**Discussion Questions**

to accompany

***Animal Behavior,* Eleventh Edition**

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**Chapter 3**

**The Developmental and Genetic Bases of Behavior**

3.1 Why do queen honey bees (*Apis mellifera*) behave very differently from their workers even though a queen has essentially the same genome as her worker sisters and daughters? Develop at least one proximate hypothesis on why the two categories of bees behave so differently.

3.2 The nature–nurture controversy involves the belief that our nature (essentially our genes) dominates our behavioral development and another belief, held just as forcefully, that our nurture (especially our upbringing as children) is what shapes our personalities. Some have dismissed the controversy by saying that the two sides might as well be fighting about whether a rectangle’s area is primarily a matter of its height or mostly a function of its width. What’s the point of the rectangle analogy? Does the analogy have any weaknesses?

3.3 When great tits were experimentally reared in blue tit (*Cyanistes caeruleus*) nests, they survived quite well but failed to mate with their own species. The reproductive success of these individuals was consequently low (Slagsvold and Hansen 2001). Discuss both the negative and positive effects that imprinting of this sort could have had on the evolution of interspecific brood parasitism (when one species lays its eggs in the nest of another species) (see Chapter 11).

3.4 A few blackcaps (*Sylvia atricapilla*) live year-round in southern France, although 75 percent of the breeding population migrates from this area in winter. Perhaps the difference between the two behavioral phenotypes is environmentally induced and not hereditary (Berthold 1991). Make a prediction about the outcome of an experiment in which the experimenter tries to select for both nonmigratory and migratory behavior in this species. Describe the procedure and present your predicted results.

3.5 Debi Fadool and colleagues studied a strain of genetically modified mice that lacked the ability to make a protein called Kv1.3 (Fadool et al. 2004). In unaltered mice, this protein is found in regions of the brain that process olfactory information, leading to the prediction that the two strains of mice should differ in their ability to smell things. In fact, the genetically modified mice were able to smell scents, such as those associated with food, at much lower concentrations than mice that possessed the protein. What Darwinian puzzle is created by these findings? What ultimate explanation do you have for the fact that mice with Kv1.3 protein are actually less sensitive to food odors than mice without that protein?

3.6 Serotonin has been shown to be sufficient to trigger the development of the gregarious form of the migratory desert locust (*Schistocerca gregaria*). What predictions must have been tested to arrive at this conclusion? You should know that you can inject serotonin as well as drugs that disable serotonin directly into nymphal locusts.

3.7 Identify the probable adaptive basis for the flexible development of body size in the redback spider (*Latrodectus hasselti*). Predict what effect large body size must have on female choice in this species versus the effect of large body size on the ability of male redbacks to compete physically with rival males (Kasumovic and Andrade 2006).

3.8 Some marine fishes exhibit a spectacular polyphenism, in that individuals can, under special circumstances, change their sex from female to male (in other species, the switch goes from male to female). This developmental change involves reproductive organs, hormones, and mating behavior (Warner 1984). In some species, the removal of a dominant, breeding male from a cluster of females triggers a sex change in the largest female present. Identify the apparent developmental restrictions imposed on this system, such as the requirement that a female be transformed into a male rather than some sort of intermediate sex. Speculate on the benefits associated with each restriction.

3.9 In a study in which men and women were asked to sit at a computer and navigate through a virtual maze, the men were able to complete the task more quickly and with fewer errors over five trials than the women (Moffat et al. 1998). What possible proximate developmental mechanisms might be responsible for this sex difference in navigational ability? Use the evolutionary explanation for sex differences in spatial learning ability by voles to make a prediction about the nature of human mating systems over evolutionary time.

3.10 Another sex difference in spatial skill exhibited by our species is the slightly greater ability of men compared with women when it comes to visualizing what a three-dimensional object would look like if rotated in space. This difference has been linked in part to differences in the parietal lobe of the two sexes (Koscik et al. 2009). One of the several authors on this report commented that it remains to be seen whether the differences in brain structure and cognitive skills are caused by nature or nurture. He went on to claim that if there were significant differences in the parietal lobes of young boys and girls, then that finding would support a “biological” as opposed to an “environmental” cause for the differences in mental rotation abilities of men and women. Do you agree?

References

Berthold, P. 1991. Genetic control of migratory behaviour in birds. *Trends in Ecology and Evolution* 6: 254–257.

Fadool, D. A., Tucker, K., Perkins, R., Fasciani, G., Thompson, R. N., et al. 2004. Kv1.3 channel gene-targeted deletion produces "super-smeller mice" with altered glomeruli, interacting scaffolding proteins, and biophysics. *Neuron* 41: 389–404.

Kasumovic, M. M., and Andrade, M. C. B. 2006. Male development tracks rapidly shifting sexual versus natural selection pressures. *Current Biology* 16: R242–R243.

Koscik, T., O’Leary, D., Moser, D. J., Andreasen, N. C., and Nopoulos, P. 2009. Sex differences in parietal lobe morphology: Relationship to mental rotation performance. *Brain and Cognition* 69: 451–459.

Moffat, S. D., Hampson, E., and Hatzipantelis, M. 1998. Navigation in a "virtual" maze: Sex differences and correlation with psychometric measures of spatial ability in humans. *Human Behavior and Evolution* 19: 73–87.

Slagsvold, T., and Hansen, B. T. 2001. Sexual imprinting and the origin of obligate brood parasitism in birds. *American Naturalist* 158: 354–367.

Warner, R. R. 1984. Mating behavior and hermaphroditism in coral reef fishes. *American Scientist* 72: 128–136.