



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

**SECOND SEMESTER EXAMINATION FOR THE DEGREE OF MASTER
OF SCIENCE IN BIOTECHNOLOGY**

SBC 532: MOLECULAR POPULATION GENETICS

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DATE: TUESDAY 27TH MARCH 2012

TIME: 9.00 A.M. – 12.00 P.M.

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INSTRUCTIONS

Section A: Answer all questions (5 Mks each)

1. Show how the attainment of genetic equilibrium is affected by
 - a. sex-linkage
 - b. inbreeding
2. In a certain population, the genotypes AA, Aa and aa occur at frequencies 0.6, 0.4 and 0 respectively. If this population mates at random, what proportion of all matings should be between mates of different genotypes?
3. Explain why the mitochondrial DNA would be preferred than genomic DNA in a phylogeny study.
4. The inability of certain people to taste a chemical PTC is governed by a recessive allele t. If 24% of a population is homozygous tasters, calculate the frequency of the:
 - a) Recessive allele
 - b) Heterozygous genotype

5. Describe one application of the polymerase chain reaction.
6. Explain the following terms:
 - a) Gene pool
 - b. Founder principle
7. If inbreeding is the only factor contributing to changes in the genetic structure of a population, what will be the inbreeding coefficient of this population once the genotypes **AA**, **Aa** and **aa** attain frequencies of 0.752, 0.096 and 0.152 respectively, given that $1 - F = H/2pq$?
8. Describe the development and use of molecular clocks.

Section B. Answer any three questions (20 marks each)

9. Discuss five factors influencing the choice of a molecular marker in molecular phylogeny analysis
10. There are about 200 species of cichlid fish in Lake Victoria in east Africa are highly specialised for different niches and show morphological diversity. Research has shown that there is very little genetic variation among the cichlids in Lake Victoria but show high genetic variation between them and those of nearby lakes. Explain the possible processes of speciation that may have led to this genetic differentiation.
11. Using a specific example explain how selection affects the allele and genotype frequencies in a population

12. (a) Explain how migration affects the gene frequencies in a population
(5 Mks)

(b) Given this equation;

$$(1-m)^n = (q_n - Q)/(q_0 - Q)$$

Where,

m = proportion of the newly introduced genes

q_0 = initial gene frequency in the recipient population

q_n = gene frequency after n generations

Q = frequency of the same gene in the migrant population

Calculate the degree of exchange (m) of the *Rh* allele for two populations, American whites and American blacks, with *Rh* allele frequencies 0.028 and 0.446 respectively after two generations. Assume East African blacks had *Rh* allele frequency of 0.630. What proportions of the African genes have remained in the American blacks? Explain the basis of all your calculations.
(15 Mks).