

## Multiple choice questions (1 pt each)

1. Which of the following items of evidence supports the view that change occurs within species?
  - a. polyploid hybridization in plants
  - b. fossils with characteristics intermediate between those of land mammals and modern whales
  - c. transposons shared by humans, chimpanzees, and gorillas
  - d. antibiotic resistance in bacteria
2. What evidence supports the view that species change into new species?
  - a. alarm calls in Belding's ground squirrels
  - b. evolution of drug resistance in HIV
  - c. polyploid hybridization in plants
  - d. sociopathy in humans
3. Several "ring species" were discussed in class and in the text. These included which of the following?
  - a. Whales
  - b. anatomically modern humans
  - c. Greenish Warbler
  - d. Long-tailed Widow Bird
4. Which of the following evolutionary transitions are documented by a series of intermediate fossils?
  - a. evolution of belding's ground squirrel from rat
  - b. evolution of sea urchin from trilobite
  - c. evolution of giraffe from zebra
  - d. evolution of whales from land mammals
5. The same crystallins are found in the eyes of all vertebrates, yet other animals have quite different crystallins. This indicates that
  - a. eyes have only evolved once.
  - b. all vertebrates share the same number of opsins.
  - c. lenses evolved after vertebrates split from other animals.
  - d. the structure of the complex eye is the same in all animals.
6. *Rodhocetus* is
  - a. thought to be the common ancestor of humans and chimpanzees
  - b. a new species produced by hybridizing two wild species of hemp-nettle
  - c. an ancient amphibious whale with legs
  - d. a species intermediate between fish and amphibians
7. Among Darwin's finches, stabilizing selection would prevent evolutionary change if
  - a. birds with average beaks were best able to survive and reproduce.
  - b. birds with unusually deep beaks were most likely to survive
  - c. the correlation between parents and offspring were weak.
  - d. birds with unusually shallow beaks were most likely to survive
8. In class, I listed several conditions that are required for selection to produce evolutionary change. Which of the following was **not** included?
  - a. variation
  - b. offspring resemble parents
  - c. sexual reproduction
  - d. some variants are more likely to survive or reproduce than others
9. What is the main weakness of the pinhole-camera eye?
  - a. lets in light from the side
  - b. double vision
  - c. image is dim
  - d. does not form an image
10. The Grant's work with Darwin's finches showed that during a drought,
  - a. finches with less efficient kidneys suffered greater mortality, hence were selected against.
  - b. finches with deep beaks increased in the population because they were better able to survive and reproduce.
  - c. there was no change in the population's characteristics, but the population size decreased
  - d. finch numbers remained stable because birds from the mainland moved in to exploit the new niche.

11. The text proposed a sequence of stages by which the vertebrate eye might plausibly have evolved. Which of these is in the right order?
  - a. (1) cup eye, (2) eye with lens, (3) pinhole-camera eye
  - b. (1) cup eye, (2) eye spot, (3) eye with lens
  - c. (1) eye spot, (2) cup eye, (3) eye with lens
  - d. (1) pinhole-camera eye, (2) cup eye, (3) eye with lens
12. In the retina of the vertebrate eye, the light-sensitive cells
  - a. face *towards* the light
  - b. contain light-sensitive molecules called *crystallins*
  - c. face *away from* the light
  - d. line the inner surface of the cornea
13. In mammals, the recurrent laryngeal nerve travels from the brain to the larynx via
  - a. a long detour around the ductus arteriosus (near the heart)
  - b. the shortest possible route
  - c. the trachea
  - d. a long detour around the ureter (near the kidney)
14. The Hawaiian islands, like many other island groups in the Pacific, are arranged in a roughly straight line pointing toward the southeast. Why are so many Pacific island groups arranged this way?
  - a. Island chains form as the surface of the earth drifts northwest across hot spots deep within the earth.
  - b. The island chains are giant wrinkles in the Earth's crust, which formed as the earth cooled from its original molten state.
  - c. Pacific island chains are subsea mountain ranges formed when tectonic plates collide.
  - d. They aren't: the chain-like appearance is a well-known optical illusion.
15. The half-life of  $^{238}\text{U}$  is 4.46 billion years. If a rock had a million such atoms when it was formed, how many would be left after two half-lives (8.92 billion years)?
  - a. none
  - b. 1/4 of the original million, or 250,000 atoms
  - c. 1/2 of the original million, or 500,000 atoms
  - d. 2/3 of the original million, or 666,667 atoms
16. With older rocks, isochrons have
  - a. greater curvature
  - b. steeper slopes
  - c. shallower slopes
  - d. less curvature
17. Pseudogenes are
  - a. nonfunctioning genes.
  - b. recent beneficial mutations.
  - c. randomly transposed genes.
  - d. artificial DNA sequences constructed by geneticists and inserted into the DNA of living organisms.
18. Which modern human characteristic is found in hominin fossils more than two million years old?
  - a. use of fire
  - b. chins
  - c. large brains
  - d. bipedal locomotion
19. Recent genetic evidence indicates that during the last few tens of thousands of years
  - a. the human population has suffered repeated epidemics of obesity.
  - b. human evolution has stopped.
  - c. the human population was much larger than previously thought.
  - d. human evolution has been rapid.
20. Lactase persistence (the ability to digest fresh milk throughout life) is common only in
  - a. Africa and parts of Asia
  - b. North America and parts of Asia
  - c. Northern Europe and parts of Africa
  - d. Asia and parts of Southern Europe
21. Which of the following is *NOT* true of typical sociopaths?
  - a. often in trouble with law
  - b. charming
  - c. personality seems open and sensitive
  - d. remain in the same neighborhood throughout life
22. Selection always increases mean fitness if
  - a. mortality declines
  - b. fitnesses are frequency dependent
  - c. fitnesses are frequency independent
  - d. the environment changes rapidly
23. In the model of cultural evolution discussed in class,
  - a. culture was neither beneficial nor harmful—it did not affect mean fitness.
  - b. culture was harmful—it decreased mean fitness.
  - c. culture was beneficial—it increased mean fitness.

24. Adaptations for the good of the group are generally thought to be less likely to evolve than adaptations for the good of the individual because
- selection between individuals is stronger than selection between groups because individuals vary more than groups do and the generation time of individuals is usually shorter than that of groups.
  - most mutations benefit groups rather than individuals.
  - those groups that overexploit their resources are more likely to survive.
  - the average life span of an individual is ordinarily longer than that of a group.

25. Which phylogenetic tree is implied by the following set of transposon data? (Note: your tree should have 4 branch tips, corresponding to the 4 species, but these species need not appear in the order given in the table.)

- a. 

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B-- |
    |--|
C-- | |
    |--|
D-----| |
          |--
A-----|
```
- b. 

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B-- |
    |--|
A-- | |
    |--|
C-----| |
          |--
D-----|
```
- c. 

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A-- |
    |--|
B-- | |
    |--|
C-- | |
    |--|
D-- |
```
- d. 

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B-- |
    |--|
D-- | |
    |--|
A-- | |
    |--|
C-- |
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Species	Transposon		
	a	b	c
A	+	-	+
B	+	+	-
C	+	-	+
D	+	+	-

Key: + present; - absent

**Short-answer questions (3 pts each)**

Be concise: 3 or 4 sentences per question. Do *not* repeat material that is given in the question.

26. List two transitional fossil species. What larger groups does each one connect?

27. The text suggested a series of steps—each advantageous—by which a complex eye might evolve from a simple eye spot. (I paraphrased his argument in lecture and in the text.) List the steps in this hypothetical evolutionary path.

28. Under what circumstances does natural selection produce evolutionary change (i.e. what three conditions are required)?

29. Why do most biologists believe that group selection is unlikely to be important in genetic evolution? (List two reasons.)

Don't forget to write your name on the test.