

EEB First Exam – 2004

There are four sections of the EEB First Exam, covering Behavior, Ecology, Evolution, and Systematics. Each section is divided into 2 parts, each with equal weight.

Behavior Section

Part 1 – Answer 4 of the following 6 “shorter-answer” questions. Your answers should be thorough but terse, running no more than 1-2 paragraphs and covering no more than a single exam form page. In writing your answers, be sure to define all the relevant terms in addition to comparing terms (where appropriate).

1. What is the difference between classical fitness and inclusive fitness? (Explain both terms and how they compare and contrast).
2. a) What is eusociality?
b) Why might eusociality arise? (Give a proximate OR an ultimate reason).
c) Briefly discuss an example of eusociality found in nature.
3. a) Distinguish between proximate and ultimate causes of behavior.
b) Provide an example for each to make your points.
4. a) What is a “search image”?
b) Describe an example from your readings that supports OR contradicts this notion (choose one).
5. a) What is an ESS?
b) What is a mixed ESS?
c) Give an example of one OR the other to illustrate your point.
6. a) Briefly explain the concept of a “critical period.”
b) Give an example of a behavior with a “critical period” that has been studied in the field and/or the laboratory.

Part 2 – Answer 1 of the 3 following “longer answer” questions. Your answer should be thorough but, again, terse, running no more than 4 exam form pages. Be sure to define important terms.

1. Animals must avoid predation if they are to live long enough to reproduce. What are some behavioral or morphological adaptations for predator avoidance?
2. Describe the current state of understanding of avian navigation (including ontogeny). Remember to specifically address modifications to Kramer’s “Map and Compass” model. [Wiltschko R, Wiltschko W. 2003. Avian Navigation: from historical to modern concepts. *Animal Behavior* 65: 257-272.]
3. Describe the study performed by Griffin and Galambos (1941). What were their hypotheses? What were their predictions? Describe the experiment, including controls. What were their conclusions? [Griffin DR, Galambos R. 1941. The sensory basis of obstacle avoidance by flying bats. *J. Exp. Zool.* 86: 481-506.]

Ecology Section

Part 1 – Answer 4 of the following 7 “shorter-answer” questions. Your answers should be thorough but terse, running no more than 1-2 paragraphs and covering no more than a single exam form page. In writing your answers, define all the relevant terms in addition to comparing terms (where appropriate).

1. How does density dependence affect population growth?
2. What are the primary differences in the dynamics of continuous versus discrete time models?

3. Why are deterministic growth rates poor estimators of growth in stochastic environments?
4. What is a source-sink system?
5. What is ecological succession?
6. What are prospective and retrospective perturbation analyses? Which is more relevant for conservation? Why?
7. What are the differences between a trophic web and a trophic ladder? Why are they important?

Part 2 – Answer 1 of the following “longer answer” questions. Your answer should be thorough but, again, terse, running no more than 4 exam form pages. Be sure to define important terms.

1. As explained in Smith and Hellmann’s paper *Population persistence in fragmented landscapes*, demographic variables, patch size and dispersal (operating through neighborhood connectedness) interact to determine success in blue-breasted fairy-wrens. What are the interactions? What are the important messages for both conservation and research? What else should be examined?
2. In the Freedman et al. paper *Life history analysis for black bears (Ursus americanus) in a changing demographic landscape*, the researchers evaluate the relative importance (elasticities) of demographic variables for a variety of models and a range of the parameter space. What are their primary conclusions? What was the effect of correlations among the demographic variables? What explanations did the researchers offer for the fact that their results differ somewhat from both theory (Heppel et al. 2000) and other studies on black bear (Powell et al. 1996)? What were their primary management recommendations and do you agree? Why?

Evolution Section

Part 1 – Answer 4 of the following 7 “shorter-answer” questions. Your answers should be thorough but terse, running no more than 1-2 paragraphs and covering no more than a single exam form page. In writing your answers, define all the relevant terms in addition to comparing terms (where appropriate).

1. Explain the concept of genetic drift and its role in small founder populations.
2. What are Charles Darwin’s major points in the argument of evolution by natural selection?
3. What is the advantage of Mullerian mimicry in noxious species?
4. What are the benefits of sexual reproduction?
5. Explain heterozygote superiority and give an example.
6. What is the role of homeotic genes in evolution?
7. Define neutral theory and explain the role of silent substitutions.

Part 2 – Answer 1 of the following “longer answer” questions. Your answer should be thorough but, again, terse, running no more than 4 exam form pages. Be sure to define important terms.

1. In their paper, Sadowski et al. examined male body size and nuptial-gift balloon size in the investigation of sexual selection—male-male competition and female choice—in balloon flies, and they did it all in a field setting!
 - What were their findings on
 - a) male-male competition and b) female choice?
 - Please make sure to include in your answer explanations of the significance of sexual selection and the roles of male-male competition and female choice. Also present background information about nuptial gifts in the Empididae and explain what it means for the gift to be empty.

2. Brodie and Brodie investigated an example of the costs of exploiting poisonous prey. Write an essay about the work including the following:
 - What is the importance of this study in evolutionary biology?
 - What factors influence poison resistance?
 - How is poison resistance distributed among various snake populations and how do the authors account for this distribution?
 - What is the proposed basis for resistance, and how might it evolve?
 - Under what circumstances would resistant predators lose their resistance?

Systematics Section

Part 1 – Answer 4 of the following 7 “shorter-answer” questions. Your answers should be thorough but terse, running no more than 1-2 paragraphs and covering no more than a single exam form page. In writing your answers, define all the relevant terms in addition to comparing terms (where appropriate).

1. Compare and contrast synapomorphy, convergence, parallelism, reversal, and symplesiomorphy.
2. What is parsimony, and relate that principle to cladistic methodology.
3. Contrast character order and character polarity and explain how each might be determined.
4. Compare and contrast monophyly, paraphyly, and polyphyly; give an example of each.
5. Describe an objective weighting criterion and a subjective weighting criterion and provide an argument for one approach over the other.
6. Discuss each of Hennig's concepts: "assume homology," "reciprocal illumination," and "checking and rechecking".
7. Compare and contrast additive and nonadditive character optimization.

Part 2 – Answer 1 of the following “longer answer” questions. Your answer should be thorough but, again, terse, running no more than 4 exam form pages. Be sure to define important terms.

1. The concept of "support" and methods to measure it are common features of modern phylogenetic tree construction and presentation. Discuss three of these approaches and contrast them with a Popperian view on corroboration of classification.
2. Discuss the arguments for and against the competing schools of thought that would have us either combine all data in analyses (e.g., "total evidence", "simultaneous analysis") or analyze data sets separately (e.g., "consensus classification", "taxonomic congruence") and express why you find one more convincing than the other.