section 22.10: Weblinks and InfoTrac

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Red Algae (Rhodophyta)

➤ 4,100 species

➤ Most abundant in tropical seas

➤ Can grow at great depths (phycobilins)

➤ Complex life cycles may include very different forms

Red Algae

Red algae life cycle

Section 22.11: Weblinks and InfoTrac

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Green Algae (Chlorophyta)

Chlamydomonas Life Cycle

Chlamydomonas Life Cycle

Green algae life cycle

Section 22.12: Weblinks and InfoTrac

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Amoeba

Amoeboid motion

Cellular Slime Mold

➤ Acrasiomycota

➤ Amoeboid cells aggregate to form migrating mass, fruiting body

Cellular Slime Mold

Cellular slime mold life cycle

Plasmodial Slime Molds

➤ Myxomycota

➤ Cell walls break down during aggregation

➤ Plasmodium migrates, then differentiates to form spore-bearing structures

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