

**Biology 170: Exam 1**

**Multiple choice (2 pts each). Mark (bubble-in) the correct answer on your scantron.**

1. How many species of animals are there?
  - a. 5 million
  - b. 60 million
  - c. 30 million
  - d. 1 million
  - e. somewhere between a and c
  
2. Rank the following animal groups from greatest to least (left to right) in the number of described species: Mammalia (mammals), Aves (Birds), Mollusca (clams, snails, etc), and Insecta.
  - a. Mollusca, Aves, Insecta, Mammalia
  - b. Insecta, Mollusca, Aves, Mammalia
  - c. Insecta, Aves, Mammalia, Mollusca
  - d. Mammalia, Aves, Insecta, Mollusca
  
3. Which theory proposes that the number of species at a site is determined by the balancing of rates of immigration of species to that site with the local extinction of species already present?
  - a. Stability-Time Hypothesis
  - b. Pleistocene Forest Refugia Hypothesis
  - c. Equilibrium Theory of Island Biogeography
  - d. Periodic Extinction Hypothesis
  
4. Periods of mass extinction as evidenced in the fossil record may have been caused by:
  - a. Periodic asteroid or comet impacts leading to a nuclear winter like scenario
  - b. Plate tectonics and the fusion of continents reducing the availability and provinciality (isolation) of suitable habitat
  - c. Episodes of widespread disease
  - d. All of the above
  - e. A and B
  
5. Which of the following is not an example of the evolution of a key innovation (a new trait) allowing occupation of a new adaptive zone (habitat or lifestyle).
  - a. Evolution of donut eating by police officers.
  - b. Invasion of the land by plants and animals
  - c. Evolution of wings in insects, birds, and bats
  - d. The evolution of plant-eating among insects

6. Which of the following traits do not help distinguish animals from other forms of life?

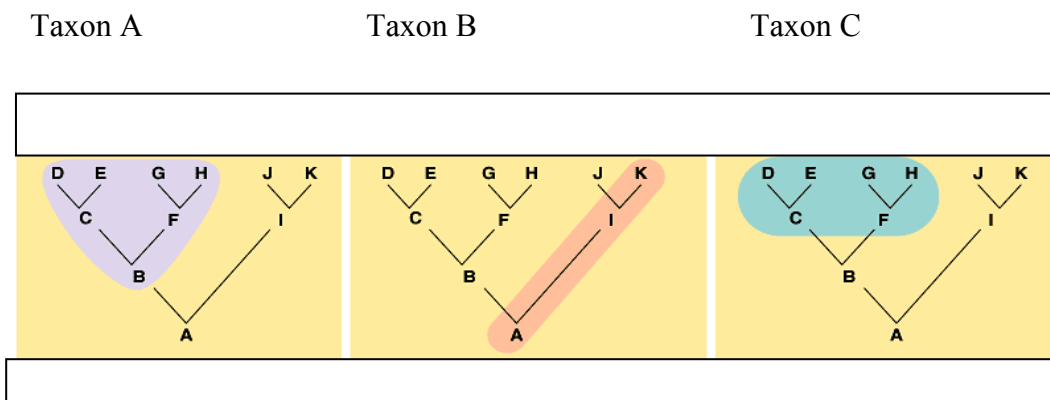
- a. The presence of DNA in the cell nucleus
- b. The presence of two types of tissues: nervous tissues for impulse conduction and muscle tissue for movement
- c. Cell walls that have structural support
- d. b and c
- e. a and c

7. Arrange the following taxonomic categories in their hierarchical order from highest to lowest (left to right): Genus, Family, Class, Order, Phylum.

- a. Phylum, Order, Class, Genus, Family
- b. Class, Phylum, Order, Family, Genus
- c. Order, Phylum, Class, Family, Genus
- d. Phylum, Class, Order, Family, Genus

8. Among the following diagrams which taxon represented by the shaded region represents a monophyletic group?

- a. Taxon A and B
- b. Taxon B and C
- c. Taxon C only
- d. Taxon A only
- e. Taxon B only



9. What sort of characters are useful in constructing phylogenetic trees?

- a. homologous traits
- b. analogous traits
- c. shared derived traits
- d. A and C
- e. B and C

10. A cladogram or phylogenetic tree
- is an hypothesis about the evolutionary relationships among a group of animal taxa
  - is a diagram in which the sequence of branching illustrates the historical chronology of evolutionary event
  - reflects the hierarchical classification of taxonomic groups nested within more inclusive groups.
  - All of the above
11. Data from which of the following sources are used for constructing phylogenetic trees:
- fossils
  - morphological data
  - molecular data
  - all of the above
12. The underlying premise of cladistics and phylogeny is that
- Taxa that share many homologous traits are more closely related than species that share few.
  - The more recently that taxa have branched from a common ancestor the more similar should they be in morphology and in their DNA sequences
  - Taxa that share many derived traits are likely to be most closely related.
  - All of the above
13. In animal cells, DNA is found in which locations:
- mitochondria
  - nucleus
  - ribosomes
  - a and b
14. Experiments designed to test the equilibrium theory of island biogeography show that
- immigration and extinction do not balance.
  - extinction rates are very low.
  - immigration and extinction rates were initially thought to be high, but when experiments are performed at or near "equilibrium" conditions they are thought to be low.
  - immigration rates exceed extinction rates.
15. Why do we not have a more precise estimate of the number of animal species on earth?
- Species that are similar in appearance may only be distinguished using molecular data
  - many species are as yet un-described
  - many regions of the earth have not been thoroughly explored
  - sometimes the same species gets two names so is counted twice
  - All of the above

16. The biological species concept defines species as:

- a. Populations that can and do freely interbreed, and are reproductively isolated from other such populations.
- b. Populations that form the smallest cluster or group that form a monophyletic grouping.
- c. Both a and b
- d. None of the above

17. Which of the following is an example (or are examples) of *prezygotic* reproductive barrier?

- a. Zygote inviability
- b. Hybrid disadvantage
- c. Hybrid sterility
- d. a, b and c
- e. None of the Above

18. Which of the following is an example (or are examples) of *postzygotic* reproductive barrier?

- a. Zygote inviability
- b. Hybrid disadvantage
- c. Hybrid sterility
- d. a, b and c
- e. None of the Above

19. Which of the following is an example (or are examples) of intersexual choice?

- a. female widowbirds choosing to mate with males with long tails
- b. male elephant seals fighting for control of a female harem
- c. female jungle fowl ejecting the sperm of a subdominant male
- d. b and c
- e. a and c

20. Which of the following is an example (or are examples) of intrasexual competition?

- a. female widowbirds choosing to mate with males with long tails
- b. male elephant seals fighting for control of a female harem
- c. female jungle fowl ejecting the sperm of a subdominant male
- d. b and c
- e. a and c

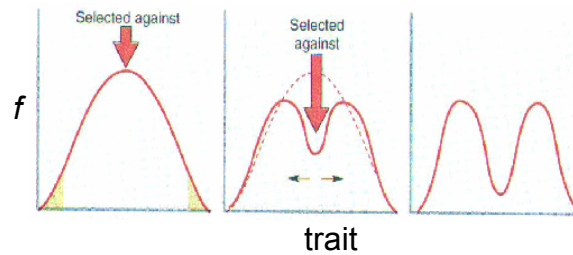
21. All of the following are sources of genetic variation for evolution, *except*:

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

22. All of the following are parts of the allopatric speciation by natural selection model, *except*:
- Geographically isolated populations evolve or change in response to novel environments
  - Reproductive isolation evolves as a by-product of changes in other traits associated with adapting to new resources or environments
  - Selection against hybridization leads to exaggeration of signals to facilitate recognizing conspecifics (individuals of the same species)
  - Changes among or between populations occur while populations are geographically separated.
  - None of the above (in other words, a, b, c and d are all parts of the allopatric speciation by natural selection model)
23. \_\_\_\_\_ states that each sex can maximize its reproductive success in different ways. Male reproductive success increases as males mate with multiple different females. Females, in contrast, gain less (or not at all) by mating with multiple, different males.
- Haldane's Rule
  - Natural selection
  - Bateman's Rule
  - Anisogamy
  - None of the above
24. \_\_\_\_\_ states that when two species hybridize, the sex that is most often inviable or sterile is the heterogametic sex (sex with different sex chromosomes).
- Haldane's Rule
  - Natural selection
  - Bateman's Rule
  - Anisogamy
  - None of the above
25. All of the following are evidence consistent with the idea that evolution is responsible for the diversity of animals we see today, *except*:
- The presence of vestigial organs in extant species
  - Structural homologies among very different animals
  - Fossil records of intermediate life forms
  - Earth is not the center of the galaxy or universe
  - a and b
26. \_\_\_\_\_ discovered that genes are inherited discretely. In other words, genes from parents do not mix, and are passed on from parent to offspring as discrete units.
- Charles Lyell
  - Charles Darwin
  - Gregor Mendel
  - James Hutton
  - None of the above

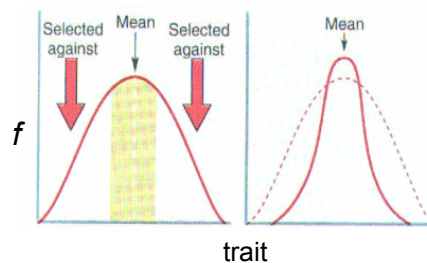
27. \_\_\_\_\_ selects for individuals that are at the two ends of a population distribution (see graph below). For instance, in a hypothetical population of birds with different wing sizes, this type of selection selects for individuals with large and small wings.

- a. Directional selection
- b. Stabilizing selection
- c. **Disruptive selection**



28. \_\_\_\_\_ selects for individuals in the middle of a population distribution (see graph below). For instance, in a hypothetical population of birds with different wing sizes, this type of selection selects for individuals with medium sized wings.

- a. Directional selection
- b. **Stabilizing selection**
- c. Disruptive selection



29. \_\_\_\_\_ is when changes in gene frequencies (evolution) occur because of chance events (sampling errors) that occur when populations are finite in size (small).

- a. Mutation
- b. Natural selection
- c. Sexual selection
- d. **Genetic drift**
- e. None of the above

30. In the \_\_\_\_\_ model, populations expand their range around an inhospitable region and when they finally meet at the end of the expansion, populations have changed so much that new species arise. An example of this is the warbler complex that inhabits forests below the Tibetan plateau. In this example, adjacent populations can interbreed, but those at the end of the range expansion do not.

- A. **ring speciation**
- B. reinforcement
- C. allopatric speciation by natural selection
- D. allopatric speciation by sexual selection

**II. True or false (2 points each). Mark (bubble in) “a” for True and “b” for false on your scantron.**

1. Animal diversity can be thought of as taxonomic diversity (diversity of categories such as species, genera, families, etc.), genetic diversity (protein or DNA sequence variation), and/or morphological diversity (diversity of form). **A. True**
2. The geographical distribution of forest trees in North America and Europe has changed very little in the last 18,000 years. **B. False**
3. The Stability –Time hypothesis suggests that habitats that are geologically old or that are characterized by environmental conditions that do not fluctuate should lead to lower species-diversity. **B. False**
4. A problem common to the Stability-Time Hypothesis, Pleistocene Forest Refugia Hypothesis, Co-Radiation Hypothesis, and the Periodic Extinction Hypothesis is that they cannot be tested using an experimental approach. **A. True**
5. Evidence from molecular clock data on DNA sequence variation and from fossil pollen records support the Pleistocene Forest Refugia Hypothesis as a means of explaining the high species diversity of birds in the Amazon basin. **B. False**
6. Latitudinal gradients are observations that for most animals groups temperate and boreal regions (high latitude) contain more different species than tropical regions (low latitude). **B. False**
7. The species-area relationship is based on the observation that large islands have more species than do small islands. **A. True**
8. The principle of Parsimony as used in phylogeny suggests that the simplest tree that fits the data is preferred. **A. True**
9. The extraction of DNA, its amplification using Polymerase Chain Reaction, and the detection of the exact sequence of nucleotides that comprise a fragment of DNA using Cycle Sequencing mimics the process of DNA replication within living cells and provides information (nucleotide sequence variation) that can be useful as characters in constructing phylogenetic trees. **A. True**
10. Analogous traits are those that are similar because of common ancestry, and homologous traits are those that are similar because of convergent evolution. **B. False**
11. Operational sex ratio is simply the ratio (proportion) of males to females in a population. **B. False**
12. One of the reasons why females are typically the choosy sex is that males invest more in producing their offspring. **B. False**
13. Charles Darwin and Alfred Wallace are credited for discovering evolution by natural selection. **A. True**
14. Polyploidy is the differential investment in gametes by different sexes (e.g., one sex invests more energy in producing eggs or sperm). **B. False**

15. Evidence of marine fossils in (current) desert areas is one of the many observations that indicates that the world is constantly changing (and not static). **A. True**
16. Heritable variation among individuals in a population is essential for evolution to occur. **A. True**
17. Gametic incompatibility is an example of an *extrinsic* reproductive barrier between species. **B. False**
18. Reinforcement model requires a penalty for hybridization between populations or species. For example, hybrids would show lower survival rates. **A. True**
19. Uniformitarianism asserts that the natural agents now at work on Earth have operated in a similar manner in the past (even long periods of time). **A. True**
20. Lamarckism asserts that changes within an organism's life through use and disuse of certain body parts are heritable (passed on to offspring). **A. True**