PG/IS/ZOOL/Z-104/09

M.Sc. 1st Semester Examination 2009

ZOOLOGY

PAPER — Z-104

Full Marks : 40

Time : 2 hours

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

Write the answers to questions of each Group in separate books

GROUP — A

(*Immunology*)

1. Answer any *two* of the following: 2 × 2

   (a) Distinguish between sequential epitope and conformational epitope.

   (b) What is clonal selection?

   (c) Why hypervariable regions of Ig molecule is called complementary determining regions (CDRs)?

   (d) How do mast cells respond to allergen?

2. Answer any *two* of the following: 4 × 2

   (a) What is proteasome? What is its significance?

   (b) Describe the structure and biological function of IgM.

   (c) Write note on ADCC.

   (d) Describe the cytosolic pathway for antigen (Ag) processing.

(*Continued*)

3. Answer any *one* of the following : 8 × 1

   (*a*) State the principle of Southern Blotting Hybridization. Discuss briefly the steps and application of Southern Blotting Hybridization. 1 + 5 + 2

   (*b*) (*i*) Describe the method of sandwich ELISA.

        (*ii*) Discuss the TD process of B-cell maturation. 5 + 3

GROUP — B

(*Cytogenetics*)

1. Answer any *two* questions : 2 × 2

   (*a*) Mention the order che A , che B , eda and sup D from the following data :

Markers	% co-transduction
che A–eda	15
che A – sup D	5
che B – eda	28
che B – sup D	2·7
eda – sup D	0

(b) A population has eight times as many as heterozygotes as homozygous recessives. What is the frequency of the recessive allele?

(c) Why P^{53} knockout mice are normal at birth and but highly sensitive to UV light?

(d) What phenotypes might you expect in cells where:

   (i) pRB was phosphorylated constitutively?

   (ii) a truncated pRB protein was produced that could not be phosphorylated?

2. Answer any *two*: 4 × 2

(a) In *E. coli*, the following Hfr strains donate the genes shown in the order given:

Hfr strain	Order of Gene transfer					
1	G	E	B	D	N	A
2	P	Y	L	G	E	B
3	X	T	J	F	P	Y
4	B	E	G	L	Y	P

Arrange the markers in the *E. coli* chromosome indicating origin and last marker. 4

(*b*) A selectively neutral, recessive character appears in 40% of the males and 16% of the females in a large randomly interbreeding population. What is the frequency of the allele? What proportions of females are heterozygous for it? What proportion of males are heterozygotes for it? 2 + 2

(*c*) In Drosophila, the rosy (*ry*) locus is located on chromosome 3 and mutants at *ry* lack the enzyme Xanthine dehydrogenase. Wild-type *ry*⁺ flies have brick red eyes. You want to test whether Benzer's findings at the r II locus in T4 phage can be replicated in eukaryotes; try to do a fine structure analysis of the *ry* locus following Benzer's method. Over the years,

hundreds of mutants with *rosy* eyes have been identified. Address each of the following concerns :

(*i*) What sets of crosses would you perform ?

(*ii*) How will you efficiently select for intragenic recombinants at the *ry* locus ?

(*iii*) If you undertake both fine structure recombination and a complementation analyses, what results do you expect to see if Benzer's findings are replicated ?

$$1\frac{1}{2} + 1 + 1\frac{1}{2}$$

(*d*) What are protein kinases ? In what way they may be involved in cell cycle ? $1 + 3$
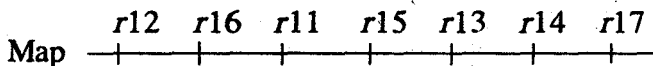
3. Answer any *one* question : 8×1

(*a*) Given the following map with point mutants and given the data in the following table, draw a

topological representation of deletion mutants
$r21$, $r22$, $r23$, $r24$ and $r25$.

$+ = r^+$ recombinants are obtained.

$0 = r^+$ recombinants are not obtained.   8

Map +——+————+————+——+————+——+
   $r12$ $r16$ $r11$ $r15$ $r13$ $r14$ $r17$

Deletion Mutants	Point Mutants						
	$r11$	$r12$	$r13$	$r14$	$r15$	$r16$	$r17$
$r21$	0	+	0	+	0	+	+
$r22$	+	+	0	0	+	+	0
$r23$	0	0	0	+	0	0	+
$r24$	+	+	0	0	+	+	+
$r25$	+	+	0	0	0	+	+

(b) In the European land snail *Cepaea nemoralis*,
multiple alleles at a single locus determine shell
color. The allele for brown (C^B) is dominant to

the allele for pink (C^P) and to the allele for yellow (C^Y). The dominance hierarchy is $C^B \rangle C^P \rangle C^Y$. In one population sample, the following color phenotypes were recorded:

Brown	236
Pink	231
Yellow	33
Total	500

Assuming that this population is in HWE (Hardy–Weinberg Equilibrium). Calculate the frequency of C^B, C^P and C^Y. $2\frac{1}{2}+2\frac{1}{2}+3$

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