

1) Directional selection on a quantitative trait is represented by a:

- \*a) linear fitness function
- b) u-shaped fitness function
- c) inverted u-shaped fitness function
- d) fluctuating fitness function
- e) none of the above

2) In a large population of stellate dung beetles, you measure five different traits that have continuous distributions, and estimate the following variance components:

	Additive genetic	Dominance genetic	Environmental
horn length	46.5	15.6	248.1
elytra length	73.0	365.2	292.2
pronotum width	42.4	10.6	53.0
head width	51.3	17.4	118.6
femur length	16.5	18.2	67.3

Which

h trait has the highest heritability?

- a) horn length
- b) elytra length
- \*c) pronotum width
- d) head width
- e) femur length

3) You are conducting a long-term study of the grackles (birds) on the UH campus. After a particularly hot summer, the population is much smaller because many birds have died. Because you have marked all birds individually as part of your study, you know the distribution of several morphological characters before and after the drought. You calculate the selection differentials and selection gradients for each trait (shown below; asterisks indicate significant differentials or gradients).

trait	s	$\beta$
body mass	+0.29*	-0.18*
bill length	+0.41**	+0.37*
wing length	+0.17*	+0.32*
tarsus length	+0.11*	+0.09

Which traits changed because of a correlated response to selection?

- a) all traits
- b) wing length
- c) bill length
- d) bill length and wing length
- \*e) tarsus length

4) Which of the following is not a

sympomorph?

- a) the wings of butterflies and beetles
- b) the bony skeleton of fish and mammals
- \*c) the body shape of whales and sharks
- d) the horns of buffalo and the horns of antelope
- e) the hands of humans and chimpanzees

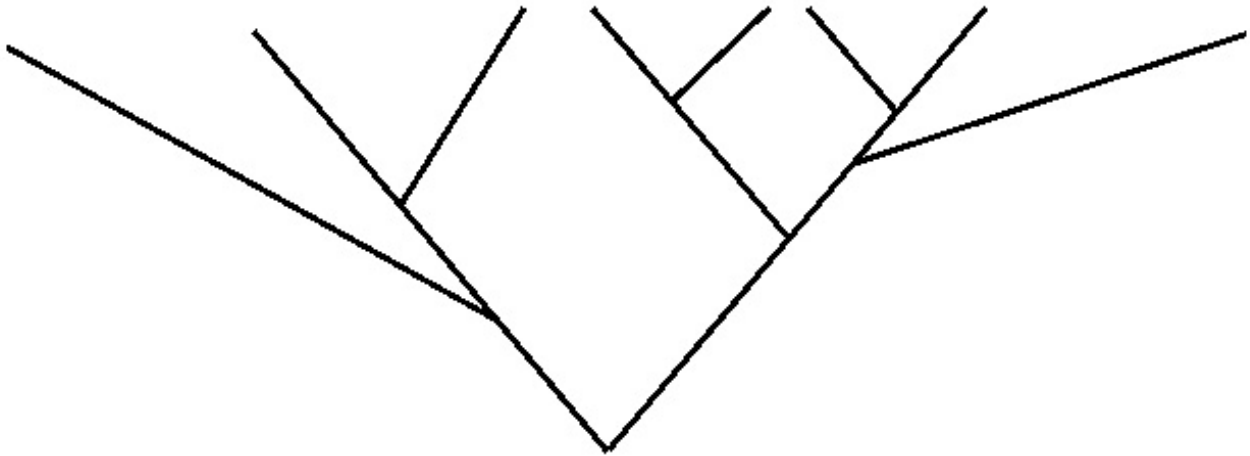
5) You are trying to reconstruct the evolutionary history of the seven species given below, using the traits a - j. For each trait, x is the ancestral state, while x' is the derived state. On the basis of these characters, which pair represents sister taxa?

- I a'bcdefgh'ij
- II abcdefg'hij
- III ab'c'de'fghij'

IV ab'cde'fghij'  
V abcdef'ghi'j  
VI abcdef'ghij  
VII abcd'ef'ghij

- a) II and III
- \*b) III and IV
- c) III and V
- d) IV and V
- e) IV and VI

6) For the phylogeny given below, how many independent contrasts are possible?



- a) five
- b) six
- \*c) seven
- d) eight
- e) nine

7) Males of Gunnison's Sage Grouse aggregate during the breeding season in leks where they display to females. Females chose a particular male as a mate, and after mating, go off and raise the offspring on their own. Unlike regular sage grouse, male Gunnison's sage grouse have elaborate head plumes (feathers). Females are more likely to mate with males that have longer head plumes. The most likely explanation for female preferences is:

- \*a) plume length indicates a high quality male
- b) plume length indicates a competitively superior male
- c) plume length indicates the amount of material benefit a female will receive
- d) plume length indicates the age of a male
- e) plume length is a signal of male territory quality

8) What is not true of traits that evolve via sensory bias?

- a) the trait has been shaped by natural selection in a different context (e.g., foraging)
- \*b) females prefer the trait because it leads to higher quality offspring
- c) females prefer the trait because it more strongly stimulates the female nervous system
- d) female preference for the trait evolves before males begin to use it in mating
- e) females receive no benefit from having a preference

9) Nepotism is defined as:

- \*a) directing help to relatives
- b) being altruistic
- c) acting in the best interests of the species
- d) increasing inclusive fitness
- e) acting as a helper

10) Poison Aster is a desert plant that only occurs in soils that contain high levels of selenium, a metal that is toxic to most plants. Although poison aster can grow in soil without selenium, it never occurs there. Individuals of this species sequester the metal in their tissues. You wish to test whether sequestering the metal is an adaptation to insect predators. You perform a common garden experiment, transplanting some individuals into soil without selenium, and some back into soil with selenium. What alternate hypothesis best describes your predictions?

- \*a) plants that have been transplanted to soil without selenium will have greater insect damage than control plants
- b) plants that have been transplanted to soil without selenium will have lower seed production than control plants
- c) plants that have been transplanted to soil without selenium will have lower survival than control plants
- d) plants that have been transplanted to soil without selenium will have insect damage similar to control plants
- e) plants that have been transplanted to soil without selenium will have survival similar to control plants