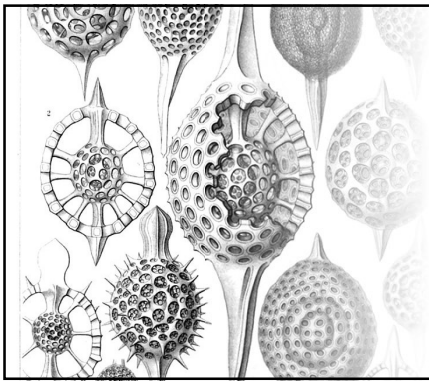


Protists

1

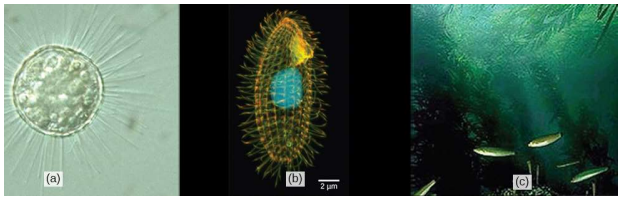
Part I: Protist morphology

- Describe the defining features of eukaryotes
- Define endosymbiosis and explain how it relates to the evolution of mitochondria and chloroplasts.

2

Eukaryotes vs. prokaryotes

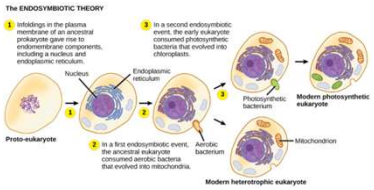
- Larger cells
- Presence of a cytoskeleton
- Internal compartmentalization
- A bit younger, appearing about 1.5 bya



3

Endosymbiosis

- Endosymbiosis increased complexity of organelle system
- Evidence:
  - DNA in mitochondria and chloroplasts
  - Ribosomes inside mitochondria are similar to bacterial ribosomes
- Chloroplasts and mitochondria replicate by binary fission



4

Part II: Protist groups

- Distinguish the six supergroups of protists
- Describe the protist supergroup that is a recent common ancestor to land plants, fungi and animals

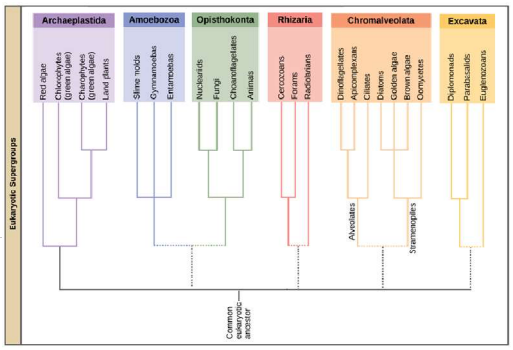
5

Major groups of eukaryotes

Excavata	Chomalveolata	Archaeplastida
Rhizaria	Amoebozoans	Ophisthokonts

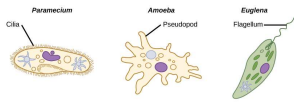
6

Protist cladogram



7

Classifying protists (1)



Cell surface
- Plasma membrane
- Extracellular material (ECM) [e.g., Silica shells of Diatoms]

Production of cysts
- Dormant cell with resistant outer covering
- Used for disease transmission

Locomotion
- Flagella
- Cilia
- Pseudopodia ("false feet")
  - Lobopods: Large, blunt
  - Filopods: Thin, branching
  - Axopods: Thin, long

8

Classifying protists (2)

Nutrition
- Phototrophs
- Heterotrophs
- Phagotrophs: Ingest particulate food matter
- Osmotrophs: Ingest soluble food matter
- Mixotrophs: Both phototrophic and heterotrophic

Multicellularity
- From single cells to colonies to true multicellularity
- Fosters specialization

9

Reproduction in protists

Asexual reproduction

- Mitosis: equal sized daughter cells
- Budding: One daughter cell is smaller
- Schizogony: cell division preceded by several nuclear divisions and produces several individuals

Sexual Reproduction

- Undergo sexual reproduction at times of stress, including food shortages.

10

Excavata

- Deep excavated oral groove
- Unicellular
- Atypical mitochondria

11

Diplomonads (Excavata)

- Unicellular
- Multiple flagella
- 2 haploid nuclei
- **Lack mitochondria**

12

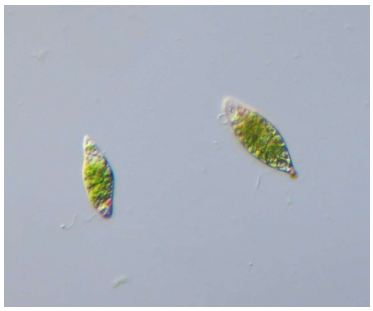
Parabasalids (Excavata)

- Unicellular
- 2 nuclei
- Undulating membrane for locomotion
- Semi functional mitochondria
- Cause of trichomoniasis (*Trichomonas vaginalis*)

13

Euglenozoa (Excavata)

- Atypical mitochondria
- Some have chloroplasts; autotrophic
- Others lack chloroplasts; heterotrophic
- Have a flexible pellicle
- No sexual reproduction



14

Understanding check

How are eukaryotic cells different than prokaryotic cells?

Based on the color of Euglena, how would you think it derives its food?

Some prokaryotes go through binary fission, what is the eukaryotic version of this?

15

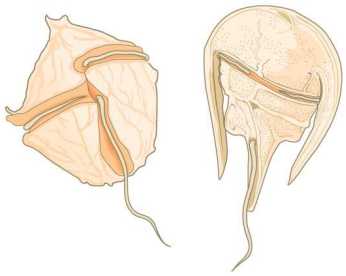
Chromalveolates

- Pigmented (chrom) w/ small cavity (alveoli)
- Very diverse
- Few shared traits
- Most are photosynthetic

16

Dinoflagellates (Alevolate)

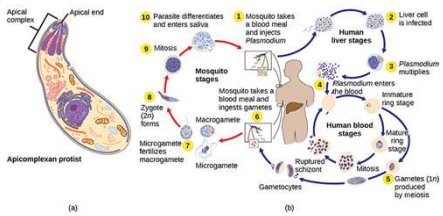
- Photosynthetic; chlorophyl *a*, *b*, carotenoids
- Some luminous
- Cellulous plates with silica
- Asexual
- Two flagella



17

Apicomplexans (Alevolate)

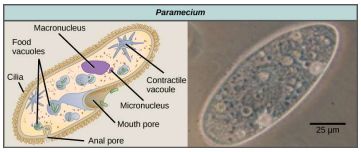
- Spore forming
- Parasitic
- Apical complex



18

Ciliates (Alevolates)

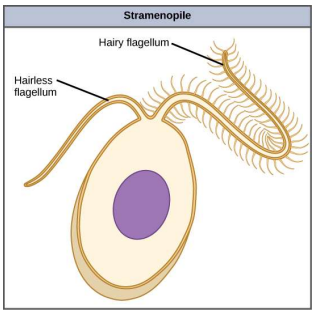
- Cilia (tiny beating hairs)
- Pellicle (outer membrane)
- A small micronucleus and a larger macronucleus
- Have anterior and posterior contractile vacuoles
- Micro and macronuclei are major component of conjugation



19

Stramenopila

- "Stramen": flagellum
- "Pilos": hair
- Highly diverse
- Two unequal flagella
- Hair like projections on flagella
- Heterotrophic and autotrophic



20

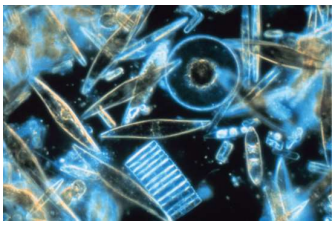
Brown algae (Stramenopila)

- Seaweed
- Photosynthetic pigments
- Haplodiplontic life cycle (multicellular)

21

Diatoms (Stramenopila)

- Double shell of silica
- Photosynthetic
- Chlorophyl *a*, *c*, carotenoids



22

Oomycetes (Stramenopila)

- Pathogenic saprobes (feed on dead material)
- Motile spores
- Aquatic and terrestrial

23

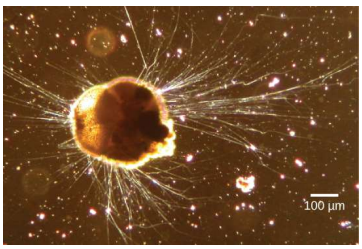
Rhizaria (root ,thread like projections)

- Unicellular
- Mostly aquatic
- Spiky pseudopods
- Amoeba like
- Hard outer shell of silica (tests)

24

Radiolarians (Rhizaria)

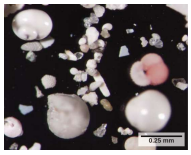
- Glassy exoskeletons made of silica
- Needle-like pseudopods



25

Foraminifera (Rhizaria)

- Heterotrophic marine protists
- Pore-studded shells (tests)
- Use podia for swimming and feeding
- Complex life cycles with haploid and diploid generations



26

Understanding check

Which strameopile is multicellular?

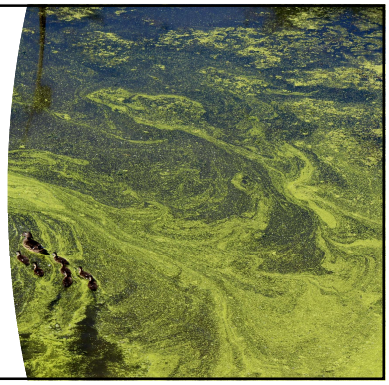
What gives diatoms their shape?

What about rhizarians?

27

Archaeplastida

- Photosynthetic
- Chloroplasts



28

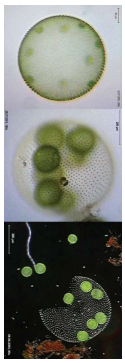
Rhodophyta (Archaeplastida)

- Lack flagella and centrioles
- Accessory photosynthetic pigments
- Haploid and diploid phases
- Mostly mutlicellular

29

Chlorophytes and Charophyes (Archaeplastida)

- Green algae
- Land plants arose from Charophytes
- Chlorophyll *a* and *b*
- Diverse
- Uni and multicellular
- Sexual and asexual reproduction



30

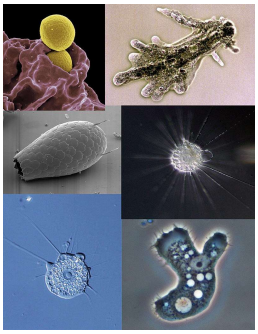
Amoebozoans

Blunt pseudopods

31

Amoeba (Amoebozoans)

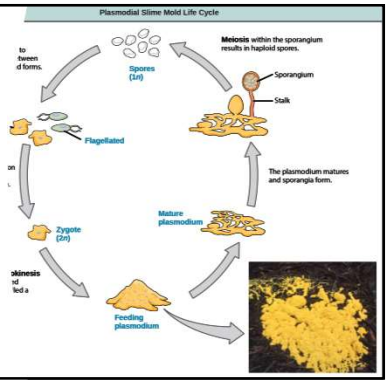
- Free living
- Soil, freshwater
- Some are parasitic



32

Plasmodial slime molds (Amoebozoans)

- Huge
- Single-celled
- Multinucleate
- Oozing masses



33

Cellular slime molds (Amoebozoans)

- Individual organisms
- Move and ingest bacteria
- Organisms aggregate to form a slug when food is scarce
- Slug differentiates

34

Opisthokants

- Unicellular organisms
- Collared flagellates
- Single posterior flagellum
- Fresh and marine environments
- Resemble sponges (animals)
- Example: Choanoflagellate

35

Understanding check

From what group do plants originate?

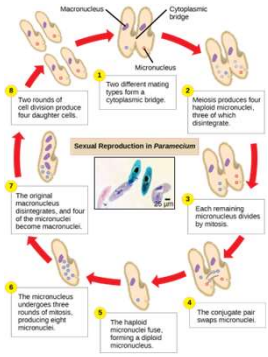
What is a pseudopod?

36

Part III: Life history of some major protist groups

- Describe the reproductive cycles of some major protist groups
  - Paramecium
  - Brown algae
  - Unicellular chlorophytes
  - Multicellular chlorophytes

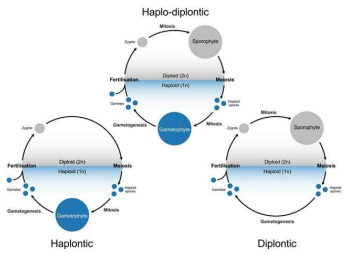
37



Conjugation in Paramecium

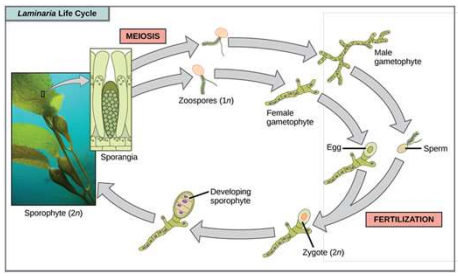
38

The three types of life cycles



39

Alternation of generation in Brown algae (Stramenopila)



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