IB 144 / Psych 115B

FIRST MIDTERM

3 October, 2003
8 pages, 100 points

Part I. Multiple choice. 4 points each. Circle the option that best answers the question or completes the statement.

1. In class, we discussed a number of ways in which biologists can determine if a trait has a genetic basis, meaning that some tendency to perform the behavior is passed from parents to offspring. The reason it is important to determine if a behavior has a genetic basis is that:

    a. the environment plays no role in how a behavior is expressed by an animal
    b. natural selection cannot operate on a behavior unless it has a genetic basis
    c. the heritability of a behavior allows us to calculate the relatedness among individuals
    d. behavior is an aspect of an organism's genotype

2. Hamilton's equation predicts that altruistic behavior will evolve when:

    a. the costs of performing the behavior exceed the benefits
    b. $r = 0$
    c. performing the behavior is for the good of the species
   d. rB is greater than C

3. In a grant proposal, a behavioral ecologist states that she will test two alternative hypotheses regarding the reasons why some primates are social and live in groups, while others are solitary, meaning that each adult lives alone. The first hypothesis states that group living is adaptive because multiple individuals are better able to detect predators, thereby increasing the survival of juveniles. The second hypothesis states that some primates are social because they produce an excess of a hormone that is known to reduce aggression and thus facilitate living together. Which of the following statements best summarizes the major problem with this proposal?

    a. both hypotheses address the same level of analysis, which means we can't distinguish between them
    b. a behavior can't simultaneously have an adaptive and a mechanistic explanation
    c. the two hypotheses address different levels of analysis and thus aren't really alternatives
    d. neither hypothesis addresses the heritability of the tendency to live in groups

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4. According to the Emlen-Oring model of mating systems, monogamy occurs as a "default" strategy, meaning that males will be monogamous only when polygyny is not an option. The reason that monogamy is viewed as a default is that:

   a. all else being equal, males are expected to maximize their reproductive success by mating with as many females as possible
   b. males in a socially monogamous species gain no direct fitness benefits from mating with only a single female
   c. there is no inter- or intra-sexual selection in socially monogamous species
   d. males in a socially monogamous species never mate with females other than their social partner (i.e., the female that they live with)

5. Based on the film clip on dunnocks that you saw in lecture, the primary reason that it took behavioral ecologists so long to recognize that EPC's were going on in many species of socially monogamous birds is:

   a. EPCs are rare and thus unimportant for understanding mating systems
   b. there are no behavioral differences between alpha and beta males
   c. extra pair matings are fast and may occur surreptitiously
   d. traditional analyses of mating systems were not based on behavioral data

6. Which of the following is NOT a consequence of anisogamy?

   a. reproduction by females is limited by resources
   b. males are the competitive sex
   c. females benefit by mating with multiple males
   d. males produce many relatively small, inexpensive gametes

7. Male hamsters appear to use phenotype matching to recognize kin. When presented with urine samples from a related and an unrelated animal, a male hamster will spend more time scent marking over the urine of the non-relative. To test the phenotype matching hypothesis, an investigator cross fosters (switches) some newborn male hamsters between litters. When the hamsters are several months old, each is presented with urine from an unfamiliar brother and from a familiar non-relative. If the phenotype matching hypothesis is correct, the expected outcome of this experiment is:

   a. no difference in scent marking between the two urine samples
   b. more scent marking over the urine from the unfamiliar brother
   c. more scent marking over the urine from the familiar non-brother
   d. no response to either urine sample

8. According to the Emlen-Oring model of mating systems variation, polygyny is most likely to occur when:

   a. the ability of males to capitalize on the EPP is low
   b. females occur in groups and no parental care is required
   c. the EPP is low and male parental care is essential
   d. the degree of monopolization of mates is low

9. The Red Queen hypothesis suggests that one benefit of sexual reproduction is:

   a. staying ahead in the evolutionary arms race with parasites and pathogens
   b. the coefficient of relatedness between parents and offspring is 0.5
   c. the effects of deleterious mutations are reduced relative to asexual species
   d. males must compete with one another for access to females

10. According to the good genes model of sexual selection, the traits that males use to attract females must entail a cost. This cost is important because:

   a. the sons of females that mate with these males will also have to pay this cost
   b. if there's no cost, natural selection can't act to halt the run away process
   c. it prevents males from "cheating" by advertising that they are better than they really are
   d. no pain, no gain; males can't benefit from competing unless there is a cost to the competition
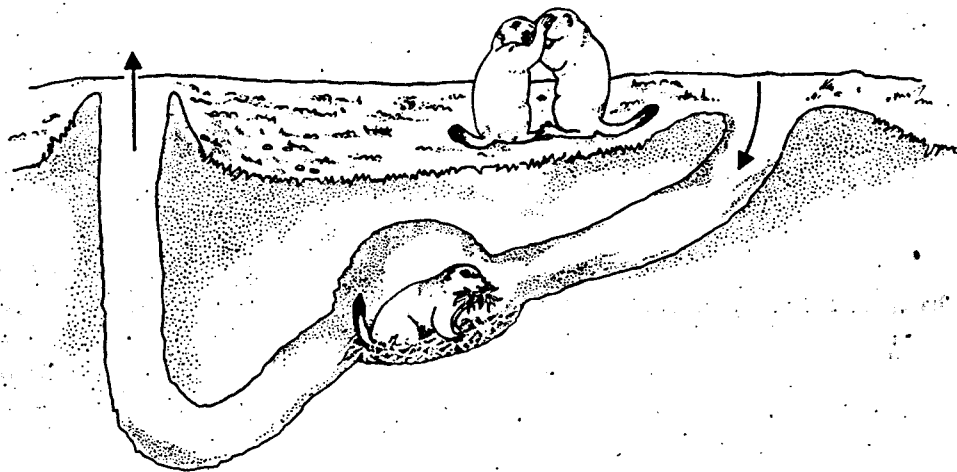
Part II. Short answer. Point values are as indicated. **Answer each question completely but succinctly. Read carefully before answering!**

1. Honeybees are haplodiploid, meaning that while females have the typical two copies of all chromosomes, males possess only one set of chromosomes that they inherit from their mother. This occurs because males are produced from unfertilized eggs and, thus, receive all of their genetic material from their mother. This type of genetic system affects the coefficient of relatedness among full sisters and has been implicated in the evolution of altruism in honeybees.

   (5 pts) Using the information provided above, calculate r for two full-sister honeybees. Be sure to show all of your calculations – don't just give us the final answer! (Hint: think about the genetic material that full sisters get from their father)
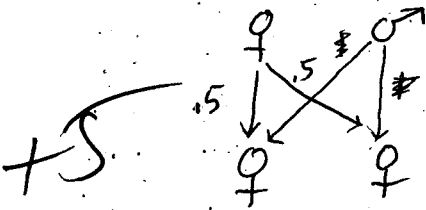
   By default, female offspring would have absolutely all of their father's DNA making up half of their DNA content. However, for the diploid mother, she would produce different haploid gametes as usual so the genetic material the daughters may share from the mother would not necessarily be the same. Thus,...

   +5.

   $r = mom + dad$

   $r = (.5)(.5) + (.5)$

   $r = mom + dad$

   $= (.5)(.5) + .5$

   $= .25 + .5 = .75$

   $r = .75$

2. (5 pts) Your calculation of r in question 1 is based on the assumption that the female mated with only one male. If, instead, queen honeybees routinely mate with more than one male, how will this affect the frequency of altruism in honeybees? In your answer, indicate how multiple mating by queens will affect r among their daughters (you don't need to calculate this value – just tell us how it would compare with your answer to question 1) and why this will influence altruistic behavior in this species.

   +3 1/2

   This would increase the frequency of altruism in honeybees. Since in honeybees, only the queen mates, the queen would therefore be the mother of every other female in the hive. Though fathers would be different, everyone (females) would have the same mother has thus always have some non-zero coefficient of relatedness that would be required in Hamilton's equation of $rB - c > 0$ for altruistic behavior to occur and evolve. Though this r-value for "half" sisters would be lower than the value for full sisters, the r-value would still be enough to justify altruism.

   depends also on B, c (B would have to be larger)

   (+8 1/2)

Part III. More multiple choice. 4 points each. Circle the option that best answers the question or completes the statement.

1. In her research lecture, Dr. Lacey used ecological data from colonial tuco-tucos to test an hypothesis developed to explain group living in African mole-rats. The reason that the mole-rat hypothesis might have been relevant to colonial tuco-tucos is:

    a. colonial tuco-tucos and mole-rats occur in Africa and thus they live in similar habitats
    b. colonial tuco-tucos and mole-rats lack fur and thus they probably respond to cold in the same way
    c. colonial tuco-tucos and mole-rats are subterranean rodents that exhibit similar patterns of social behavior
    d. colonial tuco-tucos and mole-rats show no behavioral similarities and thus it's important to determine why they differ

2. The best way to measure the heritability of a trait is to:

    a. "knock out" the gene of interest and look for a change in phenotype
    b. examine the fitness consequences of the trait by measuring reproductive success
    c. determine the indirect fitness benefits of the trait by measuring the reproductive success
    d. measure the trait in parents and offspring and determine the slope of the resulting graph

3. All of the following are features of lek polygyny EXCEPT:

    a. males defend a resource that is critical to females
    b. females choose the males that they mate with
    c. males are territorial
    d. the spatial distribution of males tends to be clumped

4. After the 144/115B final, you take a well-deserved vacation in Tahiti. While relaxing on the beach, you see someone wearing a Cal baseball cap. Based on this, you decide that this person is a current or former student at Cal. Assuming that the mechanisms of "school recognition" are the same as those for kin recognition and given that, while an undergrad at Berkeley you learned that Cal students wear baseball caps, which mechanism of "school recognition" is most likely to apply to this situation?

    a. recognition alleles
    b. location
    c. familiarity
    d. phenotype matching

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5. Which of the following is NOT an example of pre-copulatory male-male competition in birds?

    a. males who sing the loudest get the most mates
    b. a male mates repeatedly with his partner after she has been absent for a time
    c. males fight over a limited number of the nest holes that females need for nests
    d. dominant, good quality males typically display in the middle of a lek

6. Which of the following is a material benefit to females that could influence which males they choose to mate with?

    a. male crane flies give females an insect "snack" before mating
    b. sons of male widow birds with long tails are more likely to have long tails and to be more attractive to females
    c. male tragopans with the brightest colors are generally more healthy and have sons that are generally more healthy
    d. mating with multiple males may result in greater genetic diversity among a female's offspring

7. Which of the following is NOT true of a correlational study of behavior?

    a. the results may be confounded by factors other than the variable of interest
    b. the study is generally easier to conduct than an experimental manipulation
    c. the results prove that changes in one variable cause changes in the other variable
    d. a correlational study provides a useful first step toward understanding a behavioral problem

8. The traditional categories for mating systems discussed in class were often based on which of the following types of data?

    a. genetic estimates of parentage
    b. results of sperm competition studies
    c. video narrations by David Attenborough
    d. spatial relationships among males and females
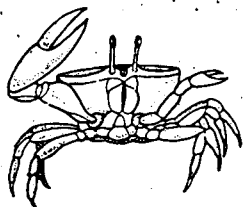
9. Behavioral ecologists are notoriously sloppy about the language that they use to describe behavior. For example, if a behavioral ecologist states that "an animal is making a mistake if it chooses to perform an altruistic behavior toward an unrelated individual," what the behavioral ecologist really means is that:

   a. the animal has failed to use it's calculator properly to estimate its relatedness to the recipient of the behavior
   b. the animal has consciously evaluated the fitness consequences of the behavior and arrived at a wrong decision
   c. the animal will suffer a net fitness cost for performing the behavior, which should lead to selection against this behavior
   d. the animal that is the recipient of the altruistic act will receive no fitness benefits as a result of that behavior

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Part IV. Short answer. Point values are as indicated. Answer each question completely but succinctly. Read carefully before answering!

1. In class, we saw a film clip in which several male manakins (small black and blue birds) danced and sang together to attract a female. Below are the results of a genetic study of paternity in manakins. Data are shown for a female, her three chicks, and the two males that danced together for the female. Male 1 is the dominant male; male 2 is the subordinate. Use these data to answer the following questions.

Locus	Female	Chick 1	Chick 2	Chick 3	Male 1	Male 2
1	AA	AB	AB	AB	BB	AB
2	AB	AA	BB	AB	AB	AA
3	BB	BB	AB	BB	AB	CC

(6 pts) Determine which male sired each of this female's chicks.

Chick 1: Male 1   Chick 2: Male 1   Chick 3: Male 1

(2 pts) What do the results of your paternity analyses suggest about direct benefits to subordinate males of cooperating to dance and attract females?

This analysis suggests that the second male gets no direct benefits from this since he sired none of the three chicks. However, this does not mean that the second male will receive no benefits. It may be necessary for a single manakin to dance in pairs to mate at all and the experience of being the subordinate male may lead to a rise in status later in life which could then lead to his own reproductive success.
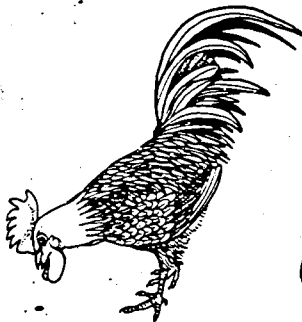
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(2 pts) List one other way (not direct fitness) by which the beta male might benefit from cooperating to attract females. *He could become experienced in the process of attracting mates and later apply that knowledge to become the dominant male and mate successfully.*
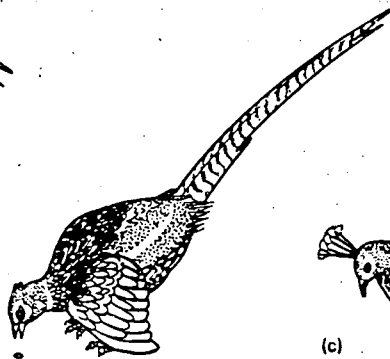
2. (4 pts) Of all of the film clips shown in class, which was your favorite? Why did that particular clip really grab your interest? *My favorite had to be the black Australian bird that danced for the female standing in front of him in a way that could be easily imitated by me. why?*
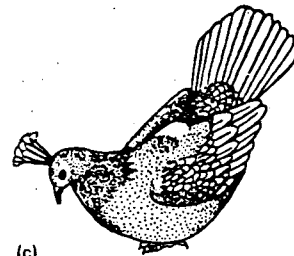

That's it!

(a)   (b)   (c)

(d)   (e)

8

(+5)