BIO 213 - Principles of Evolution
Summer 1999, Final

1. **Read these directions before you begin.**
2. Write your name on your Scantron sheet and make sure it is on the 8½×11 "cheat sheet" (**tests without names will not be graded**).
3. Check this test to make sure it has all pages, 1–3.
4. Mark all answers on the Scantron sheet. There is *only one* correct answer to each question.
5. When you are finished, turn in your take-home essay questions, the Scantron and the 8½×11 "cheat sheet" on the front table. ***Please keep this sheet.***

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1. _____ is an example of a *post*zygotic breeding barrier
   a. Allopatry
   b. Behavioral incompatibility
   c. **Hybrid inviability**
   d. Mechanical incompatibility
   e. Sperm death

2. _____ is an example of a *pre*zygotic breeding barrier
   a. Developmental abnormalities in the embryo
   b. Ecological failure of F_2s and backcrosses
   c. F_1 sterility
   d. **Sperm death**
   e. Zygote death

3. A morphological gap is
   a. a breeding barrier between organisms that don't look the same
   b. a geographic barrier to the dispersal of a species
   c. always the result of a mass extinction
   d. **the lack of individual organisms with a morphology intermediate between that of two existing species**
   e. the result of shared homologous features

4. A non-reduced gamete (of the sort that can lead to allopolyploidy)
   a. has half the number of chromosomes as the somatic (body) cells of the organisms that produced it
   b. has only one haploid chromosome set
   c. **has the same number of chromosomes as the somatic (body) cells of the organism that produced it**
   d. has twice as many chromosomes as the somatic (body) cells of the organism that produced it
   e. is the product of ordinary meiosis

5. Allopolyploidy
   a. always involves only a single species
   b. **often results in hybrid speciation (formation of new species from hybrids)**
   c. is most common in animals
   d. is most common in bacteria and other prokaryotes
   e. results in a chromosome number that is never an exact multiple of the haploid chromosome set

6. An *exaptation* is an attribute of a species that comes to serve an adaptive role other than that for which it originally evolved. Which of the following is likely to ***not*** be an exaptation?
   a. Mammals have jaws for chewing, but jaws started out in early vertebrates as supports for gills.
   b. Pandas hold the bamboo they are eating between the five fingers of a "hand" and a projection of the radial sesamoid bone in the wrist.
   c. Penguins use their wings to fly through the water. Almost all birds have wings, but most fly through the air.
   d. ***Penstemon centranthifolius*** **is a flowering plant that has long tubular red flowers, which are adapted to its hummingbird pollinators. Its closest relative has short blue flowers and is pollinated by bees.**
   e. Skunks spray a defensive chemical from their anal glands. Most other carnivores also have anal glands, that produce a scent used for marking territories or social communication.

7. Fossilization of transitional individuals (with intermediate morphology) in peripatric speciation is
   a. likely, because almost every organism fossilizes
   b. likely, because fossilization only takes place in the center of distribution
   c. likely, because new species often form at the edges of lakes
   d. unlikely, because individuals of new species have soft bones and don't fossilize well
   e. **unlikely, because there are so few individuals compared to the other species in the area**

8. From radiometric dating, we can infer that the oldest known fossils are _____ years old.
   a. around 10,000 (ten thousand)
   b. around 65,000,000 (sixty-five million)
   c. at least 300,000,000,000 (three hundred billion)
   d. just over 150
   e. **more than 3,000,000,000 (three billion)**

9. In allopatric speciation,
   a. new species always form on the periphery of established ones
   b. small numbers of organisms disperse across a pre-existing geographic barrier
   c. the ancestral species remains unchanged
   d. the new species evolves rapidly in a small population
   e. **the two resulting species have roughly equal numbers of individuals**

10. In order for true sympatric speciation to be successful,
   a. the ancestral species must be polyploid
   b. the new species and its ancestor must be allopatric
   c. the new species must form on the periphery of the ancestral species
   d. **the new species must immediately be reproductively isolated from the parent species**
   e. the new species must not be capable of self-pollination or self-fertilization

11. In peripatric speciation,
   a. a geographic barrier arises and splits the range of a species
   b. **new species ordinarily form on the periphery of established ones**
   c. the ancestral species ceases to exist, being transformed into the two new species
   d. the new species evolve slowly, since they consist of so many individuals
   e. the resulting species have roughly equal numbers of individuals

12. In species of organisms that disperse poorly, peripheral isolation usually occurs by
   a. dispersal of organisms from the center of distribution of the ancestral species across a pre-existing barrier
   b. dispersal of organisms from the periphery of the ancestral species across a pre-existing barrier
   c. **elimination of the ancestral species from a peripheral area that contains a newly-formed species**
   d. formation of a geographic barrier within the range of a species
   e. polyploidy

13. Phylogenetic species
   a. are always separated from other phylogenetic species by morphological gaps
   b. are always sister species
   c. cannot hybridize with other phylogenetic species
   d. show a hierarchic pattern of character distribution among the populations that they consist of
   e. **show a reticulate pattern of character distribution among the populations that they consist of**

14. Punctuated equilibrium
   a. accounts for gradual evolution of fossil lineages
   b. **applies the model of speciation in small peripheral populations to the evidence from the fossil record**
   c. is rejected by almost all modern evolutionists
   d. looks at the fossil record only from a gradualist viewpoint
   e. shows that rapid replacement of a species by its descendent in the fossil record represents an evolutionary transition, not an ecological transition.

15. The "punctuated" in *puctuated equilibrium* refers to _____ and the "equilibrium" means _____.
   a. Huxley's statement "Evolution is true! Period!" . . . The balance of power between evolutionists and creationists in the late 1800s.
   b. mass extinctions caused by external factors . . . the Hardy-Weinberg equilibrium.
   c. the alternation of sediments and lava in geological strata . . . the roughly equal amounts of both.
   d. **the formation of new species rapidly in the scale of geological time . . . persistence of species over long periods with little morphological change.**
   e. the imperfections of the fossil record . . . the slow process of allopatric speciation.

16. The desert annual plant *Geraea canescens* and the desert perennial *Encelia farinosa* can hybridize. All of the hybrids have *Encelia farinosa* as the maternal parent; i.e., pollen from *Geraea canescens* can pollinate *Encelia farinosa*, but not vice versa. This is an example of
    a. allopatry
    b. cryptic speciation
    c. postzygotic breeding barrier
    d. sibling species
    e. **unilateral incompatibility**

17. The earliest fossils that can clearly be identified as organisms are
    a. **bacteria**
    b. birds
    c. dinosaurs
    d. jellyfish
    e. oak trees

18. Two factors are ordinarily necessary for speciation to occur:
    a. a changing environment and animals struggling for existence
    b. a high mutation rate and a barrier to gene flow
    c. rubber bands and scissors
    d. **selection for divergence and a barrier to gene flow**
    e. stabilizing selection and change in chromosome number

19. When we consider the geographic range of a typical species, we can say that
    a. **genetic diversity is high at the periphery**
    b. genetic diversity is high in the center of distribution
    c. intraspecific competition is low in the center of distribution
    d. population density is high at the periphery
    e. the periphery represents environments just as favorable to the species as the center of distribution

20. Which of the following statements about fossils is false?
    a. Most individual organisms never form fossils.
    b. Some organisms fossilize more easily than others.
    c. **Fossils always preserve the DNA and other organic components that made up the original organism.**
    d. The order in which fossils are found in geological strata can tell us something about the evolution of the organisms that formed them.
    e. Fossils are classified taxonomically on the basis of morphological differences, rather than on their ability to interbreed.

21. According to the "biological species concept", a species consists of populations of "actually or potentially interbreeding organisms." Which of these is *not* a criticism of the biological species concept?
    a. Hybridization is common in many groups of organisms.
    b. Interbreeding doesn't always mean gene flow.
    c. **Organisms that interbreed are usually similar in their morphology and ecology, as well.**
    d. "Potential interbreeding" has no effect on evolution until it happens.
    e. There are many different evolutionary reasons for breeding barriers.

22. Mass extinctions seem to come at the end of geological eras and periods because
    a. asteroids wait until the end of an era to strike.
    b. evolutionists ignore the ones that come at other times.
    c. geologists are very sloppy about figuring out the actual dates.
    d. if the extinctions were delayed, they would mess up the subsequent adaptive radiation.
    e. **that is how the geologists define the eras and periods.**

23. A radioactive half-life is
    a. an early earth organism which didn't have all the metabolic pathways necessary for life.
    b. one-half the duration of a species on earth, as measured from its fossil record.
    c. the life of a very hyperkinetic, but severely depressed, disc jockey.
    d. **the time it takes half of the radioactive atoms in a sample to decay into another element.**
    e. two billion years.

24. According to the principle of historical contingency,
    a. a knowledge of general principles allows us to predict the future with great accuracy.
    b. **single random events can have great effects on history, both human and evolutionary.**
    c. extinctions are always the result of organisms being poorly adapted.
    d. the evolution of organisms over the history of the earth has been shaped totally by changes in the gene frequencies of populations.
    e. all you have to do is enroll in the courses and you'll automatically graduate.

25-30. Please mark the answer "a" on your Scantron for each of these questions. If you do so, they will be "free points"; if not, you will get no credit for them.