Chapter 28 - Protists

I. What Are the Protists?

A. Protists are small, often unicellular eukaryotes.
1. All protists, like other eukaryotes, have a nucleus.
2. All protists have histones associated with their DNA.
3. All protists have a cytoskeleton.

B. Protists can be defined only by what they are not.
1. Protists are all the eukaryotes that are not fungi, plants, or animals.
2. As a group, protists are paraphyletic in that they include some, but not all, descendants of the common ancestor of eukaryotes.

C. Protists exhibit a wide array of morphologies and lifestyles.
1. Many are microscopic single cells.
2. Some are multicellular organisms up to 60 meters long.
3. Some are parasitic; others are predatory or photosynthetic.
4. Some are sessile; others are motile.
5. Some have flexible, changing cell shape; others are encased in rigid tests.

D. A common feature of all protists is their tendency to live in moist habitats: wet soil, water, or inside other organisms.

II. Why Do Biologists Study Protists?

A. Impacts on Human Health and Welfare
1. The Irish potato famine
2. Malaria
3. Harmful algal blooms

B. Ecological Importance of Protists
1. Protists are extremely abundant in their habitats.
2. The abundance of protists makes them major players in the global carbon cycle.
3. Protists play a key role in marine food chains
4. How could protests help reduce global warming?

III. How Do Biologists Study Protists?

A. Microscopy: Studying Cell Structure
1. Light microscopy studies lead to the naming and initial characterization of many protist species known today.
2. Electron microscopic studies yield even better knowledge of protist structure.

B. Evaluating Molecular Phylogenies
1. Molecular analysis of the gene encoding for rRNA in small subunit of ribosome demonstrated that eight major eukaryotic groups were indeed monophyletic.
2. The resulting phylogenetic tree is the current best estimate of eukaryotic evolutionary history.
3. This tree shows that protists are paraphyletic, meaning they do not comprise *all* the descendants of a single common ancestor.

C. Combining Data from Microscopy and Phylogenies: Understanding the Origin of Mitochondria and Chloroplasts
1. What did the earliest eukaryotes look like?
2. The endosymbiotic theory (Lynn Margulis)
3. Do the data support the endosymbiosis theory?

D. Discovering New Lineages via Direct Sequencing
1. Protists are extensively studied because they are important model organisms in biology.
2. However, the study eukaryotic diversity has been rapidly advancing through the use of direct sequencing.
3. One direct sequencing study collected samples from depths of 250–3000 m below the ocean surface in waters off the shore of Antarctica.
revealed that the newly discovered eukaryotic species were as small as many bacteria.

IV. What themes occur in the diversification of protists?

A. Morphological Diversity
1. Organelles divide a large cell into compartments.

2. The evolution of multicellularity
3. Structures for support and protection

B. How Do Protists Find Food?
1. The large cell size of protists enabled some of them to develop a unique feeding strategy—ingesting other microbes.
2. Ingestive feeding
2. Absorptive feeding
3. Photosynthesis
4. Diversity in lifestyles

C. How Do Protists Move?
1. Cell crawling
2. Movement powered by cilia or flagella
3. Closely related protists can use very different forms of locomotion.

D. How Do Protists Reproduce?
1. Sexual vs. asexual reproduction
2. Variation in life cycles

V. Key Lineages of Protists

A. Excavates
1. Diplomonads
a. Morphological diversity:
b. Feeding and locomotion:
c. Reproduction: Only asexual reproduction
d. Human and ecological impacts:
2. Parabasalids
a. Morphological diversity:
b. Feeding and locomotion:
c. Reproduction: Most asexual; some sexual
d. Human and ecological impacts:

B. Discicristates: Euglenids
1. Morphological diversity:
2. Feeding and locomotion:
3. Reproduction: Only asexual
4. Human and ecological impacts: Important in freshwater food chains

C. Alveolates
1. Ciliates
a. Morphological diversity:
b. Feeding and locomotion:
c. Reproduction:
d. Human and ecological impacts: Live in the digestive tract of grazing animals, helping them digest plant food.
2. Dinoflagellates
a. Morphological diversity:
b. Feeding and locomotion:
c. Reproduction:
d. Human and ecological impacts: Important marine primary producers; some can form red tides
3. Apicomplexa
a. Morphological diversity:
b. Feeding and locomotion:
c. Reproduction: Sexually or asexually
d. Human and ecological impacts:

D. Stramenopiles
1. Oomycetes
a. Morphological diversity:
b. Feeding and locomotion:
c. Reproduction:
d. Human and ecological impacts:
2. Diatoms
a. Morphological diversity: Cells are supported by an external, silicon-rich glassy shell.
b. Feeding and locomotion:
c. Reproduction:
d. Human and ecological impacts:
3. Brown algae
a. Morphological diversity:

b. Feeding and locomotion:
c. Reproduction:
d. Human and ecological impacts:

E. Cercozoa—Foraminifera
1. Morphological diversity:
2. Feeding and locomotion:
3. Reproduction: Asexual and sexual reproduction
4. Human and ecological impacts: Sediments of tests solidify to form chalk, limestone, or marble

F. Plants--Red Algae
1. Morphological diversity:
2. Feeding and locomotion:
3. Reproduction:
4. Human and ecological impacts:

G. Ameobozoa--Plasmodial Slime Molds
1. Morphological diversity: Some species form a large multinucleated supercell.
2. Feeding and locomotion:
3. Reproduction: Sexual reproduction when food is scarce
4. Human and ecological impacts: Important decomposers in forests

Chapter Vocabulary

Eukarya
eukaryote
protists

malaria
Plasmodium
harmful algal bloom

food chain
primary producer
plankton
phytoplankton
carbon cycle
carbon sinks

synapomorphies
paraphyletic
endosymbiosis theory
symbiosis
endosymbiosis

direct sequencing
amoeba
life cycle
slug
fruiting body
Dictyostelium discoideum
chemotaxis

food vacuole
anal pore

Chlamydomonas
Volvox
colony
colonial growth
multicellular growth

pseudopodia
filter feeders
absorptive feeding
decomposer

detritus
parasite

photosynthesis
secondary endosymbiosis

Dictostelium discoideum
cell crawling

syngamy
alternation of generations
gametophyte
sporophyte
spore

excavates
diplomonads
Giardia intestinalis
Hexamida
parabasalids
discicristates
euglenids
alveolates
ciliates
conjugation
dinoflagellates
bioluminescence
cysts
apicomplexa
stramenopiles
oomycetes
hyphae

zoospores
diatomes
brown algae/ochtophyta
blades
stipe
holdfast
sessile
motile
cercozoa
foraminifera
foramen
red algae
amoebozoa
plasmodial slime molds
supercell