

**BIO 45 -- Exam 3 – Mating Systems, Parental Care and Social Behavior  
11 December 2002****EXAM KEY****INSTRUCTIONS:**

4. Do not use the same example more than once on the exam.

**Explain** = Show that you understand what is going on - don't just list facts.

**Cite or Identify** = Who did the work on what species and some details relevant to the question. If you can't remember names, give enough detail for us to identify the study you mean.

**List** = You do not have to go into detail. Make sure the items in your list are really distinct.

**Briefly** = a few well-chosen words or phrases will suffice.

**Exam grading:**

I have regarded any exam that might have made a difference for someone near a borderline.

**Course Grades:**

You could have earned 200 points for the course.

I normalized all exam grades to a mean of 38 (that meant adding three points to your exam 2 grade and 2 points to your exam 3 grade). I ranked people based on their total scores. I also did ranking with discounting and dropping the lowest exam grade to see if it made any significant differences for some people. Basically it did not.

The final grades were determined from the ranked totals and adjustments were made for those near borderlines based on their journals (how complete, how much understanding it reflected) and their participation in discussions).

Roughly speaking, an A = substantially above the mean on all three exams (generally 175-200 points) , B = above the mean on at least two of the exams (generally 150 – 175 points), C = below the mean on all exams and less than 150 points. NC = less than 125 points out of 200.

1. (9 pts) For each of the following statements, briefly explain why it is **not correct**.

- A. "When food is scarce, female lions are more likely to share food with cubs than are the fathers of the cubs."

It is males who share. They do so because each cub is greater part of their total reproduction. The other way to answer this is that females are less likely to share since their own survival and future reproduction is enhanced by not sharing in really bad times

- B. "Male parental care is more likely to evolve when males are certain of their paternity."

Paternity certainty alone will not lead to male parental care. The costs of caring must still be less than the gain from caring. Obviously paternity is potentially part of the cost – taking care of other's offspring is a high cost. But the cost alone does not determine adaptiveness.

- C. "Helping non-relatives is genotypic altruism because no inclusive fitness can be gained."

Inclusive fitness is not the only way that helping can pay and be reproductively selfish. You needed to mention reciprocal altruism, gaining experience that enhances future reproduction, gaining access to nest sites or territories (e.g., Ryer's kingfishers).

2. (8 pts) Show us your understanding of social behavior – **give examples**:

- A. **How** can variation in **social structure** be due to variation in one ecological factor?

The easiest answer here would be to use elephants or zebra and water availability. Elephants break into smaller groups in dry times, form bigger ones in wet times. Dry habitat Grevys zebra are F + kids , while plains zebra live in wet areas and have male + females + kids. Other examples include Hamadryas baboons (dry) versus yellow baboons (wetter).

Some of you confused mating systems with social structure and used examples like dunnocks and the way their mating system changes with food density or habitat structure – we let that go.

- B. **Why** is "harem" a poor term to describe the **social dynamics** of ♂ + ♀♀♀♀ social groups?

Dynamics is the key word here! Many male + females groups are female groups joined by a male rather than a male who has rounded up and retains females in a group. EXAMPLES – hamadryas versus gelada baboons – same structure but different dynamics (female-female bonds in gelada, male-female in hamadryas. The main point is not just the problem with using words like "harem" but that the same structure does not always reflect the same dynamics. Lions are not an example of male + females since there are usually 2+ males.

3. (8 pts) **Extra-pair copulations by female birds** have several possible advantages. State two of these and give an example for each (Make sure dunnocks is used as an example for one of them).

- A. Advantage (adaptive significance) #1 of female EPC

Dunnocks – female gains extra help with feeding young. Note that the resources are in the female's territory and thus they do not gain more resources by mating with the second male – the territory size remains the same. Since you use dunnocks here as an example, using them elsewhere on the test (e.g., #2A) cost you a point. Points: 2 for advantage + 2 for example.

- B. Advantage (adaptive significance) #2 of female EPC

See Alcock for other advantages to female BIRDS from EPCs. Good genes, genetic diversity among young, access to better mates or territories in the future, fertilization assurance. All examples had to fit the advantage given

4. (9 pts) Hilda the koala bear saved her full brother's life, and helped her full sister raise two sons to the age of reproduction. Her sister could have raised one son by herself. **Hilda calculates her indirect inclusive fitness as  $(0.5 \times 1) + (0.5 \times 1) = 1.0$**

A. What does the result (1.0) represent in Hamilton's rule? \_\_\_\_\_ **rb** \_\_\_\_\_ Hamilton's rule ( $rb - c > 0$ ) is not the formula for inclusive fitness

B. What else does Hilda need to know in order to apply Hamilton's rule?  
She needs to know the cost to her fitness of helping = c

C. So far her calculations are correct. It turns out that when Hilda saved her brother and helped her sister she already had two adult cubs of her own and she was post-reproductive. Thus, Hilda estimates her total **inclusive fitness** as  $2 + 1 = 3$ . Has she made any mistakes? Explain..

She is now calculating inclusive fitness. The answer to the question is, it depends... if she had any help raising her two cubs she needs to subtract that ( $N_4$ ) to obtain an accurate estimate of her inclusive fitness

5. (4 points) Termites and naked mole rats are not haplodiploid so they do not have the relatedness advantage of ants, bees and wasps. What, then, is a key factor in their being eusocial?

What, besides inclusive fitness, promotes the evolution of eusocial behavior?  
Ecological factors were what was looking for. See Alcock and lecture handouts and notes for details. Protected nest site necessary, but hard to find or produce. Clumped food sources that require a number of individuals to collect, etc.

6. (12 pts) Write a concise statement that shows me you understand the significance, for behavioral ecology, of the perspective shift below. **"Significance"** means what was gained, revealed, cleared up and/or what is different as a result of the shift. **"Concise"** means use just two clear, supported points for the perspective shift. Do not add extraneous information –.

**The perspective of the parent → The perspective of the offspring**

I expected a well thought out and written statement that included ideas and examples that showed what the significance of the shift was. For this shift there was an obvious pair of perspectives involved

1. Parent to offspring – conflicts of interest over parental investment, or sex ratios (hymenoptera), begging and parental manipulation, female cub conflict in lions, etc.
2. Sibling to sibling – conflicts over resources despite close relatedness. Sib-sib competition fostered by mother (egrets) or beyond mother's control (e.g., hyenas), or varies (boobies)