

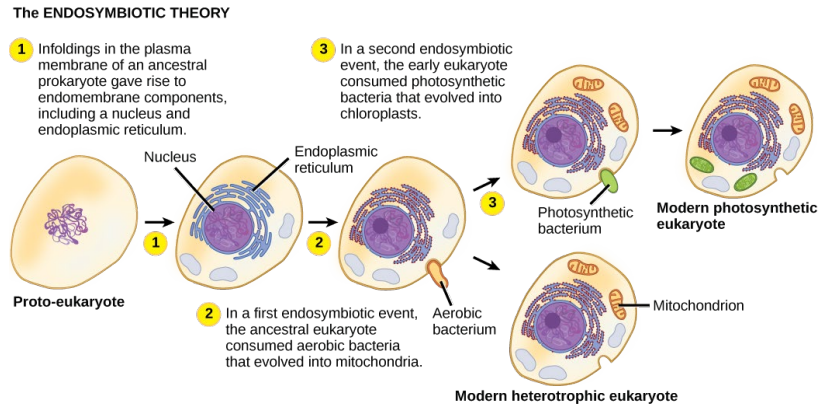
Biology 2e

Unit 5: Biological Diversity

Chapter 23: Protists

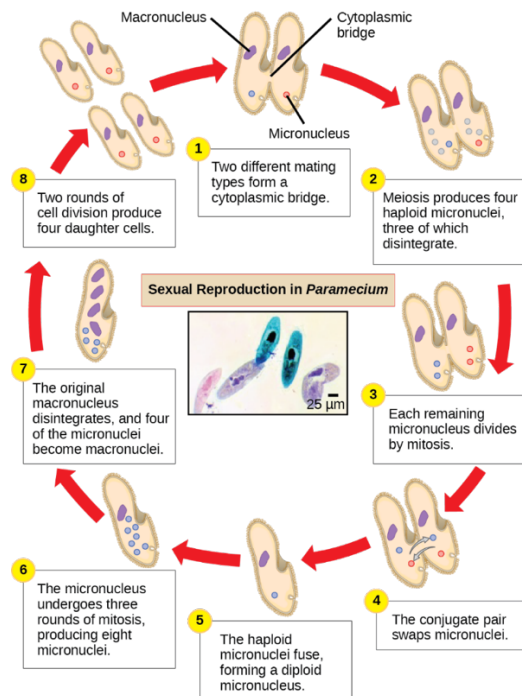
Visual Connection Questions

1. What evidence is there that mitochondria were incorporated into the ancestral eukaryotic cell before chloroplasts?



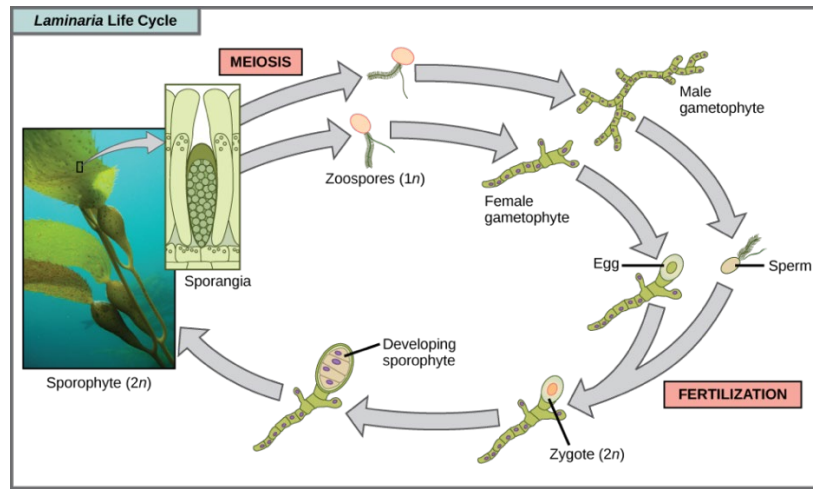
All eukaryotic cells have mitochondria, but not all eukaryotic cells have chloroplasts.

2. Which of the following statements about *Paramecium* sexual reproduction is false?



c. The conjugate pair swaps macronuclei.

3. Which of the following statements about the *Laminaria* life cycle is false?



c. The gametophyte is diploid.

Review Questions

4. What event is thought to have contributed to the evolution of eukaryotes?

d. oxygenation of the atmosphere

5. Which characteristic is shared by prokaryotes and eukaryotes?

c. DNA-based genome

6. Mitochondria most likely evolved by _____.

c. endosymbiosis

7. Which of these protists is believed to have evolved following a secondary endosymbiosis?

d. chlorarachniophytes

8. In 2016, scientists published the genome of *Monocercomonoides*, and demonstrated that this organism has no detectable mitochondrial genes. However, its genome was arranged in linear chromosomes wrapped around histones which are contained within the nucleus. *Monocercomonoides* is therefore a(n) _____.

c. Eukaryote

9. Which of the following observations about a bacterium would distinguish it from the last eukaryotic common ancestor?

b. Lack of a membrane-bound structure surrounding the genome

10. Protists that have a pellicle are surrounded by _____.

d. proteins

11. Protists with the capabilities to perform photosynthesis and to absorb nutrients from dead organisms are called _____.

b. mixotrophs

12. Which of these locomotor organs would likely be the shortest?

b. a cilium

13. Alternation of generations describes which of the following?

c. Both the haploid and diploid forms can be multicellular.

14. The amoeba *E. histolytica* is a pathogen that forms liver abscesses in infected individuals. Its metabolic classification is most likely _____.

a. Anaerobic heterotroph

15. Which protist group exhibits mitochondrial remnants with reduced functionality?

c. parabasalids

16. Conjugation between two *Paramecia* produces _____ total daughter cells.

c. 8

17. What is the function of the raphe in diatoms?

a. locomotion

18. What genus of protists appears to contradict the statement that unicellularity restricts cell size?

d. *Caulerpa*

19. A marine biologist analyzing water samples notices a protist with a calcium carbonate shell that moves by pseudopodia extension. The protist is likely to be closely related to which species?

d. *Ammonia tepida*

20. An example of carbon fixation is _____.

a. photosynthesis

21. Which parasitic protist evades the host immune system by altering its surface proteins with each generation?

b. *Trypanosoma brucei*

22. Which of the following is **not** a way that protists contribute to the food web?

b. They occupy the apex producer niche.

Critical Thinking Questions

23. Describe the hypothesized steps in the origin of eukaryotic cells.

Eukaryotic cells arose through endosymbiotic events that gave rise to the energy-producing organelles within the eukaryotic cells such as mitochondria and chloroplasts. The nuclear genome of eukaryotes is related most closely to the Archaea, so it may have been an early archaeon that engulfed a bacterial cell that evolved into a mitochondrion. Mitochondria appear to have originated from an alphaproteobacterium, whereas chloroplasts originated as a cyanobacterium. There is also evidence of secondary endosymbiotic events. Other cell components may also have resulted from endosymbiotic events.

24. Some aspects of eukaryotes are more similar to Archaea, while other aspects of eukaryotic cell composition appear more closely related to Bacteria. Explain how endosymbiosis could resolve this paradox.

The endosymbiotic theory proposes that one organism engulfed another, and the two co-evolved together until they could not exist independently. If a bacterium engulfed an archaeon, or vice versa, and the two developed an obligate symbiotic relationship, the resulting eukaryote thousands of years later would retain features from both original cells.

25. Explain in your own words why sexual reproduction can be useful if a protist's environment changes.

The ability to perform sexual reproduction allows protists to recombine their genes and produce new variations of progeny that may be better suited to the new environment. In contrast, asexual reproduction generates progeny that are clones of the parent.

26. *Giardia lamblia* is a cyst-forming protist parasite that causes diarrhea if ingested. Given this information, against what type(s) of environments might *G. lamblia* cysts be particularly resistant?

As an intestinal parasite, *Giardia* cysts would be exposed to low pH in the stomach acids of its host. To survive this environment and reach the intestine, the cysts would have to be resistant to acidic conditions.

27. Explain how the definition of protists ensures that the kingdom Protista includes a wide diversity of cellular structures. Provide an example of two different structures that perform the same function for their respective protist.

Protists are defined as any eukaryotes that do not fall into the Plantae, Fungi, or Animal Kingdoms. Since the unifying characteristics describe what they are NOT, rather than what they are, Protista can include almost any cellular/organism organization. Possible examples of structure variety:

- Barrier to exterior world: cell wall, plasma membrane, pellicle
- Locomotion: flagella, cilia, pseudopodia

28. The chlorophyte (green algae) genera *Ulva* and *Caulerpa* both have macroscopic leaf-like and stem-like structures, but only *Ulva* species are considered truly multicellular. Explain why. Unlike *Ulva*, protists in the genus *Caulerpa* actually are large, multinucleate, single cells. Because these organisms undergo mitosis without cytokinesis and lack cytoplasmic divisions, they cannot be considered truly multicellular.

29. Why might a light-sensing eyespot be ineffective for an obligate saprobe? Suggest an alternative organ for a saprobic protist.

By definition, an obligate saprobe lacks the ability to perform photosynthesis, so it cannot directly obtain nutrition by searching for light. Instead, a chemotactic mechanism that senses the odors released during decay might be a more effective sensing organ for a saprobe.

30. Opisthokonta includes animals and fungi, as well as protists. Describe the key feature of this phylum, and an example of how an organism in each kingdom uses this feature.

The key feature of Opisthokonts is the flagellum on the posterior end of cells.

Example organisms:

- Choanoflagellates use the flagellum for filter feeding.
- Sponges (animals) use the flagellum for filter feeding.
- Male gametes (animals) use the flagellum for locomotion.
- Fungi spores use the flagellum for locomotion.

31. Describe two ways in which paramecium differ from the projected traits of the last eukaryotic common ancestor.

Possible answers include:

- Two nuclei (a macronucleus and a micronucleus) instead of one nucleus
- Amitotic division/binary fission during asexual reproduction instead of mitotic cell division
- Mitosis of the micronucleus after meiosis instead of direct meiotic production of gametes for sexual reproduction

32. How does killing *Anopheles* mosquitoes affect the *Plasmodium* protists?

Plasmodium parasites infect humans and cause malaria. However, they must complete part of their life cycle within *Anopheles* mosquitoes, and they can only infect humans via the bite wound of a mosquito. If the mosquito population is decreased, then fewer *Plasmodium* would be able to develop and infect humans, thereby reducing the incidence of human infections with this parasite.

33. Without treatment, why does African sleeping sickness invariably lead to death?

The trypanosomes that cause this disease are capable of expressing a glycoprotein coat with a different molecular structure with each generation. Because the immune system must respond to specific antigens to raise a meaningful defense, the changing nature of trypanosome antigens prevents the immune system from ever clearing this infection. Massive trypanosome infection eventually leads to host organ failure and death.

34. Describe how increasing stress to the ocean would affect a food chain containing zooxanthellae, corals, parrotfish, and sharks.

Ocean stresses, such as rising temperatures or increasing levels of pollution, cause corals to expel their zooxanthellae symbionts. This leads to coral bleaching, and death if no new zooxanthellae colonize the corals. The dying corals will decrease the food source available to parrotfish, so the parrotfish population will decline. With fewer prey animals available, the shark population in the area will also decline.