

Abbreviations involving time: ky, thousands of years; my, millions of years; kya, thousands of years ago; mya, millions of years ago.

Multiple choice questions (1 pt each)

Choose the best alternative; only one answer is correct. Mark each answer on the answer sheet *and also* circle it on the test. (The test serves as a backup for the answer sheet.)

1. What did we learn from the experiment of Rice and Salt?
 - a. Selection can split a species into two reproductively isolated parts.
 - b. Selection can account for complex adaptations, such as the vertebrate eye.
 - c. Ring species become two separate species if the populations in the middle of the ring go extinct.
 - d. Radiometric decay provides an accurate measure of time.
2. Which of the following evolutionary transitions are documented by a series of intermediate fossils?
 - a. evolution of greenish warbler from wattled jacara
 - b. evolution of sea urchin from trilobite
 - c. evolution of whales from land mammals
 - d. evolution of belting's ground squirrel from rat
3. In class, I listed several conditions that are required for selection to produce evolutionary change. Which of the following was **not** included?
 - a. offspring resemble parents
 - b. variation
 - c. some variants are more likely to survive or reproduce than others
 - d. sexual reproduction
4. Many creationists have argued that natural selection cannot produce the delicate engineering seen in the vertebrate eye, this argument goes back to 1859, when it was introduced by
 - a. Alexander Fleming
 - b. Joseph Hooker
 - c. Douglas Dewar
 - d. Charles Pritchard and Joseph John Murphy
5. In the retina of the vertebrate eye, the light-sensitive cells
 - a. face *towards* the light
 - b. line the inner surface of the cornea
 - c. contain light-sensitive molecules called *crystallins*
 - d. face *away from* the light
6. The text discussed Hawaiian flightless crickets of the genus *Laupala*. This example showed that
 - a. It **is** possible for selection to split a species in two.
 - b. It **is** possible for selection to move a population beyond the original range of variation.
 - c. It **is not** possible for selection to split a species in two.
 - d. the crickets' area cladogram is just as predicted from evolutionary theory and the geological history of island formation.
7. The half-life of ^{238}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. 1/4 of the original million, or 250,000 atoms
 - b. none
 - c. 1/2 of the original million, or 500,000 atoms
 - d. 2/3 of the original million, or 666,667 atoms
8. Creationists argue that there is a vast divide between ape and human. Consequently, it is no surprise that they all agree about which fossils are ape and which are human.
 - a. true
 - b. false
9. Lactase persistence (the ability to digest fresh milk throughout life) is common only in
 - a. Northern Europe and parts of Africa
 - b. North America and parts of Asia
 - c. Asia and parts of North America
 - d. Asia and parts of Southern Europe
10. Richard Dawkins's computer simulation mimics natural selection. It shows that
 - a. most mutations are adaptive.
 - b. speciation is most likely when a species is separated by some barrier such as a mountain range.
 - c. selection cannot move a population beyond its original range of variation.
 - d. selection can converge on a complex adaptation fairly rapidly.

11. As shown by the “Farmers and thieves” model discussed in class, selection increases the reproductive success of individuals, and this inevitably increases the mean reproductive success of the species.
 - a. True
 - b. False
12. Which of the following is a group-selection argument?
 - a. Grant’s argument that beak depth of birds increases in response to drought
 - b. Wynne-Edward’s argument that many mammals have fewer offspring than they are physiologically able to do because otherwise the population would overexploit its food supply and go extinct.
 - c. The argument, discussed in class, that selection can move a population beyond its original range of variation.
 - d. Darwin’s argument that adaptation is a consequence of natural selection
13. Selection can produce plasticity (or learning) when
 - a. the potential rate of reproduction is higher in *females* than in *males*
 - b. each genotype responds to environmental change in the same way
 - c. different genotypes respond to the environment in different ways
 - d. the potential rate of reproduction is higher in *males* than in *females*
14. Among Belding’s ground squirrels, which category of individuals is most likely to give an alarm call when a predator approaches?
 - a. males with *no* relatives nearby
 - b. females with relatives nearby
 - c. females with *no* relatives nearby
 - d. males with relatives nearby
15. How long does it take for the earth’s climate to change from cold (glacial) to warm (interglacial)?
 - a. Such changes always take millions of years.
 - b. Such changes always take thousands of years.
 - c. Such changes always take hundreds of thousands of years.
 - d. Such changes may occur in a matter of decades.
16. The pronounced sagittal crest along the top of the skulls of robust australopithecines indicates that these species had
 - a. massive jaw muscles.
 - b. little hair on their scalps.
 - c. massive neck muscles.
 - d. small brains.
17. Brain tissue is energetically expensive. For this reason, Aiello and Wheeler (also Leonard, whom you read) argue that _____ must have evolved together.
 - a. large brains, bipedal locomotion, large guts
 - b. large brains, rich diets, small guts
 - c. large brains, bipedal locomotion, vertical foreheads
 - d. large brains, rich diets, opposable thumb
18. In “What are men good for,” Diamond argues that
 - a. selection favors males who hunt because such males get more extramarital sex.
 - b. men are larger than women because selection favors large males.
 - c. selection favors human males who provision their families because the children of such males are more likely to survive.
 - d. competition among sperm has adverse effect on females.
19. The *earliest* anatomically modern *Homo sapiens*
 - a. appeared around 100,000 years ago
 - b. first appeared around 40,000 years ago
 - c. were found in Europe
 - d. had a radically different toolkit from those of Neanderthals
20. In the film *The Social Brain*, Damasio uses a card game with risky and conservative choices to illustrate what happens when information from the emotional centers of the brain do not reach the prefrontal cortex. The implication of these studies is that
 - a. other primates use emotion in making decisions, but humans do not.
 - b. emotion is necessary in order to make good decisions
 - c. emotion usually interferes with good decision-making
 - d. emotion affects how one feels about loss, but does not affect decision-making

21. According to Simon Baron-Cohen, autism is a disease caused by
 - a. a deleterious mutation at the lactase locus
 - b. an inadequate neocortex ratio
 - c. a viral infection of the cerebellum
 - d. the inability to imagine what others are thinking
22. The film "The Social Brain" and lecture argued that
 - a. Human social cognition is a part of our generalized intelligence, rather than a specialization or set of specializations.
 - b. Humans have specific brain regions specialized for particular aspects of social cognition
23. In a typical mammal, the post-reproductive lifespan is
 - a. roughly 20 percent of the total lifespan.
 - b. a very small fraction of the total lifespan.
24. Selection acts with _____ force on mutations that act late in life than on those that act early. (Ignore the effect of population growth.)
 - a. lesser
 - b. greater
25. The theory of *mutation-selection balance* holds that
 - a. If a harmful mutation acts late in life, selection will be less effective at removing it from the population. Consequently, such mutations tend to accumulate in natural populations.
 - b. Many antagonistic interactions between people are prevented by pleiotropic genes.
 - c. Mutation and selection operate at similar rates in natural populations.
 - d. Many antagonistic interactions between people are caused by pleiotropic genes.
26. Conflict between parents and offspring (and between mothers and fetuses) is thought to evolve because
 - a. offspring and parents prefer different TV programs
 - b. the conflict makes it harder for parents to encourage their offspring to leave home
 - c. parents are related equally closely to each offspring, but each offspring is more closely related to itself than to its siblings
 - d. parents share more genes with their offspring than the offspring share with themselves
27. The hypothesis of maternal-fetal conflict receives support from the fact that
 - a. maternal cells destroy the muscles around the fetus's spiral arteries
 - b. fetal cells destroy the muscles around the mother's spiral arteries
 - c. maternal cells destroy the muscles around the mother's spiral arteries
 - d. fetal cells destroy the muscles around the fetus's spiral arteries
28. Paternally imprinted genes (i.e. those in which the copy inherited from the father is expressed in the fetus),
 - a. tend to reduce fetal heart rate.
 - b. tend to increase fetal heart rate.
 - c. tend to increase fetal growth.
 - d. tend to reduce fetal growth.
29. According to Ridley, the level of specialization found within human societies is matched elsewhere in nature only in
 - a. the Portuguese man of war
 - b. corals
 - c. mitochondria
 - d. multicellular organisms
30. A segregation distorter is
 - a. a tool used by neolithic Europeans for separating edible fats from inedible sinew and bone.
 - b. an environmental toxin that interferes with the normal Mendelian segregation of genes.
 - c. a person who lies in the interest of maintaining racial segregation.
 - d. a gene that gets itself into more (or less) than 1/2 of the gametes that are produced by the individual who carries it.
31. Advantages of specialization include all of the following *except*
 - a. Specialists get more practice at each skill they use.
 - b. Specialists waste less time switching between tasks.
 - c. Specialists can afford to buy (and invent) specialized tools.
 - d. Specialists can charge more for the same goods and services.
32. In the Prisoner's Dilemma game, if your opponent plays "fink" you will do best by playing_____.
 - a. mum
 - b. fink

33. Game theory is useful for understanding behavior in which the best strategy to use
- depends on what others are doing
 - does not depend on what others are doing.
34. Language may have been important in the evolution of cooperation because
- it increased the advantage of having a good reputation for cooperation and the disadvantage of cheating.
 - it made living in groups possible.
 - it increased the advantage of cheating.
35. Robert Frank put a group of strangers into a room together for half an hour and then asked them to predict who would cooperate and who would defect in a game of prisoner's dilemma. It turned out that the subjects
- were unwilling to make such predictions.
 - got the right answer less often than chance alone would predict.
 - got the right answer more often than chance alone would predict.
 - were honest about their predictions only in a double-blind experiment.
36. Rudeness is more prevalent in big cities than in small towns. Ridley suggests that this may be because
- people are less likely to encounter each other a second time in a large city
 - anti-rudeness laws are stricter in small towns
 - people in small towns are more likely to fight in response to rudeness
 - anti-rudeness laws are more likely to be enforced in small towns
37. Among humans, chimpanzees, and scorpionflies, males frequently hunt for meat so that they can trade the meat for sex.
- true
 - false
38. Kaplan and Hill studied food sharing among the Ache, and found that the foods that were shared the most
- were the most unpredictable
 - were richest in starch
 - were the most energy-efficient to procure
 - were least calorically rich
39. Grasslands are inhabited by herds of large animals because
- grasslands burn frequently, and only large animals are fast enough to outrun the flames.
 - when grass is eaten, it recovers quickly.
 - there is more vegetal matter in a grassland than in a forest
 - there is nowhere to hide on a grassland, so the animals must be large and fierce to avoid being eaten
40. During the ice ages, the world's grasslands _____ in size.
- increased
 - decreased
41. In Ultimatum and Dictator game experiments
- humans are remarkably cooperative when their behavior is known to others, and even more cooperative when choices are hidden.
 - humans are remarkably cooperative when their behavior is known to others, but are less cooperative when choices are hidden.
 - humans are cooperative only when playing against relatives.
 - humans are more selfish than game-theoretic models predict.
42. Robert Frank argues that emotions are helpful in solving commitment problems because
- it is easy to fake emotions. This makes it hard to detect cheaters and easy to cheat without getting caught.
 - it is hard to fake emotions. This makes it easy to detect cheaters and hard to cheat without getting caught.
43. Among humans, rivals often form alliances for the purpose of competing against others. This behavior is
- found in various species including the bottlenose dolphin.
 - found only among humans and their closest relative, the chimpanzee.
 - unique to humans.
 - found only among humans and some other primate species.
44. Except in captivity, chimpanzees are peaceful animals who never engage in lethal violence.
- True
 - False

45. VC Wynne-Edwards believed that group selection was responsible for
- the tendency of populations to limit their own sizes.
 - the tendency of males to be larger and more aggressive than females.
 - the pervasive cooperation found in nature.
 - the tendency of females to be better camouflaged than males.
46. George Williams used the phrase “selfish herd” to refer to his idea that
- groups of individuals can be much more cruel than any single individual would be.
 - individuals group together into herds for selfish reasons.
 - although there is little selfishness between individuals within a herd, the herds themselves behave selfishly toward other herds.
 - individuals within a herd behave selfishly toward one another.
47. Group selection is more likely to be important for culture traits than for genetic traits because
- the conformist bias in learning makes group differences *larger* for culture traits than they are for genetic traits.
 - the conformist bias in learning makes group differences *smaller* for culture traits than they are for genetic traits.
48. Private ownership is often seen as a solution to the Tragedy of the Commons. However, it can make sense for the owner of a forest to cut down all the trees. When is this so?
- when the growth rate of the trees exceeds the interest rate
 - when the interest rate exceeds the growth rate of the trees
49. According to Ridley, traditional (non-industrial) peoples
- are just as likely to over-exploit natural resources as we are.
 - have caused the extinctions of some species of animals, but have not caused deforestation.
 - never cause extinctions and never cause deforestation.
 - have a reverence for nature which helps them to conserve resources.
50. In voluntary contribution experiments, subjects are allowed to invest tokens either in an “individual exchange,” which pays 10 cents per token, or in a “group exchange,” which pays 20 cents per token. In the group exchange, however, the payment is divided evenly among group members. In some experiments, subjects were allowed to talk with each other between trials. These experiments showed that
- cooperation persists at high levels whether subjects are allowed to talk or not.
 - subjects are most likely to cooperate if they are *not* allowed to talk.
 - subjects seldom cooperate.
 - subjects are most likely to cooperate when they are allowed to talk.
51. Elinor Ostrom’s experiments (discussed by Ridley) were designed to mimic the use of a common-pool resource. The experiments showed that
- repeated communication, even without financial sanctions, enhanced cooperation because people could develop a strategy and bad-mouth cheaters.
 - the ability to impose financial sanctions, even without communication, greatly enhanced cooperation.
 - the ability to communicate once was as effective as repeated communication, because verbal sanctioning of cheaters was ineffective.
52. The Robber’s Cave experiment done by Sherif at a boys summer camp (discussed in class) showed that
- competition decreased athletic performance among low-status but not high-status boys
 - competition between groups led to intense inter-group hostility and dislike, which was ameliorated only when the researchers engineered a breakdown in the camp water supply
 - the boys were highly conformist, and followed high-status boys and counselors when expressing their opinions
 - competition increased athletic performance over baseline levels
53. Humans tend to be xenophobic (hostile to outsiders) and engage in lethal inter-group violence. Which other species has this characteristic?
- baboons
 - bonnet macaques
 - dolphins
 - chimpanzees

Short-answer questions (3 pts each)

Answer **ALL BUT TWO** of the following questions. Be concise: 3 or 4 sentences per question. Do *not* repeat material that is given in the question.

54. In class, I argued that aging should be faster in species with high rates of externally-caused mortality. Summarize two lines of evidence that bear on this claim.
55. Why should parent-offspring conflict arise if parents and offspring share genetic material? Explain briefly, and provide one example from class or text that illustrates parent-offspring conflict.

56. One might argue that people cooperate to avoid being punished. We argued in lecture that this explanation is incomplete because punishment is itself a puzzle. Explain why punishment is puzzling.

57. Explain in words why game theory predicts that both parties will defect (play Fink) if they play a single round of Prisoner's Dilemma.

58. How do outcomes change when the “Dictator Game” is made double blind?

59. Manfred Milinski’s (2006) experiment was designed to discover what conditions would make subjects more likely to sacrifice in order to prevent global climate change. What did he learn?

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