Chapter 28

The Origins of Eukaryotic Diversity

1) Which of the following cause red tides?
   A) red algae (Rhodophyta)
   B) dinoflagellates
   C) diatoms
   D) Only A and C are correct.
   E) A, B, and C are correct.

2) A certain unicellular eukaryote has a siliceous (glasslike) shell and autotrophic nutrition. It is most likely a
   A) dinoflagellate.
   B) diatom.
   C) radiozoan.
   D) foraminifera.
   E) slime mold.

3) In what ways are all protists alike?
   A) They are all multicellular.
   B) They are all photosynthetic.
   C) They are all marine.
   D) They are all nonparasitic.
   E) They are all eukaryotic.

4) The strongest evidence for the endosymbiotic origin of eukaryotic organelles is the similarity between
   extant prokaryotes and
   A) nuclei and chloroplasts.
   B) mitochondria and chloroplasts.
   C) cilia and mitochondria.
   D) ribosomes and nuclei.
   E) ribosomes and cilia.

5) According to the endosymbiont theory of the origin of eukaryotic cells, how did mitochondria originate?
   A) infoldings of the plasma membrane
   B) engulfed, originally free-living prokaryotes
   C) mutations of genes for oxygen-using metabolism
   D) the nuclear envelope folding outward
   E) a protoeukaryote becoming symbiotic with a protobi~nt

6) Which feature of protists is probably endosymbiotic in origin?
   A) cysts
   B) microtubules
   C) acritarchs
   D) a nucleus
   E) mitochondria

7) If eukaryotic cells had first evolved in an environment much lower in 02 than was actually the case, how might eukaryotes be different today?
   A) They would all be unicellular.
   B) They would be unable to photosynthesize.
   C) They would be more motile.
   D) They would lack ribosomes.
   E) They would lack mitochondria.

8) Evidence for an endosymbiotic origin of chloroplasts and mitochondria includes which of the following?
   A) Both have circular DNA.
   B) Both have prokaryote-like ribosomes.
   C) Both have histone proteins associated with DNA.
   D) Only A and B are correct.
   E) A, B, and C are correct.

9) A biologist collects a previously unknown organism in a marine habitat. It is relatively large (about 0.5 meter long), photosynthetic, and has no vascular tissue. Should it be classified as a protist in a five-kingdom classification scheme?
   A) No, because it is too large.
   B) No, because it is photosynthetic.
   C) Yes, because it has a simple morphology.
   D) Yes, because it is multicellular.
   E) More information is necessary.

10) Why are red algae red?
A) They live in warm coastal waters.
B) They absorb blue and green light.
C) They use red light for photosynthesis.
D) They are related to cyanobacteria.
E) They lack chlorophyll.

11) Each of the following groups includes many planktonic species EXCEPT
A) kinetoplastids.
B) golden algae.
C) diatoms.
D) dinoflagellates.
E) actinopods.

12) In which group would you find organisms with the most complex cell structure?
A) ciliates
B) archaezoa
C) euglenozoa
D) brown algae
E) diplomonads

13) Which of the following CORRECTLY pairs a protist with one of its characteristics?
A) Kinetoplastids; slender pseudopodia
B) Rhizopoda; flagellated stages
C) Apicomplexa; all parasitic
D) Actinopoda; calcium carbonate shell
E) Foraminifera; abundant in soils

14) Which of the following includes unicellular, colonial, and multicellular members?
A) Chlorophyta only
B) Rhizopoda only
C) euglenoids only
D) Phaeophyta only
E) both Chlorophyta and Phaeophyta

15) The largest seaweeds belong to which group?
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A) Cyanobacteria
B) Rhodophyta (red algae)
C) Chlorophyta (green algae)
D) Phaeophyta (brown algae)
E) euglenoids

16) A biologist discovers an alga that is marine, multicellular,lives in fairly deep water, and has phycoerythrin. It probably belongs to which group?
A) Rhodophyta
B) Phaeophyta
C) Chlorophyta
D) Dino£lagellata
E) golden algae

17) The Irish potato famine was caused by what kind of organism?
A) bacterium
B) stramenopilan
C) foraminiferan
D) apicomplexan
E) virus

18) According to the endosymbiotic hypothesis, chloroplasts are most likely the descendants of
A) aerobic, heterotrophic prokaryotes.
B) photosynthetic prokaryotes.
C) photoautotrophic eukaryotes.
D) Only A and B are correct.
E) A, B, and C are correct.

19) According to the endosymbiotic theory, the ancestors of mitochondria were probably
A) aerobic eukaryotes.
B) aerobic bacteria.
C) anaerobic bacteria.
D) cyanobacteria.
E) chloroplasts.

20) Which process results in genetic recombination but is separate from reproduction in *Paramecitsnl*
A) budding
B) meiotic division
C) mitotic division
D) conjugation
E) fission

21) Protozoan protists are generally classified according to
A) nutrition.
B) cell shape.
C) size.
D) locomotion.
E) type of reproduction.

22) A snail-like, coiled shell of calcium carbonate is characteristic of
A) diatoms.
B) foraminifera.
C) heliozoans.
D) rhizopods.
E) ciliates.

23) Which of the following produces the dense glassy ooze of the deep ocean floor?
A) rhizopods
B) dinoflagellates
C) actinopods
D) ciliates
E) sporozoans

24) Members of the Chlorophyta often differ from members of Plantae in that some chlorophytans
A) are heterotrophs.
B) are unicellular.
C) have chlorophyll *a.*
D) store carbohydrates as starch.
E) have cellulose cell walls.

25) *Chlamydomonas* reproduces asexually unless
A) male and female zoospores are produced.
B) growth conditions are very favorable.
C) + and - strains are present.
D) four haploid cells are produced by mitosis.
E) the antheridium hooks around the oogonium to deposit sperm.

26) Ways in which *Volvox* has become advanced over *Chlamydomonas* include which of the following?

I. Mature organism is a single haploid cell.
II, Movement is coordinated among cells.
III. Colonial organization borders on multicellularity.

A) Ionly
B) Il only
C) Illonly
D) ilandill
E) I, ⋂. and III

27) All of the following are characteristic of the water molds EXCEPT
A) coenocytic hyphae.
B) flagellated zoospores.
C) haploid antheridia and oogonia.
D) large egg cells.
E) feeding plasmodium.

28) The chloroplast structure and biochemistry of the red algae are most like which of the following
organisms ?
A) golden algae
B) Cyanobacteria
C) Bryophyta
D) Chlorophyta
E) Phaeophyta

29) Considering photosynthetic organisms, which characteristic, usually found only in vascular plants, is sometimes seen in the brown algae?
A) cellulose cell walls
B) conducting tissue
C) chlorophyll *a*
D) alternation of generations
E) carbohydrates as a food reserve

30) Which of the following is a characteristic pigment of the brown algae?
A) laminarin
B) algin
C) phycocyanin
D) leucosin
E) fucoxanthin

31) All of the following sta tements concerning protists are true EXCEPT:
A) All Protista are eukaryotic organisms; many are unicellular or colonial.
B) The organism that causes malaria is transmitted to humans by the bite of the tsetse fly.
C) All apicomplexans (sporozoans) are parasitic.
D) All myxomycotes have an amoeboid stage that is followed by a sedentary stage during which
spores are produced.
E) The Euglenophyta have a pigment system similar to that of green algae and higher land plants.

32) All Protista are alike in that they are
A) autotrophic.
B) heterotrophic.
C) unicellular.
D) eukaryotic.
E) flagellated.

33) Which taxonomic group containing eukaryotic organisms is believed to be ancestral to the plant
kingdom?
A) Chrysophyta
B) Actinopoda
C) Foraminifera
D) Apicomplexa
E) Chlorophyta

34) Which of the following is mismatched?
A) Apicomplexa; internal parasites
B) golden algae; planktonic producers
C) euglenozoa; unicellular flagellates
D) ciliates; freshwater producers
E) Rhizopoda; ingestive heterotrophs

35) You are given an unknown organism to identify. It is unicellular and heterotrophic. It is motile, with well-developed organelles and three nuclei, one large and two small. You conclude tha t this organism is most likely to be a member of which phylum?
A) rhizopods
B) actinopods
C) ciliates
D) kinetoplastids
E) wa ter molds

36) Diatomaceous earth consists of the shells of members of which phylum?
A) golden algae
B) ciliates
C) Myxomycota
D) Chlorophyta
E) diatoms

37) Which of the following statements is NOT TRUE about the dinoflagellates?
A) They possess two unequal flagella.
B) Some cause red tides.
C) They are unicellular.
D) They have chlorophyll.
E) Their fossil remains form limestone deposits.

38) All of the following statements provide evidence that chloroplasts and mitochondria originated as prokaryotic endosymbionts EXCEPT that they
A) are the same size as bacteria.
B) can be cultured on agar since they make all their own proteins.
C) contain circular DNA molecules not associated with histones.
D) have membranes that are similar to those found in the plasma membranes of prokaryotes.
E) have ribosomes that are similar to those of bacteria.

39) Which of the following characteristics of chloroplasts and mitochondria are more similar to prokaryote
cells than to eukaryote cells?
A) enzymes and transport systems of inner membranes
B) DNA not associated with histone proteins
C) single, circular chromosome
D) Only A and C are correct.
E) A, B, and C are correct.

40) The oldest possible fossil representatives of the kingdom Protista currently known are
A) stromatolites that are colonial and 3.5 billion years old.
B) acritarchs that are parts of cysts and 2.1 billion years old.
C) chromistans that are unicellular and 1.8 billion years old.
D) plasmodia that are coenocytic and 1.8 billion years old.
E) diplomonads with two nuclei that are 1.5 billion years old.

41) A biologist finds a new unicellullar organism that possesses an endoplasmic reticulum, a simple cytoskeleton, and two small nuclei that are each surrounded by a membrane. The organism has neither
mitochondria nor chloroplasts. This organism most probably is aln)
A) apicomplexan.
B) diplomonad.
C) ciliate.
D) prokaryote.
E) Chlamydomonas.

42) The small size and simple construction of prokaryotes imposes limits on the
A) number of simultaneous metabolic activities and the number of genes present.
B) type of habita t they occupy and the frequency of reproduction tha t can occur.
C) number of cells that can be associated in organized colonies.
D) number of organelles present and the size of the nucleus.
E) type of reproduction and the number of offspring that can be produced.

43) The endoplasmic reticulum and Golgi apparatus are very similar among the groups of alga-like protists, but chloroplasts differ significantly and appear to be related to different prokaryotes. What do these facts imply about the evolution of the endomembrane organelle system of eukaryotic cells?
A) The Golgi apparatus evolved before the endomembrane system.
B) Endomembrane systems evolved before chloroplasts.
C) Endomembrane systems evolved from symbiotic prokaryotes.
D) Endomembrane systems evolved after chloroplasts.
E) Chloroplasts evolved before the endoplasmic reticulum.

44) All of the following statements about the alternation of generations in algal protists are true EXCEPT:
A) Diploid sporophytes produce spores.
B) Diploid stages are multicellular.
C) Haploid gametophytes produce gametes.
D) Spores produce gametophytes.
E) Haploid stages are unicellular.

45) Why is the filamentous body form of the slime and water molds considered a case of convergent evolution with the hyphae of fungi?
A) Fungi are closely related to the slime and water molds.
B) Body shape reflects ancestor-descendant relationships among organisms.
C) Filamentous shape is an adaptation for a nutritional mode as a decomposer.
D) Hyphae and filaments are necessary for locomotion in both groups.
E) Filamentous body shape is evolutionarily primitive for all eukaryotes.

46) Many biologists consider the kingdom Protista polyphyletic. Which of the following statements is consistent with this conclusion?
A) Various combinations of prokaryote ancestors gave rise to different lineages of protists.
B) Animals, plants, and fungi arose from different protistan ancestors.
C) Multicellularity has evolved independently in different groups of protists.
D) Chloroplasts in different eukaryotes are similar to different prokaryotes.
E) Archaezoa are intermediate and should not be considered part of the Protista.

47) Which organelles do scientists believe originated by symbiotic relationships between primitive eukaryotes and certain prokaryotes?
A) nuclei and ribosomes
B) chloroplasts and mitochondria
C) vacuoles and the Golgi apparatus
D) storage vesicles and thylakoids
E) cristae and the endoplasmic reticulum

48) Protists exhibit such a variety of characteristics that
A) we should not bother to try to classify them.
B) we should classify them based on their habitats.
C) we should classify them based on their size.
D) we should classify photosynthetic forms separately from heterotrophs.
E) we should classify them in a number of smaller groups until we can learn more about them.

49) We believe eukaryotes evolved from prokaryotes. This evolution probably
A) occurred many times.
B) involved symbiosis on many occasions.
C) allowed the formation of both complexity and multicellularity.
D) Both Band C are correct.
E) A, B, and C are all correct.

50) Protists are ecologically important in all of the following ecosystems EXCEPT
A) freshwater systems.
B) marine phytoplankton.
C) antarctic dry valleys.
D) parasitic ones.
E) pathogenic systems.

51) The multiple, complex organelles of eukaryotic cells probably arose by
A) serial endosymbiosis.
B) competition for organelles in the environment.
C) specialization of existing membranes.
D) Both A and C are good responses.

52) All of the following *might* have arisen symbiotically EXCEPT
A) ribosomes.
B) endoplasmic reticulum.
C) mitochondria.
D) cilia and flagella.
E) chloroplasts.

53) The goal in classifying organisms should be to create categories that reflect the evolutionary histories
of organisms. Therefore, we should use aln)
A) three-kingdom classification system.
B) five-kingdom classification system.
C) eight-kingdom classification system.
D) system of more than eight kingdoms; this will probably be necessary.
E) single category and just call it "life."

54) A discussion of "candidate kingdoms"
A) has shown that there should be ten kingdoms.
B) splits the protists into five monophyletic groups.
C) has shown that it is unlikely that new forms of life will be discovered on Earth.
D) demonstrates the process of scientific classification.
E) has finally clarified the status of all organisms.

55) Eukaryotic cells all have the following organelles EXCEPT

A) mitochondria.
B) ribosomes.
C) a plasma membrane.
D) one or more chromosomes.

56) Of the five "candidate kingdoms" described in your text, which one is still considered polyphyletic?

A) Euglenozoa
B) Alveolata
C) Stramenopila
D) Archaezoa
E) Rhodophyta

57) Why is it NOT a good idea to classify organisms by structures that they lack?

A) It tends to lump together organisms that are unrelated. For example, both bacteria and humans
lack wings.
B) All organisms lack something that other organisms have.
C) Evolution may have eliminated these structures in several different kinds of organisms.
D) All of the above are reasonable responses.

58) Organisms classified as Euglenozoa have previously been classified as Protozoa, Protista, plants, and
animals. Why the confusion?

A) Like Protozoa, they are unicellular.
B) Like animals, they can move.
C) Like plants, many are photosynthetic.
D) Like protists, they don't fit neatly into other categories.
E) All of the above have caused confusion about the evolutionary relationships of Euglenozoa.

59) Which of the following is NOT classified in the candida te kingdom Stramenopila?

A) diatoms
B) dinoflagellates
C) golden algae
D) brown algae
E) water molds

60) Which group within the candidate kingdom Alveolata includes a group of organisms that aue important in ocean food chains, cause red tides that kill many fish, can be carnivorous, and build coral reefs?
A) ciliates
B) apicomplexans
C) dinoflagellates
D) There is not a group of organisms that encompasses all of these characteristics.

61) Which of the following is NOT a characteristic of ciliates?
A) They have relatively short cilia.
B) They are very complex cells.
C) They do mitosis.
D) Most live as solitary cells in freshwater.
E) They have two or more nuclei.

62) Eukaryotic organisms are responsible for all of the following human diseases EXCEPT
A) malaria.
B) African sleeping sickness.
C) giardiasis.
D) tuberculosis.
E) syphilis.

63) Of the following characteristics of plants and animals, which is NOT evidence for the symbiotic origins of mitochondria and / or chloroplasts?
A) Mitochondria and chloroplasts have double membranes.
B) Mitochondria and chloroplasts have ribosomes that differ from eukaryotic ribosomes.
C) Mitochondria and chloroplasts have some of the genes necessary for their own construction.
D) Mitochondria and chloroplasts can do energy transformations.
E) All plants contain mitochondria.

64) A biologist discovers a colony of unusual single-celled organisms. They seem not to fit into any known
group. How should the biologist proceed?
A) Destroy the organisms; they might be pathogenic.
B) Examine them carefully to see which cell parts might be present or absent.
C) Compare them carefully with all living protists.
D) Send samples to biologists who study somewhat similar organisms.
E) B, C, and D should be done, probably in that sequence.

65) When comparing diagrams of "typical" plant and animal cells with a variety of protists, what should one conclude?
A) Typical animal cells closely resemble some protists, but not others.
B) Typical plant cells closely resemble only a few protists.
C) The typical cell is mythical; no protists resemble typical cells very much.
D) All protists are intermediate between plant cells on one hand, and animal cells on the other.
E) Protists must have evolved as hybrids between plant and animal cells.

66) The organisms we call "seaweeds"
A) belong to a variety of kingdoms.
B) are not what we normally call "weeds."
C) are mostly found near the edge of oceans and seas.
D) have varying mixtures of photosynthetic pigments.
E) All of the above are correct.

67) Which of the following is TRUE concerning algal life cycles?
A) They are all very similar.
B) Some have alternating haploid and diploid generations.
C) They all have flagellated sperm.
D) None of the algal groups have characteristics similar to land plants.
E) They can be described as photoheterotrophs.

68) Multicellularity evolved
A) once.
B) a few times.
C) many times in the same basic way.
D) many independent times.