**Discussion Questions**

to accompany

***Animal Behavior,* Eleventh Edition**

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**Chapter 12**

**Principles of Social Evolution**

12.1 Let’s say that intelligent design theorists are correct in claiming that certain features of living things, such as termite societies composed of 20 million cooperating individuals or the long and convoluted biochemical pathways involved in the production of critical cellular compounds, are so complex that they cannot be explained by evolutionary theorists. Why would Darwinists aware of the logic of the scientific method still be justified in rejecting the assertion that these cases in themselves constitute reason to accept intelligent design theory?

12.2 In some ant species, several unrelated females may join forces to found a colony after they have mated. The females cooperate in digging the nest and producing the first generation of workers, but then they start fighting until only one is left alive. The survival rate of colonies founded by lone females is very low (Bernasconi and Strassman 1999). How might you interpret the behavior of multiple founders as the product of for-the-good-of-the-group selection? If the behavior of the several queens is the product of natural selection, not Wynne-Edwardsian group selection, what prediction can you make about the interactions between the females during the colony establishment phase prior to the fight-to-the-death phase?

12.3 If an altruistic act increases the genetic success of the altruist, then in what sense is this kind of altruism actually selfish? In everyday English, words like *altruism* and *selfishness* carry with them an implication about the motivation and intentions of the helpful individual. Why might everyday usage of these words get us into trouble when we hear them in an evolutionary context? If an individual just happened to help another at reproductive cost to itself, should the behavior be called altruistic under the evolutionary definition of the term?

12.4 We can consider the coefficient of relatedness with respect to genes on the X chromosome rather than a single gene or the complete genome. Typically, every woman has two X sex chromosomes. Her sons and daughters each get one X from her. An adult son may or may not pass on that X to his children. If he does not and instead gives an offspring his Y chromosome, he will create a grandson (XY) for his mother. That grandson will not carry his grandmother’s X chromosome. (Where then did his X chromosome come from?) What about the X chromosomes in the granddaughters of the paternal grandmother? What is the significance of the fact that the survival chances of grandsons with paternal grandmothers living nearby are much less than the odds of survival for granddaughters with paternal grandmothers nearby (Fox et al. 2010)? Does the paternal grandmother’s effect on the survival of her granddaughters generate indirect selection or direct selection?

12.5 In some species of ants, bees, and wasps, the queen of a colony may have mated once or she may have mated with several different males. If workers of these hymenopterans retain the ability to lay haploid eggs that will become their sons upon maturity, what should workers living in a colony headed by a monogamous queen try to do versus workers living in a colony with a queen that has mated with two or more males?

12.6 If a female of a monogamous social wasp species could help to produce more sisters with an *r* of 0.75, why would she ever reproduce personally, given that the relation of reproducers to their offspring is just 0.5?

12.7 In termites both males and females are diploid, and both sexes make up the worker caste. Moreover, in at least one species, two small colonies may amalgamate without conflict except between the reproductive members of the same sex, which may try to kill one another (Johns et al. 2009). The members of merged colonies cooperate with one another. Some individuals in these colonies also have the ability to become replacement kings or queens upon the demise of one of the original surviving reproductives. What might these termites tell us about haplodiploidy and the origin of eusocial behavior? Evaluate the possibility that unrelated workers (with the capacity to become reproductives) may have helped unrelated queens at an early stage in the evolution of eusocial colonies.

12.8 Wolfgang Kirchner and Andreas Grasser found that when a hive of honey bees (*Apis mellifera*) was turned on its side, the bees continued to dance in the darkness, but on a horizontal surface, not a vertical one (Kirchner and Grasser 1998). Under these conditions, recruitment at distant feeders (more than 100 meters from the hive) that had been visited by dancing bees was very poor. When, however, the hive was returned to an upright position and the comb surface on which recruiters danced was vertical (as it would be in natural hives), most recruits appeared at the feeders that the scouts had visited. What bearing do these results have on the argument about whether recruits derive information from the dances of their colony mates? What prediction can you make about relative rates of recruitment to sites less than 50 meters from the hive when it is turned on its side as opposed to when it is upright?

12.9 Why might it be that the more drones there are that mate with a queen honey bee, the more loyal are the workers in her colony and the longer she retains a workforce that acts in her interests, not their own personal reproductive interests (Richard et al. 2007)? If in a colony of eusocial Hymenoptera, you remove the queen, what prediction follows about a change in the frequency of reproduction by workers (Wenseleers and Ratnieks 2006)?

12.10 As we have seen, workers and queens of social insects can have disputes about any number of things, despite being members of the same family. Why, for example, might a worker with a once-mated mother let her mother produce daughters but attempt to produce sons herself (assuming that in this social species, workers have functional ovaries)? In the honey bee, workers provision several larvae with extra food, creating future queens. But when one of this coterie of queens emerges, she usually kills her sister queens. Why is this puzzling? Why is the behavior adaptive?

References

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