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EXAM ONE
FEBRUARY 7, 2006
LECTURE SECTIONS 3:30 PM – 4:45 PM
VERSION ONE

STUDENT NAME: _____
Print Last Name First Name

LAB SECTION: _____

USE A NUMBER TWO PENCIL, NO PEN!

- A. Write and bubble your last name**
- B. Write and bubble your four digit code under "A - D"**
- C. Write and bubble your exam version 1 (one) under "K"**
- D. Write and bubble your lab section under "O-P"**

1. The central proposition of neutral theory is that

- * a. most genotypic variation that we see has no selection acting on it.
- b. most phenotypic variation that we see has no selection acting on it.
- c. we can infer from the genetic code that most mutations are synonymous.
- d. the molecular clock is flawed, because substitution rates depend on the population size.

2. If a hybrid zone exists between two populations, one can be sure that they are not separated by

- a. a species boundary
- * b. a prezygotic barrier
- c. a postzygotic barrier
- d. hybrid infertility

3. A mutation will survive to form a substitution

- a. in most cases except when there is negative selection against the mutation.
- b. whenever it is synonymous.
- c. only when there is positive selection for the mutation.
- * d. with probability equal to one divided by the number of individuals in the population when there is no selection.

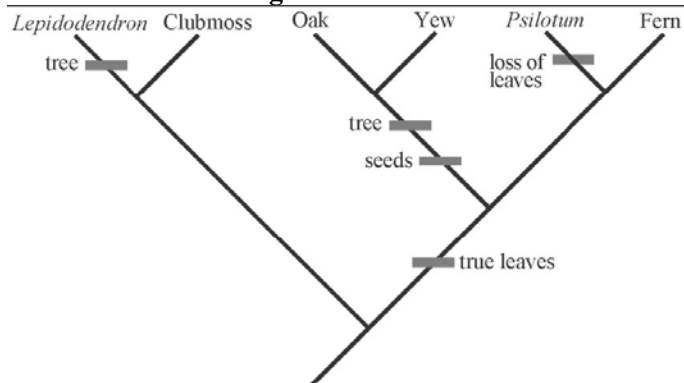
4. A synonymous mutation

- a. does not change the nucleic acid sequence.
- * b. does not change the amino acid sequence.
- c. is always deleterious.
- d. means that the same change has happened in multiple lineages.

5. Extravagant, sexually selected traits like the peacock's tail evolve more often in

- a. females.
- * b. males.
- c. Either: males or females are equally likely to evolve these traits.

6. In the tree below, assume that the ancestor was a herb (not a tree) without true leaves or seeds. Based on the tree and assuming that all evolutionary changes in these traits are shown, which of the following is a tree that lacks true leaves?



- * a. *Lepidodendron*
 b. Clubmoss
 c. Oak
 d. *Psilotum*
 e. Fern

7. Which statement is TRUE?

- a. Most synonymous mutations become fixed during evolution.
 b. The accuracy of the molecular clock can be checked by finding the mutation rate of a molecule in the lab.
 * c. New genes with new functions can arise through gene duplication.
 d. All non-synonymous mutations are deleterious.

8. A taxon consisting of humans and their pets would be best described as

- * a. monophyletic.
 b. polyphyletic.
 c. paraphyletic.

9. Which is NOT an assumption of Hardy-Weinberg equilibrium?

- a. large population size
 * b. no environmental effects on phenotype
 c. no migration
 d. no selection
 e. random mating

10. Which statement is FALSE? Sexual selection can

- * a. never be as strong as natural selection such as an increased risk of dying of disease.
 b. be based on a good indicator of how healthy an individual is.
 c. occur when one male controls reproductive access to multiple females, and males fight about which male will succeed.
 d. occur due to sperm competition when multiple males mate with the same female.
 e. favor showy traits like brightly colored birds.

11. When attempting to group species, scientists use

- a. fossils.
 b. physical structures.
 c. gene similarities.
 * d. All of the above.
 e. None of the above.

12. A key point in Darwin's explanation of evolution is that

- a. mutations occur in order to help future generations fit into their environments.
- b. the biological structures most likely inherited are those that have become better suited to the environment through constant use.
- * c. small variations among individuals significantly affect the chance that a given individual will survive in its environment and be able to reproduce.
- d. genes change in order to help organisms cope with problems encountered within their environments.
- e. extinction is nature's way of weeding out undeserving organisms.

13. A living fossil is a

- a. species that has gone extinct very recently.
- b. fossil of a species that is still around today.
- c. fossil that contains undamaged DNA.
- * d. species that is still living that has changed very little over a long period of evolutionary history.

14. The increased survival and reproduction of some individuals with particular variations relative to other individuals that lack those variations is called

- a. Hardy-Weinberg equilibrium
- b. dominance
- c. inheritance of acquired characteristics
- d. the cell theory
- * e. natural selection

15. Which statement is FALSE?

- a. The coal we mine for energy today comes from fossilized forests from the Carboniferous period.
- * b. Since the half-life of ^{14}C is 5,700 years, a fossil that is 11,400 years old has 25% of its carbon in the ^{14}C form .
- c. In the Precambrian era, oxygen levels were much lower than they are now.
- d. Arthropods such as scorpions appeared earlier than mammals.

16. Evidence for the history of life does NOT include

- a. analysis of how fossils fit in with geological strata.
- * b. carbon dating of fossils that are millions of years old.
- c. fossils of microbes or soft-bodied invertebrates.
- d. molecular phylogenies.

17. Which of the following is NOT evidence of a meteor collision?

- a. craters
- * b. sudden appearance of completely new kinds of fossils, such as flowering plants.
- c. disfigured rocks or rocks with unusual isotopic ratios
- d. high concentrations of iridium, such as that in the rock layer separating the Cretaceous and Tertiary periods

18. The genetic code is sometimes called "redundant" because

- a. there are more nucleic acids than is needed.
- b. there are more amino acids than is needed.
- * c. most amino acids are specified by more than one codon of three nucleotides.
- d. most codons of three nucleotides are specified by more than one amino acid.
- e. it is not needed: information is all stored somewhere else.

19. When biologists organize species into groups, the main criteria are

- a. physical similarities.
- b. ecological niches.
- c. chronological order.
- * d. evolutionary relationships.
- e. All of the above.

20. Low birth weight babies die of infectious disease more easily than high birth weight babies. High birth weight babies are more difficult to deliver through the pelvis, which can also lead to early deaths. Because of these two forces, human birth weight is under

- * a. stabilizing selection.
- b. disruptive selection.
- c. directional selection for low birth weight.
- d. directional selection for high birth weight.
- e. sexual selection.

21. In recent years, high birth weight has become less of a problem since Caesarian sections are readily available. Immediately after Caesarian sections became available, we would predict human birth weight to be under

- a. stabilizing selection.
- b. disruptive selection.
- c. directional selection for low birth weight.
- * d. directional selection for high birth weight.
- e. sexual selection.

22. Once Caesarian sections have been available for many generations, it is likely that other constraints will eventually cause problems for very heavy babies. At this point, human birth weight is most likely to be under

- * a. stabilizing selection at a higher birth weight than before.
- b. stabilizing selection at a lower birth weight than before.
- c. disruptive selection
- d. directional selection for low birth weight.
- e. directional selection for high birth weight.

23. Which of the following phrases is NOT an essential part of the biological species concept?

- * a. Morphological similarity
- b. Reproductive isolation
- c. Interbreeding
- d. Natural population

24. The appearance of multicellular organisms coincided with increased levels of _____ in Earth's atmosphere.

- a. sulfur dioxide
- b. carbon dioxide
- c. nitrogen
- d. hydrogen
- * e. oxygen

25. Selection acts on _____ variation; however, evolution depends on _____ variation.

- * a. phenotypic; genetic
- b. genetic; phenotypic
- c. genetic; environmentally-induced
- d. environmentally-induced; phenotypic

26. Which of the following statements about allopatric speciation is FALSE?

- a. Allopatric speciation is also called geographic speciation
- * b. Allopatric speciation requires that daughter populations be fairly small when first separated
- c. Continental drift resulted in allopatric speciation
- d. The founder effect may result in daughter populations having a more limited set of alleles than the parent population
- e. Allopatric speciation is the most common form of speciation

27. Which of the following choices is the conventional representation for the name of a sea star common to the rocky intertidal zone?

- a. Pisaster Ochraceous
- b. *Pisaster Ochraceous*
- * c. *Pisaster ochraceous*
- d. *pisaster ochraceous*
- e. pisaster ochraceous

28. In certain crickets, females approach males of their own species when the males give their mating calls, which are genetically determined. Two such species will mate when confined together in the laboratory; but they do not mate in nature. This provides an example of _____.

- a. spatial isolation
- b. temporal isolation
- c. mechanical isolation
- * d. behavioral isolation
- e. gametic isolation

29. During the Mesozoic era, the continent Pangaea separated into multiple individual continents. As a result

- * a. individual continents acquired distinctive terrestrial floras and faunas.
- b. flight evolved to allow organisms to migrate among continents.
- c. many species became extinct.
- d. All of the above

30. Limpets growing high in the intertidal zone, where they experience heavy wave action, are more conical than individuals of the same species growing in the subtidal zone, where they are protected from waves. Individuals transplanted from the high intertidal zone to the subtidal zone add new growth, which produces a flatter, subtidal shape. This experiment suggests that the difference in

- * a. phenotypes is environmentally-induced.
- b. genotypes is environmentally-induced.
- c. phenotypes is genetically based.
- d. genotypes is due to natural selection.

31. A population evolves whenever

- a. juvenile and adult stages require different environments.
- b. the environment changes on a seasonal basis.
- * c. individuals with different genotypes survive or reproduce at different rates.
- d. individuals are not perfectly adapted to their environment.
- e. environmentally-induced variation is constant between generations.

32. Most taxonomists today believe that classification systems should be

- a. paraphyletic.
- * b. monophyletic.
- c. polyphyletic.
- d. phylogenetic.
- e. changed.

- 33. Although this might seem strange, monarch butterflies could be considered a different species from monarch caterpillars under a strict application of:**
- a. The biological species concept
 - * b. The morphological species concept.
 - c. Both of the above
 - d. Neither of the above.
- 34. _____ selection occurs whenever members of a population that have a trait that is extreme in either direction contribute more offspring to the next generation than average members of the population do.**
- a. Sexual
 - * b. Disruptive
 - c. Stabilizing
 - d. Directional
 - e. Corrective
- 35. Evolutionary change within one population ...**
- a. results from barriers to gene flow
 - * b. is called anagenesis
 - c. is sufficient to cause speciation
 - d. prevents speciation
 - e. is called cladogenesis
- 36. The Cenozoic era (66 mya–present) is often called the age of**
- a. plants, because they convert radiant energy from the sun into chemical energy.
 - b. fishes, because they are an important food resource.
 - c. viruses, because viruses such as AIDS have evolved recently.
 - d. bacteria, because they cause so many diseases.
 - * e. mammals, because of the extensive radiation of this group.
- 37. Why is the protein cytochrome *c* important in the study of molecular evolution?**
- * a. It is found in all eukaryotes, and performs the same function in all cases.
 - b. Its mutation rate is very low.
 - c. All of its mutations are adaptive changes.
 - d. Its mutation rate fluctuates to a great extent.
- 38. Individuals with *aa* genotypes cannot wiggle their ears, while individuals with *AA* and *Aa* genotypes can. There are 900 people on the island of Yananadudo, 800 of whom can wiggle their ears. If we assume Hardy-Weinberg equilibrium, then we can predict that the frequency of the *A* (dominant) allele, often referred to as *p*, is**
- a. 1/9
 - b. 8/9
 - c. 1/3
 - * d. 2/3
 - e. Not enough information to answer.
- 39. When creating a phylogenetic tree, it is best to**
- a. use morphological traits rather than molecular traits, because the gene tree and the species tree are not always the same.
 - b. use molecular traits rather than morphological traits, because there is less human bias.
 - * c. try to combine all traits, both molecular and morphological, into a consensus tree.

40. Allopatric speciation may result when:

- a. An existing geographic barrier is crossed by a few individuals, which then found a new population.
- b. An existing species' range is divided by the appearance of a new geographic barrier.
- * c. Either (a) or (b).
- d. None of the above.

41. The normalized ratio of non-synonymous to synonymous substitutions is given by K_a/K_s . For most genes,

- a. $K_a/K_s < 1$, because most mutations are advantageous.
- * b. $K_a/K_s < 1$, because most mutations are deleterious.
- c. $K_a/K_s = 1$, because most mutations are neutral.
- d. $K_a/K_s > 1$, because most mutations are advantageous.
- e. $K_a/K_s > 1$, because most mutations are deleterious.

42. Any two structures derived from a common ancestral trait are said to be

- a. homoplastic.
- * b. homologous.
- c. biochemical traits.
- d. morphological traits.

43. If the nucleotide sequence

**AGTCCTAACGT changes to
AGTAATCCCGT, this is best described as a(n)**

- a. neutral mutation.
- b. synonymous mutation.
- * c. inversion.
- d. polyploid mutation.
- e. point mutation.

44. Which statement is TRUE?

- a. Changes in the environment are always gradual, with plenty of time for species to adapt to them.
- b. Evolution of species on earth has more or less stopped.
- * c. More than 99% of species that ever lived are now extinct.
- d. Evolution always proceeds at around the same rate.

45. Every completed speciation process must include:

- a. Mating incompatibility
- b. Geographic isolation
- c. Both prezygotic and postzygotic barriers.
- * d. A barrier to gene flow between populations
- e. All of the above

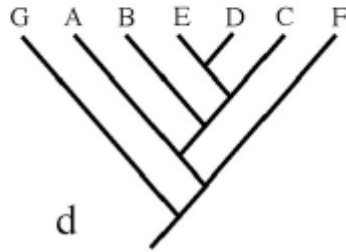
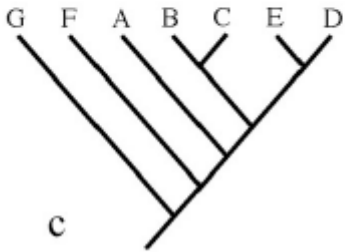
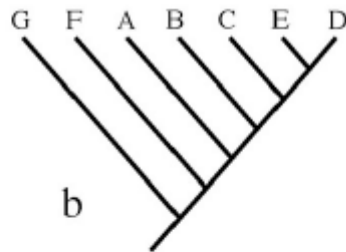
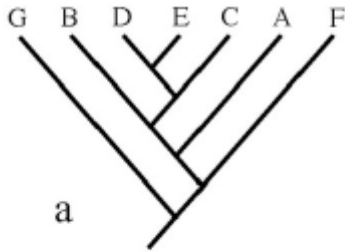
46. Which statement is TRUE?

- * a. If you know the genotype frequency of a diploid population, you can work out the allele frequency.
- b. If you know the allele frequency of a diploid population, you can work out the genotype frequency.
- c. a and b
- d. None of the above.

47. Which statement is TRUE?

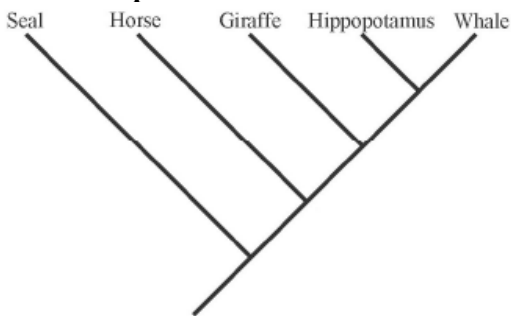
- a. A polymorphism is when two or more phenotypes can be produced by the same genotype.
- b. Evolutionary biologists often make predictions about long-term evolution.
- c. There is always enough variation for any adaptation that is needed.
- * d. A neutral allele is one that does not affect fitness.

48. Which of the four trees below depicts a different pattern of relationships than the others?



(*c)

49. By reference to the tree below, which of the following is an accurate statement of relationships?



- a. A seal is more closely related to a horse than to a whale.
- b. A seal is more closely related to a whale than to a horse.
- * c. A seal is equally related to a whale and a horse.
- d. A seal is related to a whale, but is not related to a horse.

50. Sexual reproduction promotes adaptation by means of

- a. mutation
- * b. recombination
- c. gene flow
- d. genetic drift