Chapter 24

The Origin of Species

1) Which of the following is the most likely pattern for the origin of species?
A) anagenesis
B) cladogenesis
e) phyletic evolution
D) spontaneous generation
E) inheritance of acquired characteristics

2) To a punctuationalist, the "sudden" appearance of a new species in the fossil record means that
A) the species is now extinct.
B) the Earth is only 6000 years old.
e) speciation occurred instantaneously.
D) speciation occurred in one generation.
E) speciation occurred over many thousand years.

3) The biologist who proposed the biological species concept is
A) Mayr.
B) Gou
ld.
e) Wright.
C) Sheldon.
D) Eldridge.

4) The only taxonomic ca tegory tha t actually exists as a discrete unit in na ture is the
A) species.
B) ge
nus.
e) family.
C) class.
D) phylum.

5) Which of the following statements is consistent with the punctuated equilibrium interpretation of specia tion?
A) Evolution proceeds at a slow, steady pace.
B) Long periods of minor change are interrupted by short bursts of significant change.
e) Rapid speciation is caused by population explosions.
C) There is an equilibrium between living and extinct species.
D) Large populations evolve more quickly than small ones.

6) A rapid method of speciation that has been important in the history of flowering plants is
A) genetic drift.
B) parapatric speciation.
C) a mutation in the gene controlling the timing of flowering.
D) behavioral isolation.
E) polyploidy.

7) If two species are able to interbreed but produce sterile hybrids, their species integrity is maintained by
A) gametic isola tion.
B) a prezygotic barrier.
C) hybrid inviability.
D) a postzygotic barrier.
E) introgression.

8) A new plant species formed from hybridization of a plant with a diploid number of 16 with a plant with a diploid number of 12 would probably have a gamete chromosome number of
A) 12.
B) 14.
C) 16.
D) 22.
E) 28.

The following questions are based on this paragraph. A botanist discovers a large population of annual plants. The plants all look basically the same, but seem to be of two different size classes. The larger and smaller plants inhabit the same areas and are visited by the same pollinating insects.

9) What is the most likely reason for the size differences?
A) The larger plants are polyploids derived from the smaller plants.
B) The larger plants happen to be in areas with more nutrients.
C) The smaller plants are haploids that developed from unfertilized eggs.
D) The larger plants germinated in the winter and the smaller plants germinated in the summer.
E) The larger plants are dominant and the smaller plants are recessive.

10) What would be the LEAST productive research to discover the relationship between the plants?
A) electrophoretic studies to see if they have the same enzymes
B) chromosome counts
C) growing seeds of one size of plant with various nutrient concentrations
D) growing seeds from the two sizes of plants under identical conditions
E) careful measurement of anatomical features

11) Although different species of warblers often migrate together and use the same habita ts for ma ting
and feeding, they rarely hybridize. The isolating mechanism most likely to be operating is
A) ecological isola tion.
B) temporal isolation.
C) behavioral isolation.
D) mechanical isolation.
E) gametic isola tion.

12) Which of the following is NOT considered a reproductive isolating mechanism?
A) sterile offspring
B) ecological isolation
C) feeding behavior
D) gametic incompatibility
E) timing of courtship display

13) Which of the following reproductive isolating mechanisms is postzygotic?
A) habitat isolation
B) temporal isolation
C) hybrid sterility
D) behavioral isolation
E) gamete incompatibility

14) Some species of *Anopheles* mosquito live in brackish water, some in running freshwater, and others in stagnant water. What type of reproductive barrier is most obviously separating these different species?
A) ecological isola tion
B) temporal isolation
C) behavioral isolation
D) gametic isola tion
E) postzygotic isolation

15) The reproductive barrier that maintains the species boundary between horses and donkeys is
A) mechanical isola tion.
B) gametic isolation.
C) hybrid inviability.
D) hybrid sterility.
E) hybrid breakdown.

16) According to advocates of the punctuated equilibrium theory,
A) natural selection is unimportant as a mechanism of evolution.
B) given enough time, most existing species will branch gradually into new species.
C) a new species accumulates most of its unique features as it comes into existence.
D) most evolution results from disruption of a Hardy-Weinberg equilibrium.
E) transitional fossils are intermediate between newer species and their parent species.

Use the following options to answer the following questions. For each description of reproductive isolation, select the option that best describes it. Options may be used once, more than once, or *not at all.*

A. gametic
B. temporal
C. behavioral
D. habitat
E. mechanical

17) two species of orchids with different floral anatomy

18) two species of trout that breed in different seasons

19) two species of meadowlarks with different mating songs

20) Two species of garter snakes live in the same region, but one lives in water and the other lives on land.

21) Two species of pine shed their pollen at different times.

22) Mating fruit flies recognize the appearance, odor, tapping motions, and sounds of members of their own species, but not of other species.

23) The scarlet oak is adapted to moist bottomland, whereas the black oak is adapted to dry upland soils.

24) The biological species concept is inadequate for grouping
A) plants.
B) parasites.
C) asexual organisms.
D) endemic populations.
E) sympatric populations.

25) The most important factor in preserving horses and donkeys as distinct biological species is
A) allopolyploidy.
B) a geographic barrier.
C) a prezygotic barrier.
D) a postzygotic barrier.
E) an allopatric barrier.

26) Races of humans are unlikely to evolve extensive differences in the future for which of the following
reasons?
1. The environment is unlikely to change.
II. Humans are essentially perfect.
III. The human races are incompletely isolated.

A) Ionly
B) IIIonly
C) I and II only
D) II and III only
E) I, II, and III

27) The only way that two populations can assure their integrity as distinct biological species is by
A) sympatry.
B) allopatry.
C) introgression.
D) geographic isolation from one another.
E) reproductive isola tion from one another.

28) Two species of frogs belonging to the same genus occasionally mate, but the offspring do not complete
development. This is an example of
A) the postzygotic barrier called hybrid inviability.
B) the post zygotic barrier called hybrid breakdown.
C) the prezygotic barrier called hybrid sterility.
D) gametic isolation.
E) adaptation.

29) If two subspecies, A and B, are not considered separate species even though they cannot interbreed, then
A) they are groups that are endemic to isolated geographic regions.
B) they have eliminated postzygotic barriers but not prezygotic barriers.
C) gene flow between A and B may exist through other related subspecies.
D) gene flow has ceased and genetic isolation is complete.
E) their diploid gametes are produced by nondisjunction.

30) A characteristic of allopatric speciation is
A) the appearance of new species in the midst of old ones.
B) asexually reproducing populations.
C) geographic isolation.
D) artificial selection.
E) large populations.

31) The process of a new species arising within the range of the parent populations is termed
A) semispeciation.
B) adaptive radiation.
C) sympatric speciation.
D) parapatric speciation.
E) allopatric speciation.

32) The formation of a land bridge between North and South America about three million years ago resulted in which of the following?
I. allopatry of marine populations that were previously sympatric
II. sympatry of marine populations that were previously allopatric
III. sympatry of terrestrial populations that were previously allopatric

A) I only
B) II only
C) IIIonly
D) land II
E) I and III

33) The biologists who proposed the theory of punctua ted equilibrium are
A) Mayr and Wright.
B) Watson and Crick.
C) Darwin and Wallace.
D) Eldridge and Gould.
E) Sheldon and Templeton.

34) Plant species A has a diploid number of 28. Plant species B has a diploid number of 14. A new, s~xually
reproducing species C arises as an allopolyploid from hybridization of A and B. The diploid number of C would probably be
A) 14.
B) 21.
C) 28.
D) 42.
E) 63.

35) The origin of a new plant species by hybridization coupled with nondisjunction is an example of
A) allopatric speciation.
B) sympatric speciation.
C) autopolyploidy.
D) introgression.
E) a peak shift.

36) All of the following statements about splinter populations, or peripheral isolates, are correct EXCEPT:
A) The gene pool may represent the extremes of genotypic and phenotypic clines.
B) Many peripheral isolates have an increased likelihood of experiencing a founder effect.
C) Life on the frontier is usually harsh for the peripheral isolates, and most become extinct.
D) They undergo speciation readily because they are large populations with immense gene pools.
E) The selective factors operating on peripheral isolates may be quite different from those operating
on the parent population.

37) According to one hypothesis, the production of sterile mules in nature by the mating of horses and
donkeys tends to
A) result in the extinction of one of the two species.
B) decrease character displacement between horses and donkeys.
C) reinforce prezygotic isolating mechanisms between horses and donkeys.
D) weaken the intrinsic reproductive isolating mechanisms between horses and donkeys.
E) eventually result in the formation of a single species from the two parental species (horses and
donkeys).

38) Which of the following would be a position held by a punctuationalist?
A) A new species forms most of its unique features as it comes into existence and then changes little
for the duration of its existence.
B) One should expect to find many transitional fossils left by organisms in the process of forming new species.
C) Given enough time, most existing species will gradually evolve into new species.
D) Natural selection is unimportant as a mechanism of evolution.
E) Most speciation is anagenic.

39) The Hawaiian Islands are a great showcase of evolution because of intense
A) **ecological isolation and parapatric speciation.**
B) adaptive radiation and allopatric speciation.
C) allopolyploidy and sympatric speciation.
D) cross-specific mating and reinforcement.
E) hybrid vigor and allopatric speciation.

40) Which of the following statements about biological species is (are) CORRECT?

1. Biological species are defined by reproductive isolation.
II. Biological species are the model used for grouping extinct forms of life.
ill. The biological species is the largest unit of population in which gene flow is possible.

A) Ionly
B) IIonly
C) land ill
D) II and ill
E) I, II, and ill

41) Plant species A has a diploid number of 8. A new species, B, arises as an autopolyploid from A. The diploid number of B would probably be
A) 4.
B) 8.
C) 16.
D) 32.
E) 64.

42) Which of the following best describes what occurs when two species hybridize and a fraction of the hybrids manage to backcross with one of the parent species?
A) introgression
B) genetic drift
C) random mating
D) heterozygote advantage
E) differential reproduction

43) Which of the following statements about speciation is CORRECT?
A) The goal of na tural selection is specia tion.
B) When reunited, two allopatric populations will not interbreed.
C) Natural selection chooses the reproductive barriers for populations.
D) Prezygotic reproductive barriers usually evolve before postzygotic barriers.
E) Natural selection amplifies sexual adaptations that lead to reproductive success.

44) Differences in all of the following would be useful in distinguishing one biological species from
another EXCEPT
A) physiology.
B) biochemistry.
C) behavior.
D) fossil morphology.
E) genetic makeup.

45) Which of the following would apply to BOTH anagenesis and cladogenesis?
A) branching
B) increased diversity
C) speciation
D) more species

46) For which of the following organisms is the concept of a "biological species" not applicable?
A) triploid, asexual plants
B) humans of different ethnic origins
C) dogs of different breeds
D) haploid male honeybees
E) Peromyscus maniculatus

47) Which of the following is a postzygotic barrier to hybridization?
A) hybrid sterility
B) habitat isolation
C) mechanical isola tion
D) genetic isolation
E) behavioral isolation

48) Dog breeders perpetuate breeds of dogs by controlling mating. This is analogous to which of the
following natural isolating mechanisms?
A) reduced hybrid fertility
B) hybrid breakdown
C) mechanical isola tion
D) habitat isolation
E) gametic isolation

49) All of the following would increase the rate of allopatric speciation EXCEPT
A) genetic drift.
B) introgression.
C) founder effect.
D) natural selection.
E) geotypic clines.

50) All of the following have contributed to the diversity of organisms on the Hawaiian archipelago EXCEPT that
A) the islands are distant from the mainland.
B) multiple invasions have occurred.
C) adaptive radiation has occurred.
D) the islands are very young.

51) Which of the following is a way that polyploidy can most directly influence speciation?
A) It can improve success in island habitats.
B) It can overcome hybrid sterility.
C) It can change the mating behavior of animals.
D) It can generate new adaptive peaks.
E) It can enhance the rate of stabilizing selection.

52) Which of the following is a CORRECT statement about the concept of punctuated equilibrium?
A) It explains variation in the tempo of specia tion.
B) It contradicts much of the evidence for evolution.
C) It explains gradual changes in the fossil record.
D) It applies only to trilobites.
E) It argues against the possibility of morphological stasis.

53) An adaptive peak represents
A) a symbolic landscape with valleys and rivers.
B) a place where alpine organisms can flourish.
C) a stable environment for a given population.
D) a place where microevolution can cause a founder effect.
E) a successful combination of allele frequencies.

54) Which of the following would be an example of macroevolution?
A) populations of peppered moths in England shifting from a predominantly white form that was cryptic on lichen-covered tree trunks to a black, melanistic form that was less visible on darkened, soot-covered tree trunks following the pollution-producing Industrial Revolution
B) evolution of polymorphism in *Papilio dardanus,* with each morph mimicking a different protected butterfly
C) evolution of modem man, *Homo sapiens,* from australopithecine ancestors
D) evolution ofinsecticide resistance in populations ofinsect pests treated through the years with DDT
E) evolution of antibiotic resistance in bacteria

55) The species concept used by Linnaeus was the
A) biological species concept.
B) morphological species concept.
C) recognition species concept.
D) ecological species concept.
E) cohesion species concept.

56) A biologist discovers two popula tions of wolf spiders whose members appear identical. Members of one population are found in the leaf litter deep within a woods. Members of the other population are found in the grass at the edge of the woods. The biologist decides to designate the members of the two
populations as two separate species. Which species concept is this biologist most closely utilizing?
A) ecological
B) biological
C) morphological
D) recognition
E) cohesion

57) Which of the various species concepts recognizes the LEAST degree of genetic exchange among
species?
A) evolutionary
B) recognition
C) biological
D) All species concepts require complete isolation of gene pools.

58) You are confronted with a box of pinned (preserved) grasshoppers of various species that are undescribed (new to science). Your assignment is to separate them into what you think are species. The specimens have no informa tion with them as to where or when they were collected. Which species
concept will you have to use?
A) biological
B) recognition
C) ecological
D) evolutionary
E) morphological

59) Autopolyploidy is a speciation process that begins with an event
A) during habitat selection.
B) during copulation.
C) during meiosis.
D) during embryonic development.
E) during hybridization.

60) Two populations of fish (call them type A and type B) differ only in color patterns, with each population occupying a different, adjacent lake. An earthquake produces a fissure that unites the two bodies of water. Hybridization occurs, but type A fish produce more offspring if they mate with fish of the same type and vice versa, and both types tend to mate with their own type. Natural selection continues to refine differences in mating behavior between the two types. You, as a taxonomist, designa te A and B as different species. Which species concept fits most closely with your decision to
do this?
A) evolutionary
B) recognition
C) ecological
D) biological
E) morphological

61) Two closely related populations of mice have been separated for a long period by a river. Climatic change causes the river to dry up, thereby bringing them back into contact in a zone of overlap. Which
of the following is NOT a possible outcome when they meet?
A) They interbreed freely and produce fertile hybrid offspring.
B) They no longer interbreed.
C) They develop behavioral characteristics that cause them both to abandon the area of overlap and
become allopatric again.
D) They remain separate in the extremes of their ranges but develop a hybrid zone in the area of
overlap.

62) Stable hybrid zones between two populations designated different species most comfortably fits which
concept of species?
A) cohesion
B) biological
C) morphological
D) ecological
E) Stable hybrid zones fit all species concepts.

63) Which of the following is NOT an idea or fact consistent with the model of punctuated equilibrium?
A) "Although each species must have passed through numerous transitional stages, it is probable tha t the periods during which each underwent development, though many and long as measured in years, have been short in comparison with the periods during which each remained in an unchanged condition." --Charles Darwin
B) Species undergo most of their morphological modifications as they first bud from parent species, then change little.
C) Transitional forms between taxa are relatively rare in the fossil record.
D) When new species are rapidly evolving, they are often doing so in small, isolated populations.
E) Macroevolution is simply micro evolution spread across vast expanses of time.

64) An explanation for the evolution of insect wings suggests that wings began as lateral extensions of the
body that were used as heat dissipaters for thermoregulation. Later, when they had become sufficiently large, these extensions became useful for gliding through the air and selection later refined
them as flight-producing wings. If this hypothesis is correct, insect wings could best be described as
A) adaptations.
B) mutations.
C) exaptations.
D) isolating mechanisms.
E) a bauplan.

65) Ants occur in various morphological forms, such as workers and soldiers, called castes. The larval stage tha t produces a worker can produce a soldier if it is fed more food and grows larger. The head
capsule and associated mandibles increase in size to a greater extent than the rest of the body to produce the soldier form. This is a good example of
A) allometric growth.
B) paedomorphosis.
C) homeosis.
D) heterochrony.
E) exaptation.

62) Stable hybrid zones between two populations designated different species most comfortably fits which
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66) Bagwonn moth ca terpillars feed on evergreens and carry a silken case or bag around with them in which they eventually pupate. Adult female bagworm moths are larvaform: they lack the wings and other structures of the adult male and instead retain the appearance of a caterpillar even though they are sexually mature and can lay eggs within the bag. This is a good example of
A) anagenesis.
B) paedomorphosis.
C) sympatric speciation.
D) adaptive radiation.
E) heterochrony.

67) Imagine a hypothetical mutation in a squirrel population that produced organisms with eight legs rather than four. Further, imagine that these squirrels survived, successfully invaded new habitats, and eventually gave rise through evolution to a new class of vertebrates. The initial event giving rise to extra legs would be a good example of
A) punctua ted equilibrium.
B) species selection.
C) cladogenesis.
D) homeosis.
E) allometry.

68) Many species of snakes lay eggs, but in the boreal forests of northern Minnesota with short growing
seasons, there are only two species of snakes, the eastern garter and the red belly snake; both are live
bearers. Their ability to speed up embryonic development by sunning on warm rocks is probably a great advantage. This trend toward live birth is an example of
A) natural selection.
B) sexual selection.
C) species selection.
D) goal direction in evolution.
E) directed selection.

69) The changing facial features of a maturing child are an example of
A) phylogeny.
B) preadaptation.
C) allometric growth.
D) paedogenesis.
E) homologies.

70) Which of the following terms best describes the process in which organisms reach sexual maturity
while retaining some juvenile characteristics?
A) homeosis
B) allometry
C) c1adogenesis
D) paedomorphosis
E) heterochrony

71) Which of the following best describes our current understanding of the role of natural selection in evolutionary theory?
A) Natural selection has been discarded as an important concept in evolution.
B) Changes in gene pools due to natural selection are now seen to be unimportant.
C) Microevolution has replaced natural selection as an organizing concept.
D) Natural selection is able to explain virtually all changes in gene pools.
E) Natural selection produces adaptations that are essential to the survival of organisms.