



THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME – LEVEL 04

FINAL EXAMINATION – 2008/2009

BOTANY

BTU 2102/BTE 4102/BTI 4102 – GENETICS, EVOLUTION & INTRODUCTORY  
MOLECULAR BIOLOGY

DURATION: TWO and A HALF (2 1/2) HOURS

DATE : 29<sup>th</sup> December 2008

TIME : 1.00 – 3.30 p.m.

ANSWER **FOUR (04)** QUESTIONS SELECTING AT LEAST **ONE (01)** QUESTION FROM EACH PART.

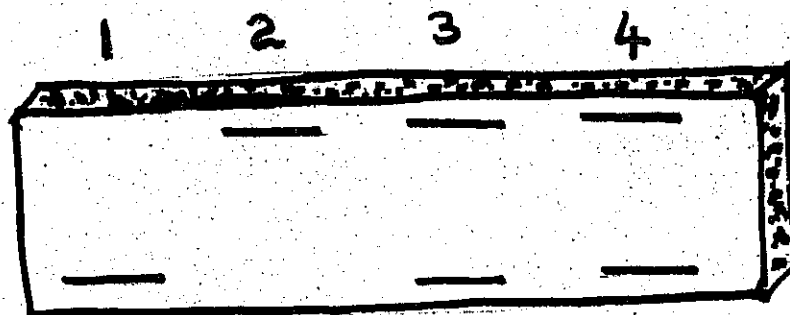
**PART - A**

1. A) In a plant species, long leaves (L) are dominant to short leaves (l). Round pollen (R) are dominant to irregular pollen (r). The progeny resulting from a cross between a plant bearing long leaves, round pollen with that of long leaves and irregular pollen is given below.

Plants with	long leaves, round pollen	108
	long leaves, irregular pollen	102
	short leaves, round pollen	31
	short leaves, irregular pollen	34

Explain these results.

- B) The following electrophoretic gel shows activity for a particular enzyme.



- Lane 1 is a sample from a "fast" homozygote.
- Lane 2 is a sample from a "slow" homozygote.
- In lane 3 the blood from the first two was mixed.
- Lane 4 relates to one of the children of the two homozygotes.

- i) If this was an X-linked trait, illustrate the bands on an electrophoretic gel that you would expect from the blood of
- a) a heterozygous female
  - b) a male

2. A) What is epistasis ?
- B) Briefly explain the different types of epistasis observed.
- C) Summer squash fruits can be found in three shapes: disk, spherical and elongate.

In one experiment, two squash plants with disk-shaped fruits were crossed. The first 160 seeds planted from this cross produced plants with fruit shapes as follows:

89 disk  
61 spherical  
10 elongate

- i) What type of gene interaction is involved? Explain.
- ii) What were the probable genotypes of the parents?
3. Male house cats may be black or yellow. Females may be black, tortoise-shell patterned, or yellow.
- a) If these colours are governed by a sex-linked locus, how can these results be explained?
  - b) Using appropriate symbols, determine the phenotypes expected in the offspring from the cross, yellow female X black male.
  - c) A certain kind of mating produces females, half of which are tortoise-shell and half are black; half the males are yellow and half are black. What colours are the parental males and females in such a cross?

## PART B

4. A) What would be the effect of a mutation in the initiating codon of an mRNA?  
 B) Consider the following nucleotide sequence.

5' AUGAGAUACCAUGGGCUGAAUGUGAAAA 3'

With the help of Table 1, predict,

- a) The amino acid sequence of the small polypeptide encoded in this prokaryotic mini-message.
- b) The amino acid sequences that would result if the following changes occurred in the message?
  - i. the first C is changed to a G
  - ii. the first U is changed to a G
  - iii. the first C is changed to an U
  - iv. the second G is changed to an A
  - v. the first C is deleted
  - vi. an extra G is added after the first G

**TABLE 1**

		Second position					
		U	C	A	G		
First position (5'-end)	U	UUU } Phe	UCU } Ser	UAU } Tyr	UGU } Cys		
		UUC } Phe	UCC } Ser	UAC } Tyr	UGC } Cys		
		UUA } Leu	UCA } Ser	UAA } STOP	UGA } STOP		
		UUG } Leu	UCG } Ser	UAG } STOP	UGG } Trp		
	C	CUU } Leu	CCU } Pro	CAU } His	CGU } Arg		
		CUC } Leu	CCC } Pro	CAC } His	CGC } Arg		
		CUA } Leu	CCA } Pro	CAA } Gln	CGA } Arg		
		CUG } Leu	CCG } Pro	CAG } Gln	CGG } Arg		
	A	AUU } Ile	ACU } Thr	AAU } Asn	AGU } Ser		
		AUC } Ile	ACC } Thr	AAC } Asn	AGC } Ser		
		AUA } Ile	ACA } Thr	AAA } Lys	AGA } Arg		
		AUG } Met	ACG } Thr	AAG } Lys	AGG } Arg		
	G	GUU } Val	GCU } Ala	GAU } Asp	GGU } Gly		
		GUC } Val	GCC } Ala	GAC } Asp	GGC } Gly		
		GUA } Val	GCA } Ala	GAA } Glu	GGA } Gly		
		GUG } Val	GGG } Ala	GAG } Glu	GGG } Gly		

The genetic code. All sixty-four codons are

C) The molecular weight of the *E. coli* chromosome is about  $2.5 \times 10^9$  daltons. The average weight of a nucleotide is 330 daltons and the distance between two adjacent nucleotide pairs is 0.34 nm. The DNA double helix makes one complete turn every 3.4 nm.

(i) How long is the DNA molecule of *E. Coli* ?

(ii) How many turns does this DNA contain ?

5. Explain how the natural selection changes the allele frequencies in a population.

6. Write short notes on any three of the following.

- a. Characteristics that distinguish man from apes
- b. Coacervate theory
- c. Post mating reproductive isolating mechanisms
- d. Plate tectonic theory
- e. Body cavities

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