

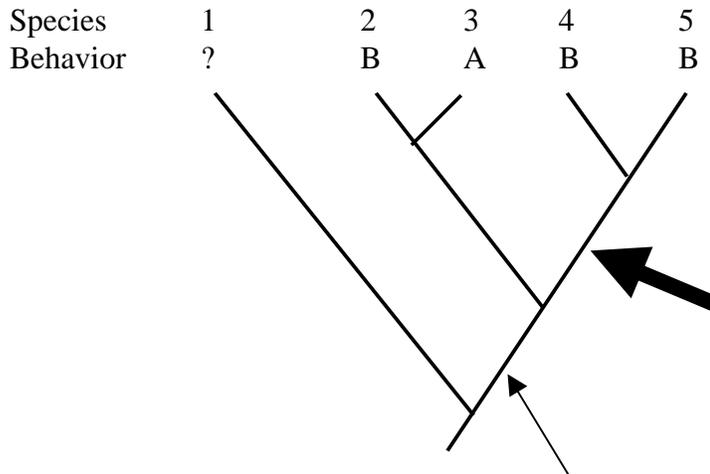
Midterm I, Behavioral Ecology /BIO 359

Spring 2002

Please put your name and ID# on every page of the exam in the space indicated. Please do not exceed the space allowed for short-answer questions (think BEFORE you write). All questions are worth 5 points unless specifically noted otherwise. Multiple-choice questions may have more than one correct answer (although NONE will have all 5 choices correct). To receive full credit for such questions you must mark ALL the correct answers and NONE of the incorrect answers. You will be marked off for each incorrect answer so that completely random guesses will result in a grade of 0. To mark an answer in a multiple-choice question, circle the initial letter before the answer (that is: a), b), c)...).

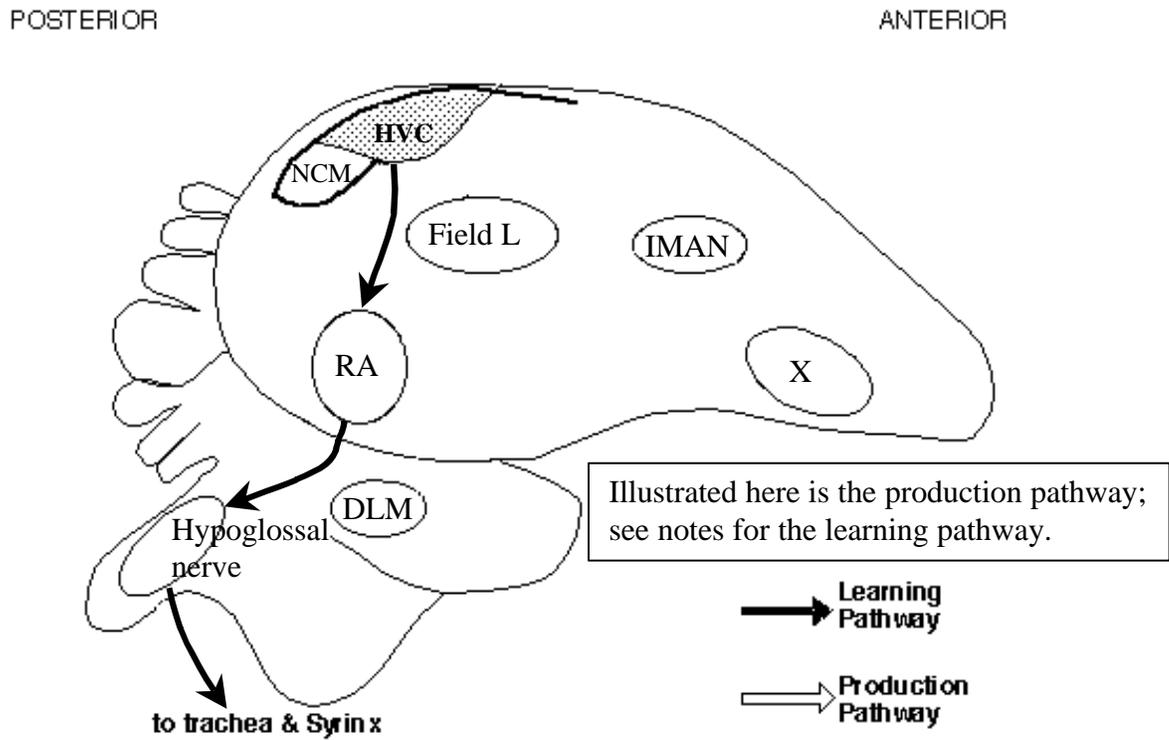
CORRECT ANSWERS ARE IN BOLD AND ITALICS

1. (10 points) Here is a make-believe phylogeny. Note that the behavior of species 1 is currently unknown:

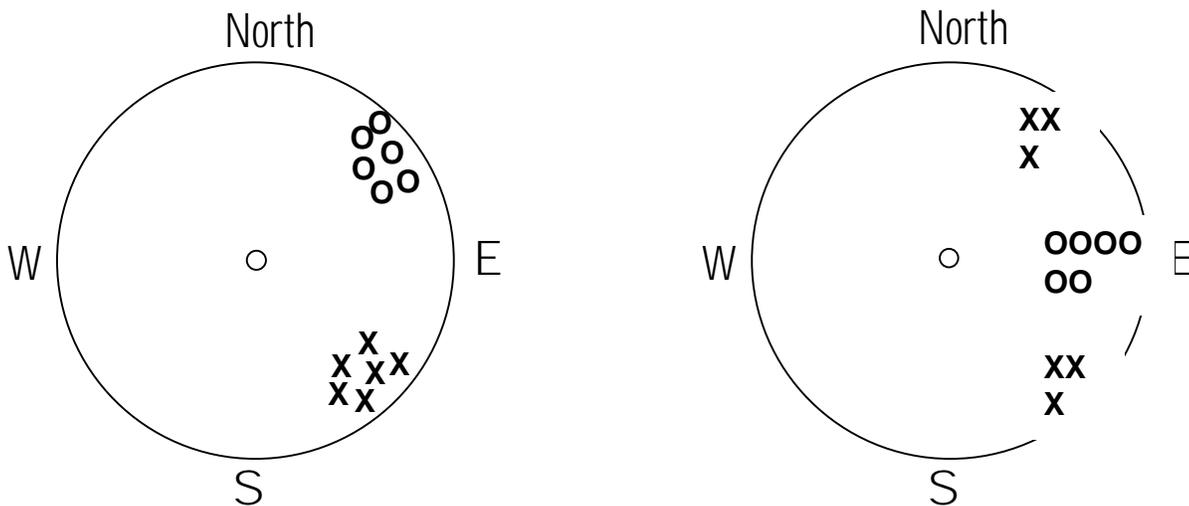


- a) What is the most parsimonious inference about the behavior shown by the species at the thick arrow? ***B***
- b) What can be inferred by parsimony about the behavior of the species at the thin arrow?
 B
- c) How does the answer to (b) change if species 1 is found to have behavior A?
 CANNOT TELL THEN, SMALL ARROW COULD THEN BE A OR B
2. The professor's favorite example, that of color vision in primates, illustrates which of the following points about evolution:
- mutations arise to provide particular traits when they are needed
 - genetic factors can constrain a trait to be less adaptive than it could be***
 - primitive species are less well adapted than more derived species
 - trichromatic (3-color) vision is the best type of color vision under all conditions
 - 3-color vision evolved independently only twice in all 200-plus species of primates***

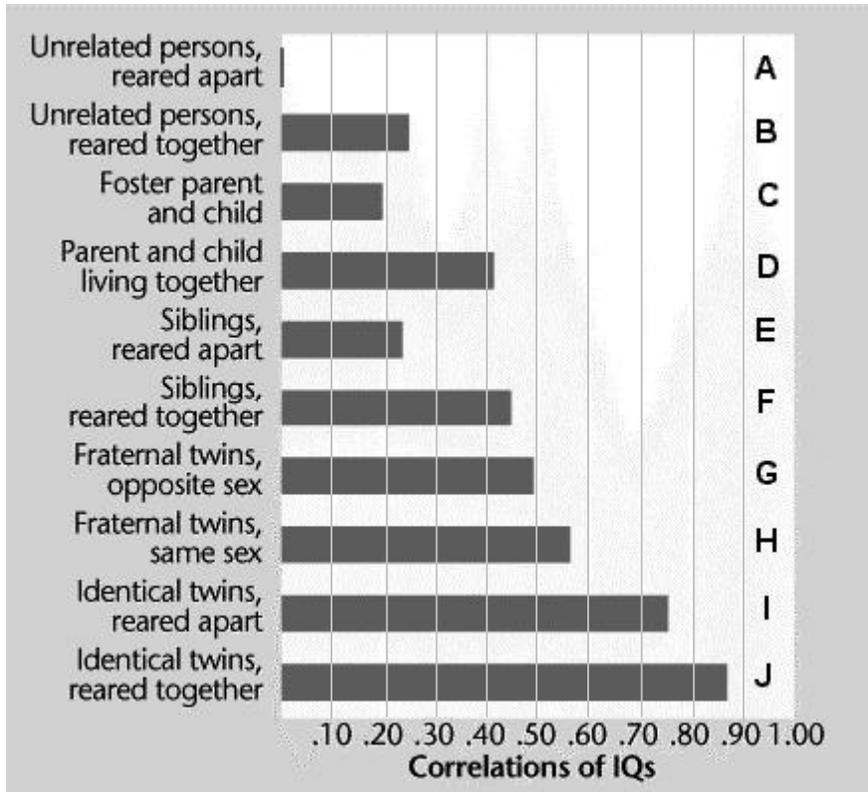
3. (10 points) Below is a cross-section of a bird's brain. Label each of the nerve centers involved in the learning OR production of bird song. Then draw arrows (not necessarily straight) from each center to the one it connects to in the learning OR production pathway.



4. Below on the left I give the results of a test of migration direction preferences by six individuals apiece from two distinct populations of birds (shown as crosses and circles, respectively). On the right I provide a blank circle. Imagine that a breeding experiment is performed with these birds, so that each population provides half the females and half the males to the six crosses. Each cross produces a single offspring (that is, a total of 6 offspring altogether). A) In the right-hand circle show (with X's) the migration direction expected of the offspring of these mixed pairings if migration tendency is strictly learned from the male parent. B) In the right-hand circle, show with O's the migration tendency expected of the offspring, if differences in migration tendency are strictly based on genetic differences, and heterozygous offspring behave exactly half-way between their parents.



5. (10 points) The following diagram provides current information on the correlation in IQ scores among relatives of different levels and reared in different environments. Each combination of relatives and environments is referred to by the letter at the right of each bar. For instance, the correlation in IQ's between siblings reared apart is about 0.23, and is given by bar E.



- Which PAIRS of bars can be compared to tell you the effect of ENVIRONMENT (only) on the similarity of IQ scores (*AB*), (*AC*), (*EF*), (*IJ*), (*DE*), (*EG*), (*EH*)
- Which PAIRS of bars can be compared to tell you the effect of GENES (only) on the similarity of IQ scores? (*AE*), (*AI*), (*CD*), (*CF*), (*CG*), (*CH*), (*CJ*), (*DJ*), (*FJ*), (*GJ*), (*HJ*)
- Why might same-sex fraternal twins be more similar in IQ than opposite sex-twins?

THEY MAY BE TREATED MORE SIMILARLY BY OTHER PEOPLE, THUS THEIR ENVIRONMENTS MAY BE MORE SIMILAR

6. What is the major problem with adaptive explanations that rely on group selection?

SUCH ADAPTIVE EXPLANATIONS, BY DEFINITION, REQUIRE THAT A COST IS PRESENT TO THE ACTOR. A "SELFISH" MUTANT THAT DOES DO THE BEHAVIOR (I.E. A BEHAVIOR THAT BENEFITS SELF OVER GROUP) WILL NOT PAY THE COST AND SO HAS A HIGHER FITNESS AND WILL INCREASE WITHIN EACH POPULATION. THUS, YOU WOULD END UP WITH A POPULATION OF INDIVIDUALS THAT DO NOT DO THE BEHAVIOR THAT BENEFITS THE GROUP.

7. Briefly describe one example of a trait in which the original evolution of the trait was for a different reason than its current function.

MANY EXAMPLES POSSIBLE.

FOR EXAMPLE: FEATHERS IN BIRDS PROBABLY EVOLVED TO KEEP THEM WARM AND ONLY LATER WERE MODIFIED FOR FLIGHT.

8. For a behavioral trait to be heritable, it must...

- a) be adaptive
- b) have a genetic component**
- c) be variable**
- d) be caused by a dominant allele
- e) directly affect reproduction

9. Which of the following observations are consistent with the sexual selection hypothesis for infanticide?

- a) Killings occur only shortly after takeover of a group by a male.**
- b) Only infants that are still nursing are killed.**
- c) Males eat the infants.
- d) Males kill their own offspring.
- e) Nursing females become sexually receptive quickly after the loss of their young.**

10. Which of the following hypotheses concerning dialect differences in bird song are consistent with natural selection theory?

- a) Dialect differences are the result of cultural transmission of song. During the learning process, transmission errors occur that lead to differences in songs between areas.
- b) Dialect differences are the result of mate attraction pressures. Immigrant males that sing a different dialect than local birds are less likely to attract female mates.**
- c) Dialect differences result from song-matching among male birds in adjacent territories. Males are less likely to act aggressively towards birds singing a similar song.**
- d) Dialect differences are due to the accumulation of random genetic differences between populations that are genetically isolated
- e) Dialects arise because distinct song types transmit more or less well in different habitat types.**

11. Which of the following observations could be used as evidence for the influence of the environment on song learning in birds.

- a) *Song centers in the bird's brain grow and shrink seasonally.*
- b) *A zebra finch sings a song more like his father's song than that of males in other territories*
- c) Destruction of the LMAN region results in the inability to sing a complete song.
- d) *Male cowbirds are observed to change their song to match that of local females.*
- e) *Young, healthy birds isolated from others of their species during a critical period never learn to sing their species song properly.*

12. Suggest two testable and reasonable hypotheses why female zebra finches do not sing.

CAN INCLUDE 2 OF THE FOLLOWING TESTABLE ULTIMATE HYPOTHESES, OR 1 OF THESE PLUS ONE PROXIMATE (MECHANISTIC) HYPOTHESIS

1. *Mate attraction hypothesis: Males sing to attract females. In bird species where females attract males to mate, you would predict the females would sing, not the males.*
2. *Territory Defense Hypothesis: Males sing to defend their territory against intruders. Non-territorial males should not sing and territorial females should sing.*
3. *Mate Defense Hypothesis: Males sing to guard their females against mating with other females. Females would not sing according to this hypothesis because they have no reason to guard males.*

13. Tiger salamanders can develop into either a normal form, which eats insects, or a cannibalistic form. All else being equal, cannibals are less likely to develop when only their siblings are present in the pond. This is an example of...

- a) *behavioral flexibility*
- b) latent learning
- c) genetic differences
- d) stimulus filtering
- e) *kin recognition*

14. Which of the following concepts are components of Darwin's theory of natural selection?

- a) *Variation exists within a species for characteristics.*
- b) *Parents pass on some of their characteristics to offspring.*
- c) Random mutations affect hereditary information.
- d) *Because of distinct characteristics, some individuals within a particular population produce more offspring than others.*
- e) Only the fit survive

15. Mute Swans are observed to be monogamous, and only very rarely are observed to change mates during their breeding lifetime. Scientists would not expect to observe infanticide in this species. Why not?

Infanticide is generally predicted to occur after a male takes over a new group as the new male wants to increase his chances of producing offspring with reproductive females. In species that are monogamous and do not change mates, the male should be confident that the offspring are his own and have no reason to kill them.

16. Which of the following are ultimate (U) questions and which are proximate (P) questions? Indicate your answer by putting either a U or P in the blank provided.

 P How does the hippocampus develop differently in male and female meadow voles?

 U By what sequence of evolutionary changes did flapping flight evolve in birds?

 P Why does nest-building in mice respond to artificial selection?

 U In what way(s) does nest-building in mice increase fitness?

 P How do zebra finches learn to sing?

 P What is the role of hormones in controlling sexual behavior in garter snakes?

 U How does behavioral flexibility increase fitness?

 P What genes control male singing in fruit flies?

17. Following are predictions (a-f) that can be made from a variety of hypotheses concerning infanticide in animals. Next to each prediction, write the number(s) of the hypotheses associated with each prediction, using the following list: **1. Social Pathology Hypothesis, 2. Group Selection Hypothesis, 3. Cannibalism Hypothesis, 4. Sexual Selection Hypothesis.**

a) Infanticide should ONLY occur at high densities **1, 2,** _____

b) Males should eat the infants they kill 3 _____

c) Infanticide should only occur shortly after a male takeover 3,4 _____

d) Nursing females that lose their infants should become sexually receptive soon after the loss of their infant 4 _____

e) Males should not kill their own offspring 4 _____

f) Males may kill their own offspring 1,2,3 _____

18. The 'right' and 'left' jawed morphs of the scale eating cichlids *Perissodus microlepis* are maintained by

a) genetic drift

b) natural selection

c) frequency-dependent selection

d) frequency-independent selection

e) behavioral flexibility

19. Central pattern generators are responsible for

a) certain wing movements during grasshopper flight

b) dimorphisms in the stripe pattern in *Thamnophis elegans*, the garter snake.

c) escape behavior in the *Tritonia sea slug*

d) the use of specific migration routes in Black-capped warblers

e) releasing Fixed Action Patterns

20. The A1 and A2 receptors in noctuid moths

a) detect pheromones from potential mates

b) may not be present in the flightless females of some species

c) do not show tuning

d) emit high frequency sounds

e) detect the odor of approaching bats

21. Greylag geese retrieve eggs that roll away from the nest they are incubating. In experiments, the geese were found to continue the retrieval behavior even when the egg was taken away from them in the middle of retrieval. Moreover, geese will retrieve gigantic artificial eggs that are placed near their nests. This example illustrates...

- a) *behavioral inflexibility*
- b) *a fixed action pattern (FAP)*
- c) developmental homeostasis
- d) stimulus filtering
- e) *behavior toward a supernormal stimulus*

22. What is the difference between an animal's genotype and its phenotype?

GENOTYPE=THE GENETIC MAKEUP OF AN INDIVIDUAL

PHENOTYPE=AN OUTWARD EXPRESSION OF A TRAIT, EXPRESSION OF THE GENOTYPE

23. Scientists find that birds in open areas generally sing songs of very high frequency notes while birds in dense forest generally sing songs composed of low frequency notes. What do these observations suggest about the ultimate causes of differences in bird songs across species? *Differences in bird songs may follow an adaptive hypothesis. Frequency of song notes may have evolved to be transmitted most efficiently in the typical environment for that species.*

24. Which of the following hypotheses are *plausible* explanations for the observation that most individuals within a species behave very similarly despite being exposed to many distinct environments and having different genomes?

- a) neural development depends more on chemical concentration than on the kind of chemical signal between cells.
- b) *only a brief exposure to the environment during a critical period is required for 'normal' development.*
- c) developing embryos are sheltered from environmental differences in most animals
- d) *an organism is capable of developmental compensation (playing catch-up)*
- e) *animals learn the proper behavior by watching others of its species*

25. Why might you see a trait that is not optimal?

The environment may now be different than that in which the trait originally evolved and was optimally adapted in past. Not all traits are adaptive. Pleiotropic interactions between genes may give rise to non-optimal traits.