

Part I (選擇題每題3分, 單選)

The F1 from a cross of $AB/AB \times ab/ab$ is test-crossed, resulting in the following phenotypic ratios:

AB	122	aB	195
Ab	165	ab	118

1. What is the frequency of recombination between genes a and b ? (a) 0.3 (b) 0.4 (c) 0.5 (d) 0.6.

A man has a Y-linked disorder and married to a normal healthy woman. Consider questions 2-4:

2. What is the probability for him having a son? (a) 1 (b) 0.5 (c) 0.25 (d) 0.
 3. What is the probability for him having an affected daughter? (a) 1 (b) 0.5 (c) 0.25 (d) 0.
 4. What is the probability for him having an affected son? (a) 1 (b) 0.5 (c) 0.25 (d) 0.

In a population study, heterozygosity of Loci A and B are 0.15 and 0.20, respectively. Consider questions 5-7:

5. What is the probability that an individual is heterozygote at both loci? (a) 0.35 (b) 0.03 (c) 0.05 (d) 0.32.
 6. What is the probability that an individual is at least heterozygote at one locus? (a) 0.35 (b) 0.03 (c) 0.05 (d) 0.32.
 7. How many individuals do we need to screen in order to obtain 100 people are heterozygote for at least one locus (a) 633 (b) 525 (c) 312 (d) 446.

A normal chromosome has the gene sequence as $ABCD * EFGH$ where the “*” in between two blocks of genes indicate centromere region. Determine the chromosomal mutation illustrated by each of the following chromosomes (questions 8-11).

8. $ABD * EFGH$ (a) deletion (b) duplication (c) inversion (d) translocation.
 9. $ABCFE * DGH$ (a) deletion (b) duplication (c) inversion (d) translocation.
 10. $ABCD * EFEFGH$ (a) deletion (b) duplication (c) inversion (d) translocation.
 11. $AD * EFBCGH$ (a) deletion (b) duplication (c) inversion (d) translocation.

In human the three alleles I^A , I^B , and i constitute a multiple allelic series that determine the ABO blood group system. A woman of blood group AB marries a man of blood group A whose father was group O. Consider questions 12 and 13:

12. What is the probability that one child will be group B and the other group O? (a) 0 (b) 1/4 (c) 1/8 (d) 1/64.
13. What is the probability that the first child will be a son of group AB and their second child a son of group B? (a) 0 (b) 1/4 (c) 1/8 (d) 1/64.

Part II. 問答題

1. 大自然中，不同生物間（例如大象和小老鼠）的體積差異相當大，可是他們的細胞平均大小卻差不多，為什麼？（15分）
2. 什麼是生物資訊學(bioinformatics)? 生物資訊學對生命科學的研究有什麼重要性? 舉例說明你的論點。(15分)
3. 請舉出三種在生命科學研究上常用的技術，並說明他們的原理及重要性。(15分)
4. 複製羊桃莉(Dolly)死了，活了六年半，而一般正常的羊大約可以活 11-12 年。桃莉的遺傳上的媽媽在 6 歲時給桃莉 DNA，桃莉死前有一般正常老年羊會發生的疾病：關節炎及肺炎，然而 6 歲的桃莉卻正值壯年。請探討複製生物所引發的科學上的問題。(16分)