

STUDY QUESTIONS

- 1) The development of new satellite and radio-tracking technology has allowed scientists to make detailed observations about the migratory behavior of birds. For example, observations of osprey (fish hawks) with satellite tags have demonstrated that some individuals that breed here on Long Island in the summer (May-September) spend their winters (October-April) as far away as Brazil. Given this observation of long-distance migratory behavior in osprey,
 - a) Develop 3 Proximate Questions about this migratory behavior.
 - b) Develop 3 Ultimate Questions about this migratory behavior
- 2) What is evolution? Describe two proposed mechanisms for the process of evolution.
- 3) Why is the theory of evolution by natural selection important to the study of behavior? Give an example of a behavior in birds that may have been shaped by natural selection and an explanation of how natural selection may have shaped that behavior.
- 4) Imagine that you are a primatologist studying in the rain-forest of Madagascar. You have just begun to study a new group of Brown Lemurs and know nothing about this group or their behavior and biology except that the group is composed of 1 adult male, 2 adult females, and 1 infant. During the first week of observations, you observe that the adult male attacks and kills the group's infant. The male does not eat the infant. You need to write a report to your funding organization reporting this infanticide and offering possible explanations. In this report,
 - a) Describe three possible explanations for this infanticide event. (Note, you know that it was not cannibalism).
 - b) Detail what types of predictions you would make from each of the preceding explanations so that you can focus your future data collection techniques.
- 5) In which of the following two species of primates might you predict to observe more occurrences of infanticide.
 - a) Diademed Sifakas: this species of lemurs breeds seasonally and can only come into estrus (reproductive fertility) one time per year.
 - b) Colobus Monkeys: these old world monkeys do not breed seasonally and may come into estrus at different times of the year.
- 6) What do the following 2 observations by Peter Marler on song production in White-Crowned Sparrows suggest about the roles of genes versus the environment in song production?
 - a) Observation 1: White-crowned sparrows that are isolated between the ages of 10-50 days and hear tapes of both White-Crowned Sparrow and Song Sparrow, will develop a normal White-Crowned Sparrow Song Dialect. They will not sing the Song Sparrow song.
 - b) Observation 2: White-crowned sparrows that live in Marin County, north of San Francisco Bay, sing a different dialect of their species' song than do white-crowns to the south of San Francisco Bay.

- 7) Research has identified certain regions in the brains of birds that are responsible for different aspects of song production and learning. For example, destroying the IMAN region in an adult zebra finch does not affect its ability to sing its species' song. Destroying the IMAN region in a young zebra finch results in the bird singing a song that is not recognizable as its species' song. Destroying the RA region in either adults or juvenile birds results in the bird not being capable of singing. What is the function of the IMAN region? What is the function of the RA region? Be sure you can label a diagram of a bird's brain with the correct names of the various song centers AND the neural connections between them (to the extent that they are known).
- 8) Describe two possible ultimate explanations for seasonal variation in the size of brain centers for song in male birds.
- 9) A young male bird may have all of its brain centers intact, be developing properly and be exposed to a proper song tutor, yet the young bird may be incapable of learning its song. Why? What other proximate influences affect song development?
- 10) Describe two possible hypotheses for the differences in songs found between species of birds.
- 11) Although female birds have the ability to sing, generally only male birds do the singing. Following are three hypotheses to explain this observation. For each hypothesis, provide one prediction that could be tested to determine if the hypothesis is valid:
 - a) Mate-attraction hypothesis: Males sing to attract females.
 - b) Territory defense: Males sing to announce their presence and defend their territories against intruders.
 - c) Mate Defense: Males sing not to guard their territories, but to guard their mates against mating with other intruding males.
- 12) Males of the same species often sing different dialects of the same song. Describe one adaptive hypothesis and one non-adaptive hypothesis for this behavior.
- 13) How can comparing phylogenies of organisms help scientists to understand whether a trait of interest is adaptive or non-adaptive.
- 14) In what ways is it useful to find that a given hypothesis appears to explain similar behaviors in many quite different species? Give an example.
- 15) Why is it UNlikely that current common (behavioral) phenotypes are the best possible adaptations to current environmental challenges? Place your answer in the context of the three requirements for evolution by natural selection.
- 16) Be able to explain the scientific method and identify how the scientific method has been used in at least one study we discussed in class.

- 17) What are norms of reaction? What do they tell us about the relative influence of genes and environment on a trait?
- 18) What are the ways in which we can determine the effects of genes on a behavior or trait? What types of experiments can we do?
- 19) What is heritability?
- 20) What is polymorphism? Why might a polymorphism be maintained in nature? In what other ways might alternative strategies be useful to an organism?
- 21) In what ways does the environment influence behavior? How might these influences change with the age of an organism?
- 22) Give some examples of the ways in which learning may be constrained.
- 23) What is homeostasis? What is developmental homeostasis? What mechanisms promote developmental homeostasis?
- 24) Explain fixed action patterns.
- 25) Give examples of ways in which sensory systems may influence an animal's behavior in relation to its environment.
- 26) Given an example of how hormones affect behavior during development.
- 27) How do you go about extrapolating an evolutionary history for an organism or trait? Be sure you can explain the principle of parsimony and USE it to infer along which branch of a small phylogeny (provided as a diagram) one or more changes in a behavior may have occurred (e.g., see sample exam1 on web).
- 28) What is optimality? How do we determine the optimal value for a trait? What hypotheses can account for common trait values that differ from the optimal one?
- 29) What is fitness? How do we measure fitness?
- 30) Are common traits in a population necessarily adaptive? (Hint: what processes other than natural selection affect the frequency of a trait in a population).
- 31) A close match between organism form and function could be due to natural selection or to intelligent design by a supreme being. What evidence could be used to rule out the latter in favor of the former explanation?
- 32) What do cross-fostering experiments tell us about the importance of genes vs. environment in the production or form of a behavior?

- 33) How do neurons 'know' which cells (other nerve cells or muscles) they need to hook up to during development to produce a given behavior pattern?
- 34) Explain how an action potential is generated in a nerve cell, how it travels down an axon, and how it 'communicates' to adjoining cells.
- 35) Describe the song template hypothesis for the learning of bird song. What kinds of experiments were used to derive this hypothesis? Do female birds form a song template? How do we know that they do?
- 36) What is the evidence that human language has a genetic component?
- 37) Define imprinting. Give an example. How does imprinting relate to the concepts of 'releasers' and 'fixed action patterns'?
- 38) Why don't most animals rely on flexible learning instead of highly specific learning programs?
- 39) In what way is spatial learning in birds important to their ability to navigate?
- 40) Describe two examples of developmental alternatives in some behavior.
- 41) What is a threshold trait? Describe an example in behavior (e.g., mating strategies in male salmon). How would genetic variation in the threshold affect the form or frequency of the behavior?
- 42) Describe the basic components of bat detection by moths, including the sensory neurons involved, their sensitivity to sound (pitch and loudness), and the reactions they produce in the moth.
- 43) How do bats 'see' in the darkness? What special abilities do they need to perform this special ability?
- 44) What is the evidence that the A1 and A2 neurons function specifically as bat detectors (instead of in general hearing, and just happen to be useful in detecting bats)? Think of both design features of the system and its pattern of occurrence in different moth species.
- 45) Give an example of stimulus filtering.
- 46) Why are identical twin studies useful to measure the heritability of a behavior? What are the problems related to using identical twin studies if you would like to tease apart the effect of the environment from those of heredity?
- 47) Is it correct to interpret the results of twin studies showing a high heritability of a trait as providing evidence that the trait is "genetically determined". Why?

- 48) In the scale-eater fish, *Perissodus microlepis*, two phenotypes ("jaw bends to right" and "jaw bends to left") are equally common (the frequency of both types oscillates around 50%). Explain what mechanism may explain these proportions.
- 49) Kin discrimination is an important behavior in many animals. Female Belding's ground squirrels are less aggressive to biological sisters reared apart with whom they have no prior experience than to non-siblings reared apart. What mechanism may explain this type of kin recognition?
- 50) What would you predict about the relative sizes of the hippocampus of monogamous species of voles where males and females have similar home ranges? Why?
- 51) Describe at least one example in which differences in stimulus perception between species are likely to be adaptive.
- 52) Design an experiment to demonstrate that pigeons use olfaction to navigate.
- 53) Give an example of a socially induced change in behavior.
- 54) What factors are known to affect the tendency of tiger salamander to become cannibalistic morphs?