(THIS EXAM IS YOURS TO KEEP)

BIOS 209 - **FUNDAMENTALS OF BIOLOGY II** - 20 OCT. 2008

EXAM II (34 QUESTIONS; 68 PTS)

MULTIPLE CHOICE (Fill in the bubble on the Scantron form with the **best** answer).

1) %03Which of the following is the best definition of evolution?

a) The total of all events that occur during the development of zygotes into multicellular organisms;
b) The orderly division of organisms into categories based on their similarities or differences ;
c) The study of interactions between organisms and the environment;
d* The change in genetic composition of a population over time;
e) The study of the functions of an organism.

2) %06The mutations responsible for Huntington's disease are known as

a) synonymous substitution mutations;
b) gene duplication mutations;
c* insertion/deletion (indel) mutations;
d) inversion mutations;
e) polyploidization.

3) %04Working with desert tobacco Dr. Danny Kessler measured the fitness of wild type (control) and bioengineered plants and showed that

a) genes from bioengineered plants readily escape to closely related wild species;
b) natural selection occurs too slowly to be measurable during the course of a few years;
c) the plants with the greatest fitness were those that were pluripotent or totipotent;
d* both benzyl acetone, a floral scent that attracts hummingbirds, and nicotine, are adapative;
e) plants could be bioengineered to have greater fitness than wild type plants.

4) %07Thalassemia, a type of anemia found in human populations of the Mediterranean region,

a* is a balanced polymorphism that arose because heterozygotes were resistant to malaria;
b) causes anemia leading to death in infants who are heterozygous for the condition;
c) rapidly produced new species of hominids after which there was evolutionary stasis;
d) nearly forms a postzygotic reproductive barrier because the disease can be fatal;
e) arose because of a flood-induced bottleneck among humans that occurred about 6,000 years ago.

5) %02In recent news a South Korean company found that there is big money to be made in cloning. Bernann McKinney, a California resident, paid $50,000 for five "booger clones," which were

a) research-quality fruit flies;
b* pet pit bulls;
c) nematodes;
d) cultivated orchids;
e) human nasal secretions.

6) %07Directional selection is an outcome of natural selection in which

a) the mean phenotype from one generation to the next does not change;
b* there is a unidirectional shift in the mean phenotype from one generation to the next;
c) two different morphs become adaptive in the same population of organisms;
d) variation in the genes expressed as different phenotypes are decreased;
e) a mutation for a new phenotype arises and rapidly spreads throughout the population.

7) %01In nematode embryos that are only four cells in size, a signal protein on the surface of one of the cells causes a neighboring cell to follow a different path of development than the other two cells in the embryo in a developmental process known as

a) cell division;
b) differentiation;
c* induction;
d) apoptosis;
e) morphogenesis.

8) %05In a hypothetical population of plants at Hardy-Weinberg equilibrium where flower color is determined by two alleles, heterozygous plants have pink, rather than red or white flowers. If the frequency of the allele for red flowering is 50% in a given generation, what is the frequency of this allele in the next generation?

a* 50%;
b) 2pq = 2(0.5)(0.5) = 0.5; The frequency of the pink-flowered allele will be 0.25;
c) p = 0.5; p^2 = 0.5(0.5) = 0.25; There will be 25% red flowered plants in the next generation;
d) p^2 = 0.5; p = 0.5^{-2} = 0.707; The frequency of red-flowered plants in the next generation is 70.7%;
e) It depends on the frequencies of white and pink flowered plants, but this information is not given.

9) %05In the Hardy-Weinberg equilibrium equation, the term, 2pq, represents the frequency of the

a) homozygous dominant genotype in the population;
b* heterozygous genotype in the population;
c) homozygous recessive genotype in the population;
d) dominant allele for one locus in the gene pool of a population;
e) recessive allele for one locus in the gene pool of a population.

10) %02Embryonic stem cell research poses a moral dilemma for some people because the embryonic stem cells are harvested from

a) human umbilical cords in cord banks WITHOUT the permission of the parents;
b) human placentas obtained from hospitals WITHOUT the permission of the parents;
c) aborted human fetuses obtained from abortion clinics WITH the consent of the mother;
d) aborted human fetuses obtained from abortion clinics WITHOUT the knowledge of the mother;
e* human embryos, which are less than ten days old, that were conceived in fertility clinics.

11) %04Which of the following types of information were available to Darwin as he formulated the theory of natural selection?

a) The absolute ages of fossils as determined by radiometric dating methods;
b) The structure of DNA and how it encodes genes.;
c) How gametes form by the process of meiotic cell division;
d* The distribution of organisms on parts of the earth including South America and oceanic islands;
e) All of the above.

12) %06Unlike the southern elephant seal, virtually no genetic variation can be found in the northern elephant seal. This difference between the two types of seals is thought to be because of

a* a bottleneck that occurred when the northern elephant seal was nearly hunted to extinction;
b) weak selection for a limited set of adaptations in the northern elephant seal;
c) strong genetic drift in the relatively small population of the southern elephant seal;
d) a mutation in the homeotic gene clusters of the northern elephant seal;
e) periodic gene flow between populations of the two types of elephant seal.

13) %02The four sets of Homeotic (*Hox*) genes in mice and other vertebrates

a) have no homology with *Hox* genes in fruit flies and other insects;
b* show evidence of common ancestry when compared to the *Hox* genes of fruit flies;
c) occur in a different linear sequence than the *Hox* genes of fruit flies and other insects;
d) include fewer copies of genes than the single *Hox* cluster in fruit flies and other insects;
e) are found on the same chromosome suggesting recombination.

14) %06The gene family of olfactory receptors grew to over 1,000 members in mammals by the process of

a) synonymous substitution mutations;
b* gene duplication mutations;
c) insertion/deletion (indel) mutations;
d) inversion mutations;
e) horizontal gene transfer.

15) Homeotic gene products

a* have a general DNA-binding homeodomain and other domains that give DNA-binding specificity;
b) regulate only the process of apoptosis (programmed cell death) during embryonic development;
c) are translation factors that will bind to any segment of RNA in a nonspecific manner;
d) catalyze the acetylation, methylation and phosphorylation of histones;
e) are found only in aquatic and terrestrial vertebrate animals. %03

16) %05Microevolution and macroevolution

a) only occur within individuals;
b) only occur within populations of a species;
c) both refer specifically to changes above the taxonomic level of the species;
d) were both historically studied by population geneticists;
e* were originally considered to be distinct, but have been shown to be unified by molecular evolutionary processes.

17) %04In an experiment in which guppies were transplanted to pools with a different predator fish

a* there was differential selection for guppies that were better able to survive each specific predator;
b) the predators in the new pool ate the introduced guppies until they were extinct;
c) a new species of guppy evolved that was unable to breed with members of the original population;
d) the predator species in the new pool evolved to the point where it only fed on guppies;
e) there was no measurable change in either the guppies or the predators after 60 generations indicating that natural selection is very gradual.

18) %01Although the developmental stages of chickens, frogs, fruit flies, and bean plants appear to be very different, these organisms are remarkably similar in terms of their

a) patterns of morphogenesis;
b) overall genome sizes;
c) cell wall architectures;
d* types of homeotic (*Hox*) genes;
e) reproductive organs.

19) %07Sexual selection occurs when there is/are

a) completely random mating in a population;
b* a correlation between secondary sex characteristics and other adaptations;
c) males and females of a species that are indistinguishable, except for sex-specific genitals;
d) there is an imbalance between males and females due to positive natural selection for one sex;
e) natural selection of both males and females.

20) %05Population geneticists study

a) gene flow;
b) microevolution;
c) how populations change genetically over time;
d) genetic drift;
e* all of these.

21) %01The cell walls found in plants and fungi

a* prevent relocation of cells so that morphogenesis must proceed by unequal cell division;
b) accelerate the relocation of cells and tissues during morphogenesis;
c) are commonly found around the cells of organisms such as starfish, frogs and humans;
d) channel water through the organism and into cells during the process of morphogenesis;
e) are found only in prokaryotes, such as bacteria, that are exclusively single-celled. %01

22) %05Which of the following would be most likely to cause a change in allele frequencies in a population of organisms from those predicted by the Hardy-Weinberg equation?

a) Mating between individuals in the population is completely random;
b* New individuals migrate into the population from a neighboring population;
c) There are an exceptionally large number of individuals in the population;
d) There is no measurable natural selection in the population;
e) Any of these might be expected to cause a change from the Hardy-Weinberg equilibrium.

23) %03Charles Darwin published the “Origin of Species”

a) in 1798, in which he described how available resources limit population growth;
b) in 1809, in which he explained how unused body parts gradually deteriorate;
c) in 1830, in which he proposed the theory of uniformitarianism;
d* in 1859, in which he proposed natural selection to be the cause of evolution;
e) in 1865, in which he described how the characteristics of organisms are inherited.

24) %08According to the biological species concept, individual organisms are considered to be part of the same species on the basis of

a) morphological and anatomical similarities;
b) behavioral and ecological similarities;
c) biogeographic similarities;
d) the presence of one or more pairs of identical chromosomes;
e* The ability to interbreed.

25) %02The ability of a single, mature cell to develop into an entire organism is known as

a) apoptosis;
b) morphogenesis;
c* totipotency;
d) induction;
e) inference.

26) %04The use of the anti-HIV drug, 3TC, has

a) reduced the level of viral infection below measurable levels for indefinite periods;
b* positively selected drug-resistant mutant strains of HIV within just a few weeks;
c) caused mutations for drug resistance to arise in HIV;
d) negatively selected against strains of HIV with high mutation rates;
e) increased the replication rate of HIV.

27) %06A population bottleneck is an example of

a* genetic drift;
b) gene flow;
c) natural selection;
d) mutation;
e) adaptation.

28) %05In a population of plants at Hardy-Weinberg equilibrium, the proportion of plants with red flowers, which is the dominant flower color, is 0.64. All other plants have white flowers What proportion of the total population of plants is heterozygous for flower color?

a) 0.16;
b) 0.36;
c* 0.48;
d) 0.64;
e) Not enough information is given to determine the proportion of heterozygous plants.

29) %01The programmed cell death that occurs during development is

a) evidence of the totipotency of embryonic stem cells;
b* a normal part of the process and called apoptosis;
c) an abnormal condition, often caused by parasites or pathogens;
d) the result of an early mutation in the zygote or very young embryo;
e) proof of asymmetrical mitotic cell division.

30) %08Allopolyploidy, or hybridization between closely related species of plants may occur after errors of cell division produce gametes with abnormal numbers of chromosomes. This process

a) causes speciation because of a geographic barrier;
b) is an example of sexual selection;
c) will always fail because the gene pools of the two species do not intersect;
d* has been a documented cause of sympatric speciation;
e) is likely to cause allopatric speciation.

31) %03Antibiotic-resistant strains of pathogenic microbes are becoming more common. An evolutionary biologist would explain this increase to be the direct result of

a) generally increasing mutation rates among microbes in response to antibiotic use;
b) the general lack of cleanliness and personal hygiene in modern society;
c* repeated selection for antibiotic resistance in microbes by the widespread use of antibiotics;
d) genetic drift in populations of microbes because of limited population sizes;
e) the introduction of antibiotic susceptible microbes into hospitals by infected patients.

32) %01The capability of certain single cells to develop into entire organisms is known as

a) heterochrony;
b* totipotency;
c) paedomorphosis;
d) induction;
e) preadaptation.

33) %08There are two species of garter snakes that occur in the same geographic areas, but one lives mainly in the water while the other lives primarily on land. These two species rarely interbreed because of a

a* prezygotic habitat isolation barrier;
b) prezyogotic gametic isolation barrier;
c) postzygotic barrier, in which hybrids between the two species fail to survive;
d) postzygotic barrier, in which hybrids between the two species are sterile;
e) postzygotic barrier due to temporal isolation.

34) %07Genetic variation can be measured as average heterozygosity, which is

a) the change in the frequency of heterozygotes from one generation to the next;
b* the mean number of genes that are heterozygous in the entire genome of an organism;
c) a theoretical limit on variation that depends on overall genome size;
d) the frequency of the heterozygous genotype in a population;
e) a decreasing quantity when mutation rate is high.