BIOLB242: EVOLUTIONARY AND ECOLOGICAL GENETICS (2005)

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 of the whole paper.

SECTION A (carries 1/3 of the marks). Essay.
Answer **ONE** of questions 1-3.

1. Darwin devoted a major passage in the *Origin of Species* to artificial selection as an analogue of natural selection. Is the analogy still valid? Describe examples of selection experiments, and discuss inferences that can be made about natural selection.

2. "Game theory is useful for gamblers but is of little value in evolutionary biology". Discuss this statement, and the steps involved in using evolutionary game theory to understand animal conflict.

3. Describe the "good genes" theory of sexual selection? Explain, with examples, whether it provides a useful explanation of secondary sexual traits.

SECTION B (carries 1/3 of the marks). Short answers.
Answer **TWO** of questions 4-8.

4. Discuss the plausibility of macromutations as agents driving adaptive evolutionary change.

5. Describe the definitions of species that appear in the current literature. What are your views on these definitions?

6. Explain fully the differences between homologous and analogous characters, and the consequences of these differences for taxonomy.

7. Describe how inbreeding is measured. Discuss whether inbreeding theory is useful in conservation.

8. Use illustrative examples to compare and contrast stabilising and disruptive selection on quantitative traits.

PLEASE TURN OVER FOR SECTION C!!

9. In a population from a hybrid zone between geographic races, 25 *Uroderma* bats were typed for two chromosomal polymorphisms, as follows:

AA CC	AA Cc	Aa CC	AA cc	Aa Cc	aa CC	Aa cc	aa Cc	aa cc
10	2	2	0	8	0	1	1	1

In this table, *Aa* indicates heterozygote for the *A* translocation, *AA* is homozygote for the translocation, *aa* is homozygote unrearranged, and so on.

a) Determine the allele frequency of the *A* translocation. *(Remember to sum across all two locus genotypes to get the total numbers of each genotype at A/a. For example there are 12 AA genotypes in this population).*

b) What are the expected genotypic frequencies for the *A* translocation polymorphism assuming Hardy-Weinberg equilibrium?

c) Test whether there is deviation from Hardy-Weinberg for the *A* translocation polymorphism using a chi-square test, helped by the tables below.

Table of chi-square values
Degrees of freedom	Value of *P*						
	0.99	0.9	0.5	0.1	0.05	0.01	0.001
1	0.00	0.02	0.46	2.71	3.84	6.63	10.83
2	0.02	0.21	1.39	4.61	5.99	9.21	13.82

d) Test whether there is a deviation from Hardy-Weinberg at the *C* locus.

e) Assuming gametic equilibrium, what is the expected frequency of *AC* gametes in the population?

f) What is the expected frequency of the *AC* gametes in the population if the value of the gametic disequilibrium coefficient is *D*.

Barton estimated that the gametic disequilibrium coefficient was in fact $D = +0.146$ in this population.

g) What is the expected frequency and number of *AACC* genotypes in the population with this level of gametic disequilibrium?

h) What is the expected frequency and number of *AaCC* genotypes in the population with this level of gametic disequilibrium?

i) What is the most likely cause of gametic disequilibrium in this population?

END OF PAPER