**Discussion Questions**

to accompany

***Animal Behavior,* Eleventh Edition**

by Dustin Rubenstein and John Alcock

**Chapter 4**

**The Neural Basis of Behavior**

4.1 Suggest how a modern behavioral biologist might explore the effect of a releaser, such as a red dot on a moving gull bill, in terms of changes in gene expression and neural activity in selected portions of the brain of the gull chick.

4.2 Males of certain Australian beetles have been seen trying to copulate with everything from beer bottles to large orange signs. Apply ethological terminology to these cases by identifying the releaser, the fixed action pattern, and the innate releasing mechanism. Then develop an ultimate hypothesis to account for what clearly is maladaptive behavior on the part of these obtuse beetles (which sometimes die rather than leave the inanimate and unresponsive copulatory partners that they have chosen).

4.3 An American cockroach (*Periplaneta americana*) can begin to turn away from approaching danger, such as a hungry toad lunging toward it or a flyswatter wielded by a cockroach-loathing human, in as little as a hundredth of a second after the air pushed in front of the moving object reaches the roach’s body. A cockroach has very sensitive wind sensors on its cerci, which are small appendages at the end of its abdomen. One cercus points slightly to the right, the other to the left. Use what you know about moth orientation to bat cries to suggest how this simple system might provide the information the roach needs to turn away from an attacking toad, rather than toward it. How might you test your hypothesis experimentally?

4.4 Some small fishes have evolved an antipredator mechanism rather like those possessed by noctuid moths and cockroaches. In the case of the fishes, this system is based on two large neurons located on either side of a fish’s brainstem. The giant cells respond very rapidly to water disturbances that reach the side of the fish; the cell closest to the source of the disturbance fires more strongly, and the fish responds by turning away from the side more strongly stimulated. Hunting tentacled snakes form their bodies into a U shape in order to catch their prey. Small fish that happen to swim into the U-shaped bay formed by the body of the snake often turn *toward* the mouth of the predator, facilitating their capture. Provide a proximate and an ultimate explanation for the fish’s behavior, which constitutes an obvious Darwinian puzzle.

4.5 The blue tit (*Cyanistes caeruleus*) is a songbird with a blue patch of feathers that reflect ultraviolet radiation. Female blue tits apparently prefer to pair with males that have relatively bright UV-reflecting feathers on their crowns. But at least in one population, male blue tits whose crowns reflected less UV produced more offspring than males with more UV-ornamented crowns (Hunt et al. 1999). A research team suggested that males with low-UV crowns were better able to sneak onto neighboring territories and sire “extra-pair” offspring with their neighbors’ mates than were males with high-UV crowns. How would you test this hypothesis experimentally? List your predictions.

4.6 Homing pigeons (*Columba livia domestica*) are very good at returning home after being released in a strange location. Internal biological clocks play a role in this ability (Walcott 1972). You can reset a pigeon’s biological clock by placing the bird in a closed room with artificial lighting that comes on and goes off out of phase with sunrise and sunset in the real world. For example, if sunrise is at 6:00 AM and sunset at 6:00 PM, let’s set the lights in the room to go on at noon (6 hours later than the actual sunrise) and off at midnight (6 hours later than actual sunset). A pigeon exposed to this routine for several days will become clock-shifted 6 hours out of phase with the natural day. If taken from the room and released *at noon* 30 kilometers due east of its loft, the bird will behave as if the sun had just come up in the east. Why then will the bird fly north instead of west?

4.7 Outline Mike May’s research on crickets in terms of the question that provoked his study and his hypothesis, prediction(s), evidence, and scientific conclusion. In addition, what contribution to this research could come from learning that locusts, a group of insects not closely related to crickets, also possess a special mechanism for very rapidly altering leg positions and wingbeat patterns in reaction to ultrasound, such that a flying individual banks sharply downward away from the side stimulated by the stimulus.

4.8 Cowbirds are another bird with a highly developed cognitive skill (White et al. 2009). If a brood parasitic cowbird female (see Chapter 11) is to successfully lay an egg in a nest of one of its many host species, she had better do so after the host parent has finished laying her clutch (usually three to six eggs, laid one every day or so) but before incubation of the eggs in the nest has begun. If a female cowbird can make her way to the victim’s nest, toss out one of the host’s eggs, and lay one of her own during this brief window of time, then her egg is more likely to be accepted. Since cowbird eggs develop very rapidly, the cowbird chick will be first out of the egg and well on the road to monopolizing the food provided by its hosts. How might a female cowbird tell when a host’s clutch of several eggs is complete and incubation is about to start? Why would a kind of mathematical skill come in handy for this brood parasite?

References

Hunt, S., Cuthill, I. C., Bennett, A. T. D., and Griffiths, R. 1999. Preferences for ultraviolet partners in the blue tit. *Animal Behaviour* 58: 809–815.

Walcott, C. 1972. Bird navigation. *Natural History* 81: 32–43.

White, D. J., Ho, L., and Freed-Brown, S. G. 2009. Counting chicks before they hatch: Female cowbirds assess temporal quality of nests for parasitism. *Psychological Science* 20: 1140–1145.