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RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences
First year – Semester I Examination –October/November 2015

BIO 2102 – GENETICS & EVOLUTION

Time: 1½ hours

Answer **3 questions** only.
Illustrate your answers with labelled diagrams where appropriate.

1. In cats, there is a gene, which produces fur with bands of different colours on each hair called Agouti (H). The recessive allele (h) for this gene produces hair that is a solid brown colour. In addition, there is a coat colour gene, which has a recessive albino allele (a) in which the homozygote, prevents the production of any coat colour pigment, resulting in a white cat with pink eyes, the traditional albino. These two completely different genes are unlinked. An albino female cat is mated to a solid brown coloured male cat. All of their offspring are Agouti. The males and females among these offspring (F_1 progeny) are allowed to freely interbreed, producing a flock of F_2 kittens.

   a) Deduce the parental genotypes.
   b) Predict the phenotypic ratio for fur colour among the F_2 kittens using a punnet square.
   c) Propose a possible explanation for observed phenotypic ratios in the F_2 progeny.
   d) Suggest a possible mechanism for the coat colour production in these cats.

2. Cystic fibrosis is an autosomal recessive monogenic disease. Individuals homozygous for the recessive alleles that cause the disease, die during their teenage years.

   a) Explain what is meant by autosomal recessive monogenic disease.
   b) If 4 in 10,000 newborn babies have the disease, what are the expected frequencies of the three genotypes in newborns, assuming the population is at Hardy-Weinberg equilibrium?
   c) State the assumptions of the Hardy-Weinberg equilibrium.
   d) Explain why the Hardy-Weinberg equilibrium is not strictly applicable to the above scenario.

3. a) Despite the debates on the appropriateness of various species concepts, all species concepts should possess certain fundamental features. Briefly describe the fundamental features of a species concept.

   b) Briefly discuss the different modes of speciation.

4. Write short notes on any **four** of the following.

a) Genetic drift
b) Adaptive evolution
c) Catastrophism
d) Incomplete dominance
e) Gene and environment interactions