BIOLOGY B242: EVOLUTIONARY AND ECOLOGICAL GENETICS

EXAM 2000

Answer ONE question from section A, TWO questions from section B, and ALL OF section C (overleaf). Each section carries 1/3 of the marks on the paper.

SECTION A. Answer ONE of questions 1-3.

1. Consider, using specific cases, whether evolutionary biologists in the year 2000 need to invoke different genetic processes to account for micro- and macro-evolution?

2. Are the effects of mutation on fitness important in evolution? Support your argument with suitable examples.

3. "Every species has come into existence coincident both in space and time with a pre-existing closely allied species" (Wallace 1855). Discuss this statement in the light of modern theories of spatial evolution.

SECTION B. Answer TWO of questions 4-8.

4. What are the relative merits of the phylogenetic and cladistic approaches to resolving the classification of species? Assess the assumptions of each method in your answer.

5. How does genetic drift interact with selection in (a) chromosomal evolution **OR** (b) survival of endangered populations?

6. Is artificial selection a useful tool for an evolutionary biologist? Give some examples of its use to illustrate your response.

7. What are secondary sexual characteristics? What best explains them?

8. What use is linkage disequilibrium in modern evolutionary genetics?

Remember to answer Section C overleaf!

TURN OVER

SECTION C. Attempt ALL parts of question 9.

9. Dobzhansky studied the frequency of inversions "Standard" and "Arrowhead" in two mountain peak populations of *Drosophila pseudoobscura* in California 50 km apart:

Inversion Genotype	Arrowhead Homozygotes	Arrowhead/Standard Heterozygotes	Standard Homozygotes
Kingston Peak	52	39	12
Charleston Peak	102	21	5

a) Estimate the frequencies of Standard and Arrowhead in each population.

b) Calculate the expected genotype frequencies for each population.

c) Use a chi-square test to find whether there is any evidence for deviation from Hardy-Weinberg in each population.

d) How might you explain your findings in part (c) given the data so far?

e) In addition: (i) It is known that the local effective population sizes of each peak were very large, well over 1000 flies per peak, and that mating is approximately random. (ii) Dobzhansky found that environmental conditions on different mountains contribute to geographic variation in inversion frequency; (iii) Jones has since found that some *D. pseudoobscura* individuals regularly move over 60km between sites. (iv) Dobzhansky showed that inversion frequencies in laboratory populations stabilize at about 65% Arrowhead: 35% Standard.

How do these observations (i-iv) compare with the genotype frequency data from Kingston Peak and Charleston Peak? How might these observations be reconciled? Can you suggest any experiments to test between your hypotheses?

END OF PAPER