BIOL*2400 EVOLUTION
W18
Midterm I

February 5th, 12:30 – 1:20pm

Instructors: Dr. Moira Ferguson
Dr. Elizabeth Boulding

Last																	
First																	
ID #																	

Instructions (pink)

1. Fill in **SECTION 55** on your test scoring answer sheet (scantron) with a pencil. Also, fill in your name, student number, Courselink ID (under Email)**.**

2. This first midterm exam is worth either 15% or 25% of your final grade depending on how you do on the second midterm. It consists of 16 multiple choice questions all weighted equally (1 mark each) and 2 short answer questions weighted equally (3 marks each). You must answer all questions.

3. Use a #2 HB pencil to completely fill in the circle of your choice for the Multiple Choice Questions. Choose only one answer per question. If more than one answer is chosen, the question will not be marked.

4. Write your full name and student ID on the top of Section 2. Use full sentences in your answers to the short answer questions.

5. This exam should have 7 pages.

6. You are permitted to use dedicated calculators; NOT your phone.

7. Please bring your exam to the front of the room when you are finished so that we can check that your scantron has been completed.

8. All remaining exams will be collected at 1:20am. You will not be given extra time to fill in your multiple-choice answers on the scantron form.

Part 1 Multiple Choice [16 questions – 1 mark each]

1. Homologous morphological traits:

    a. always serve the same function in two different groups of organisms and have therefore been selected to have similar anatomical characteristics.
    b. are often anatomically similar in structure in two or more groups of organism because they were inherited from a common ancestor.
    c. appear to be identical in two or more groups of organisms.
    d. always serve different functions and have different anatomical character states in two or more groups of organisms.
    e. all of the above.

2. Morphological traits often have a continuous phenotypic distribution because they are:

    a. a result of dominance interactions.
    b. not related to genotypes.
    c. influenced only by the environment.
    d. often polygenic.
    e. none of the above.

3. If species A and B are more closely related to each other than either is to species C, then species A and B *must*:

    a. share a more recent common ancestor.
    b. be more similar physically overall.
    c. share more derived traits (synapomorphies).
    d. both a and c are correct.
    e. a, b, and c are all correct.

4. How does the degree of dominance with respect to fitness affect the rate at which an advantageous allele increases in frequency by natural selection?

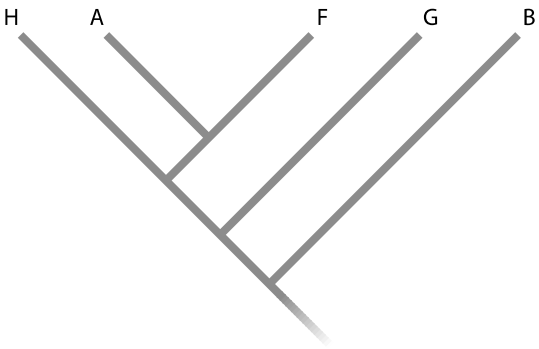
    a. An advantageous dominant allele increases faster when it is rare relative to an advantageous recessive allele.
    b. The level of dominance has no effect on the rate of increase of an advantageous allele.
    c. An advantageous recessive allele increases faster when it is rare relative to an advantageous dominant allele.
    d. An advantageous additive allele increases slower when it is rare relative to an advantageous recessive allele.
    e. None of the above.

5. Tasmanian devils once inhabited most of present day Australia, but only an isolated population on the island of Tasmania has survived to present day. Which of the following processes has likely affected Tasmanian devils as a result of this history:

    a. a higher mutation rate
    b. stronger natural selection
    c. a genetic bottleneck
    d. gene flow

6. Which of the individuals listed below believed that organisms and species did not change over time?

    a. Georges Buffon
    b. Charles Darwin
    c. Carolus Linnaeus
    d. Jean-Baptiste Lamarck
    e. Alfred Russel Wallace

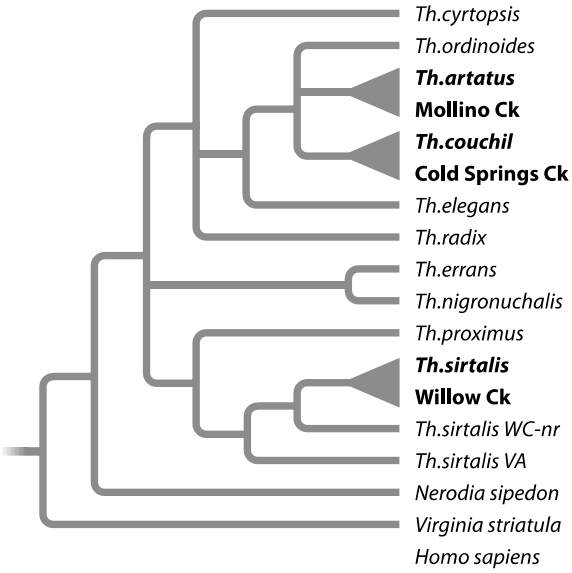


7. According to the tree above:

    a. Species F is more closely related to species G than species A
    b. Species B is equally related to species G and species A
    c. Species H is more closely related to species A than to species F
    d. Species B is the common ancestor of species A, H, F, and G

8. Inbreeding results in a higher frequency of _____ in a population. Inbreeding depression occurs because _____.

    a. deleterious alleles; individuals with deleterious alleles have high mortality
    b. heterozygosity; heterozygotes have lower fitness
    c. heterozygosity; deleterious dominant alleles are expressed more often
    d. homozygosity; deleterious recessive alleles are expressed more often

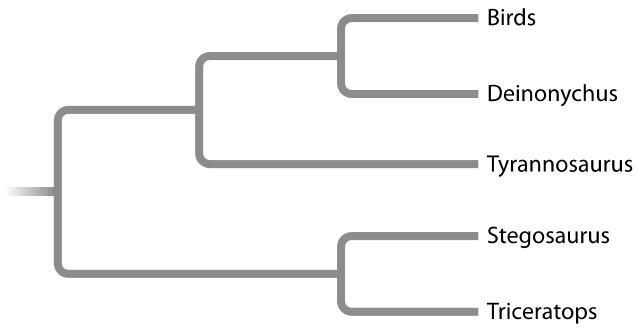


9. Only a few species of garter snakes (*Th. atratus, Th. couchii,* and *Th. sirtalis*) have evolved the ability to tolerate a toxin produced by newts called tetrodotoxin (TTX). The phylogeny above shows how these three species are related. Referring specifically to *Th. couchii* and *Th. sirtalis*, tolerance to TTX is an example of _____ caused by _____.

   a. reversal; homology
   b. homology; convergent evolution
   c. homoplasy; homology
   d. homoplasy; convergent evolution
   e. ancestral homology; genetic drift

10. Which of the following was an observation that Darwin made during his voyage on the Beagle to support his idea of "descent with modification"?

    a. Rock layers provide a record of earth's history
    b. Animals found on the Galapagos Islands were more similar to the species found on the mainland than to those found on the Cape Verde Islands even though the two sets of islands seemed ecologically similar.
    c. Populations are capable of exponential growth and yet most population sizes are stable over time.
    d. Individuals vary in appearance and some of their attributes make them more successful.



11. The phylogeny above shows relationships between birds and four different dinosaur genera. Based on the logic of using phylogenies to group species into taxonomic groups, which of the following statement(s) is/are accurate?

    a. Dinosaurs and birds form a monophyletic group (a clade)
    b. In order for dinosaurs to be a valid taxon, birds must also be called dinosaurs
    c. Dinosaurs are a paraphyletic group
    d. All of the above
    e. None of the above

12. The numbers of individuals with the genotypes A_1A_1, A_1A_2, and A_2A_2 are listed in the table below.

Genotype	Number of Individuals
A_1A_1	45
A_1A_2	36
A_2A_2	19

    The frequency of the A_1 allele in the population is:

    a. 0.47
    b. 0.63
    c. 0.19
    d. 0.37
    e. 0.67

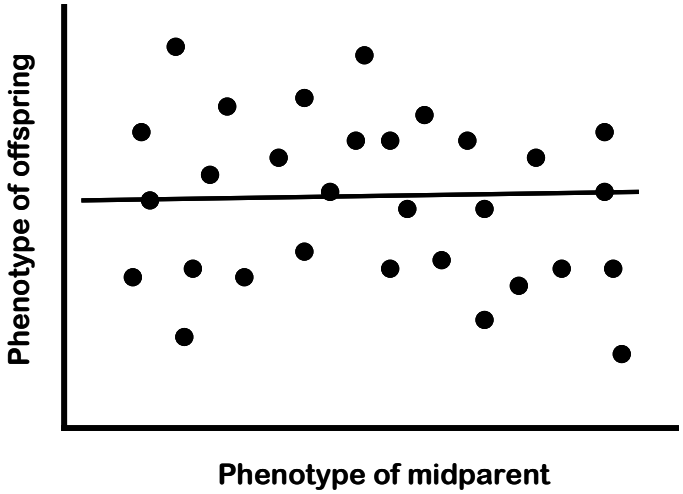
13. If p (A_1) = 0.4 and q (A_2) = 0.6 what would the expected frequency of the A_1A_2 genotype be at Hardy-Weinberg equilibrium?

    a. 0.24
    b. 0.16
    c. 0.32
    d. 0.48

14. If the expected frequency of the A_2A_2 genotype at Hardy-Weinberg equilibrium was 0.2 in a population of 200 animals, how many individuals would you expect to have the A_2A_2 genotype at Hardy-Weinberg equilibrium?

    a. 20
    b. 40
    c. 8
    d. 4
    e. 2

15. Which of the following is a correct interpretation of the graph below?



    a. the value of heritability is 1
    b. the trait has no genetic basis.
    c. most variance in the trait is due to genetic variation.
    d. most variance in the trait is due to environmental variation.

16. Two species are subdivided into subpopulations of the same size. Species A shows an F_{ST} value of 0.2 and Species B shows an F_{ST} value of 0.8. Which of the following statement is correct? Assume that neither natural selection nor mutation is occurring in either species?

    a. The amount of genetic drift is higher in Species A compared to Species B
    b. The amount of genetic drift is higher in Species B compared to Species A
    c. The amount of gene flow is higher in Species B compared to Species A
    d. The amount of gene flow is higher in Species A compared to Species B

Last																	
First																	
ID #																	

Part 2 Short Answer [2 questions = 3 marks each]. Use full sentences and write your answer in the spaces below.

1. Discuss the effects of genetic drift and natural selection in small vs. large populations when a new beneficial allele is introduced into a population via mutation. Explain the effects of each process alone in relation to population size and then why each process is stronger/weaker depending on the population size when both processes are occurring. Assume that no gene flow is occurring. (3 marks)

2. What is the principle of parsimony? Why might we need to use it in a phylogenetic analysis? What is a consensus phylogenetic tree and why do we sometimes need to build one? (3 marks)