國立臺灣大學95學年度碩士班招生考試試題

1. What concept of "gene" was derived from the experiment with *Neurospora* by Beadle and Tatum? (4 points)
2. Eight independently isolated mutants that display the same defective phenotype were analyzed in all possible cis and trans heterozygotes. All of the cis heterozygotes were like wild type. The trans heterozygotes resulted in either wild-type phenotype (+ in the table) or the mutant phenotype (- in the table). Based on this complementation test, how many genes are defined? Which mutants carry mutations in the same genes? Please include a brief interpretation in your answer. (10 points)

Mutant:	1	2	3	4	5	6	7	8
8	-	+	+	-	+	-	+	-
7	+	+	-	+	+	+	-	
6	-	+	+	-	+	-		
5	+	-	+	+	-			
4	-	+	+	-				
3	+	+	-					
2	+	-						
1	-							

3. A recessive mutation (m) of the wild-type (M) gene was isolated. You examined for the linkage relationship between (M) and two RFLP markers. One RFLP marker (A) has two restriction forms (A1) and (A2), and the other marker (B) has the (B1) and (B2) forms. The strain A1/A1 B1/B1 M/M was crossed to the strain A2/A2 B2/B2 m/m to get the F1 (A1/A2 B1/B2 M/m). The F1 was self-pollinated to get F2 progeny. The distribution of A and B RFLP patterns in the m/m F2 was showed in the following table.

RFLP pattern	number	RFLP pattern	number	RFLP pattern	number
A1A1B1B1	0	A1A2B1B1	0	A2A2B1B1	0
A1A1B1B2	28	A1A2B1B2	50	A2A2B1B2	28
A1A1B2B2	272	A1A2B2B2	547	A2A2B2B2	271

Is the M gene linked to any of these two RFLP markers? Please include a brief interpretation in your answer. (10 points)

4. The frequencies of blood types in Taiwan are A: 27%, B: 25%, AB: 6%, and O: 42%. What are the frequencies for I^A, I^B, and i alleles in our population based on the Hardy-Weinberg principle. (10 points)

5. Explain the following terms: (4 points each)
   a. gene conversion
   b. functional genomics
   c. T-DNA
   d. gene pool

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6. Compare the difference among dominance, incomplete dominance and codominance. (9%)

7. If a woman of blood group AB marries a man of blood group A whose father was of group O, what is the probability that
   (a) their two children will both be of group A? (3%)
   (b) one child will be of group B, the other of group O? (3%)
   (c) the first child will be a son of group AB and the second child a son of group B? (3%)

8. Answer "yes" or "no" in the blank to contrast eukaryotic chromosomes and bacterial chromosomes with respect to the following features: (20%) (回答本問題時，請將下列表格重新畫於答案紙中，然後填寫 "yes" or "no")

Feature	Eukaryotic chromosomes	Bacterial chromosomes
Nucleosomes		
Supercoiling		
Origin of replication		
Telomeres		
Nonhistone proteins		
Circular chromosome		
rRNA genes		
Looping		
Repetitive sequences		
Centromeres		

9. How do Xic region, *Xist* gene, Xce region and *TsiX* gene control the X chromosome inactivation in the somatic cells of female mammals, respectively? (12%)

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