

一、選擇題 (每題 2%) ※ 本大題請於試卷內之「選擇題作答區」依序作答。

1. What is the best way to generate a BAC clone-contig map?
 - A. Use fluorescent in situ hybridization (FISH) to determine the relative chromosomal location of the inserts in each of a set of BAC clones.
 - B. Identify which of a set of sequence-tagged sites (STSs) are present in a set of BAC clones using PCR-derived probes, compare the maps to identify overlapping regions, and then align the clones.
 - C. Sequence each of a set of BAC clones using a random shotgun approach, then align the BACs based on the overlapping sequences.
 - D. Determine what genes are present in each BAC clone by identifying which of a set of ESTs are present in each BAC clone using PCR-derived probes. Then infer the overlap between different BACs clones from a previously completed genetic map of the genes identified by the ESTs.

2. 156 tetrads were analyzed in a series of two-point crosses in *Neurospora*. One hundred and two of the tetrads are parental-ditype tetrad (PD), 40 are tetratype tetrad (T), and 14 are nonparental-ditype tetrad (NPD). What is the frequency of recombination between the two genes?
 - A. 14%
 - B. 22%
 - C. 34%
 - D. 50%

3. Down syndrome is associated with
 - A. an inversion
 - B. a Robertsonian translocation
 - C. trisomy-21
 - D. both b and c

4. Before transcription of the *lac* operon can occur, RNA polymerase must bind strongly to the promoter. This happens when
 - A. a CAP-cAMP complex binds to the CAP site in the promoter
 - B. CAP binds to the CAP site in the promoter
 - C. catabolite repression occurs
 - D. *lacI*⁺ is mutated to *lacI*⁻

5. In eukaryotes, cell- and tissue-specific gene expression is achieved via
 - A. the use of operons
 - B. a cell- and tissue-specific set of activators and repressors
 - C. DNase I sensitivity
 - D. selective deletion of genes not active in differentiated cells

見背面

二、簡答題

1. A cloned DNA sequence was used to probe a Southern blot. There were two DNA samples on the blot, one from white blood cells and the other from a liver biopsy of the same individual. Both samples had been digested with *HpaII*. The probe bound to a single 2.2-kb band in the white blood cell DNA but bound to two bands (1.5 and 0.7 kb) in the liver DNA.
 - A. Is this difference likely to result from a somatic mutation in a *HpaII* site? Explain. (5%)
 - B. How would it affect your answer if you knew that white blood cell and liver DNA from this individual both showed the two-band pattern when digested with *MspI*? (5%)

2. Several investigators have demonstrated that chemical and environmental treatments of plants and animals can lead to abnormalities that persist for several generations before disappearing. For example, Hoffman found that treating the bean *Phaseolus vulgaris* with chloral hydrate led to abnormalities in leaf shape that persisted in the female (but not male) line for almost six generations before disappearing.
 - A. In what different ways could you explain the origin of these abnormalities, and their disappearance after several generations? (5%)
 - B. What broader implications might these findings have? (5%)

3. Give two examples of effector molecules, and discuss how effector molecules function to regulate gene expression. (10%)

4. The frequencies of gametes of different genotypes, determined by testcrossing a triple heterozygote, are as shown in the table as follows:

Gamete Genotype	%
+++	12.9
abc	13.5
++c	6.9
ab+	6.5
+bc	26.4
a++	27.2
a+c	3.1
+b+	3.5
Total	100.0

 - A. Which gametes are known to have been involved in double crossovers? (3%)
 - B. Which gamete types have not been involved in any exchanges? (2%)
 - C. The order shown is not necessarily correct. Which gene locus is in the middle? Explain. (5%)

5. Please describe Mendel's principle of segregation. (6%)

6. The genetic code is universal from bacteria to human, what implication could be derived from this fact? (6%)

7. Consider the MN blood type of a population with 10000 individuals, the allele frequency for M is $p = 0.7$ and for N is $q = 0.3$. What would be the predicted Hardy-Weinberg individual number of MM, MN, and NN blood type, respectively? (6%)

三、配合題 (32%)

Select the most related choice from the answer collection for each of the following items:

- | | |
|-----------------------|--------------------------------------|
| 1. aneuploid | 2. Holliday junction |
| 3. DNA array | 4. western analysis |
| 5. UV light | 6. sexual reproduction |
| 7. cDNA | 8. 2:2 -> 3:1 |
| 9. chromosome walking | 10. ddNTP |
| 11. alleles | 12. 9:3:3:1 -> 9:7 |
| 13. topoisomerase | 14. A=T, G=C |
| 15. attenuation | 16. ability to survive and reproduce |

Answer collection:

- | | | |
|---------------------------------|------------------------------|----------------------|
| A. restriction endonuclease | B. reverse transcriptase | C. founder effect |
| D. gene conversion | E. DNA sequencing | F. crossing over |
| G. functional genomics | H. genetic drift | I. frame-shift |
| J. thymine dimmer | K. protein | L. RNA |
| M. synapsis | N. chromosome nondisjunction | O. meiosis |
| P. alternate forms of a gene | Q. epistasis | R. DNA supercoils |
| S. termination of transcription | T. heterozygote | U. operon |
| V. Hershey and Chase | W. Chargaff | X. map-based cloning |
| Y. fitness | Z. kinase | |

試題隨卷繳回