

91 學年度醫技系碩士班入學考筆試

科目：生物技術

單選擇題 (Choices) (33%) (3% each)

1. Microarray is a newly developed technique for gene detection. It offers several advantages compared with the traditional Southern/Northern hybridization methods. What are these advantages?
 - a. cheap
 - b. simultaneous detection of lots of genes
 - c. easily prepared on benchtop
 - d. a, b and c
 - e. b and c
2. Which of the following statements are **true** for the oligonucleotide and cDNA microarray systems?
 - a. oligonucleotide chip system is more suitable for SNP detection
 - b. cDNA chip system is usually prepared by *in situ* synthesis of the DNA probes on chip surface
 - c. cDNA chip system is mainly used for gene expression detection
 - d. Nylon membrane is the most commonly used chip material worldwide
 - e. a and c
 - f. all of the above
3. Define the "**restriction enzyme**"
 - a. the enzyme that recognizes and cleaves at specific base pair sequences
 - b. the enzyme that functions in a very restrictive temperature
 - c. the DNA enzyme that does not have the polymerization property
 - d. the enzyme that cleaves on protein or peptide molecules
4. Which of the following statements is **untrue**?
 - a. Southern hybridization is the detection for DNA-RNA hybridization
 - b. Northern hybridization is the detection for DNA-DNA hybridization
 - c. Western blot is the detection of antigen-antibody interaction
 - d. a and b
 - e. a, b and c
5. Which of the following statements for agarose gel electrophoresis is **untrue**?
 - a. the bigger the DNA fragment is, the lower percentage of agarose should be used
 - b. mostly are vertical electrophoresis systems, other than horizontal systems
 - c. agarose gel can be melted when heated to 70°C
 - d. a and c
6. Define the term "**Bioinformatics**"
 - a. creation of the robots that own human wisdom
 - b. application of the computer tools to biological studies
 - c. use of the biological materials to manufacture the computer chips
 - d. none of the above
7. **proteomics**
 - a. two-dimensional protein electrophoresis is an important approach of it
 - b. it is the study of the protein degradation mechanism in cells

(背面仍有題目,請繼續作答)

- c. it is the systemic study for protein functions and expressions in cells
- d. it is only limited to the *E. coli* system
- e. a and b
- f. a and c

(questions 8-11) Assuming you were a graduate student at the Medical Technology of NCKU, and your master thesis is "The functional characterization of the human protein X". You would need to conduct the following studies. Please think carefully and decide how to perform the experiments:

8. To gain the functional product for study, you need to have the purified protein X. Which is the right order in the experimental processes?
- a. RT-PCR gene X from human total RNA -> IPTG induction -> nickel column purification
restriction enzyme digestion -> clone into pET21 vector
 - b. PCR gene X from human genomic DNA -> nickel column purification -> restriction
enzyme digestion -> clone into pET21 vector -> IPTG induction
 - c. RT-PCR gene X from human total RNA -> restriction enzyme digestion -> clone into
pET21 vector -> IPTG induction -> nickel column purification
 - d. PCR gene X from human genomic DNA -> restriction enzyme digestion -> clone into
pET21 vector -> IPTG induction -> nickel column purification
9. Now you have obtained a good amount of the protein X, you would want to know whether the protein X has a DNA-binding activity, what kind of experiment should you perform?
- a. western blot
 - b. band shift assay
 - c. *in vitro* transcription/translation study
 - d. co-immunoprecipitation assay
10. The protein X is an important risk factor the cardiovascular disease. A polymorphic site (SNP site) on codon 103 has been identified. To screen for this polymorphic site in the cardiovascular patients in the NCKU hospital, what kind of approach should you take?
- a. RFLP
 - b. sequencing
 - c. single strand conformation polymorphism (SSCP)
 - d. allele specific oligonucleotide hybridization (ASO)
 - e. all of the above
11. To screen for the protein(s) that is(are) associated with the protein X, you have decided to perform the yeast two hybrid assays. Which of the following statement for the yeast two hybrid assay is true?
- a. the plasmid containing the X gene should be transformed into the yeast cell, and selected with ampicillin selection marker
 - b. the vectors used for the yeast two hybrid study usually contain the Gal-AD or Gal-BD domains
 - c. in the assay, the protein-protein interaction is based on the formation of blue color that is derived from the cleavage of the substrate x-gal
 - d. b and c
 - e. a, b and c

多選題 (Multiple choices) (Questions 12 - 15) (12%) (3% each)

12. Thymidine kinase
- a. blocked by aminopterin
 - b. phosphorylates free thymidine to thymidine monophosphate

- c. key enzyme in salvage pathways
 - d. selectable marker used in transfection experiment
13. Chloramphenicol acetyltransferase
- a. acetylates antibiotic chloramphenicol
 - b. selectable marker used for transposons
 - c. selectable marker used in transfection experiment
 - d. a reporter for promoter activity assay
14. Enhancers
- a. can work from thousands of base pairs away from the gene
 - b. can not work from downstream of gene
 - c. can locate within an intron
 - d. can function in either orientation relative to the gene
15. The advantages using the bacteria *E. coli* as the expression system include:
- a. short generation times
 - b. simplicity
 - c. good posttranslational modification
 - d. large yields of product with low cost

(> | %) 配合題(Directions) (Questions 16-22): Select the ONE lettered option that is MOST closely associated with the numbered items. Each lettered option may be selected once, more than once, or not at all.

(> | % each)

Questions 16-19

- (A) a mutation detection assay
 - (B) detection of variations in DNA fragments using restriction enzymes
 - (C) a protocol for the isolation of exons
 - (D) *in vitro* assay to demonstrate DNA binding
 - (E) *in vitro* assay for protein-protein interactions
16. DNase footprinting
17. Mobility-shift assay
18. co-immunoprecipitation
19. Single strand conformation polymorphism

Questions 20-22

- (A) an enzyme that degrades double-stranded DNA
 - (B) an enzyme that removes nucleotides from the 3'-hydroxyl ends of double-stranded DNA
 - (C) seals up nicks in the DNA strand
 - (D) nicks RNA-DNA hybrid
 - (E) digests single-stranded nucleotide
20. DNA ligase
21. RNase H
22. S1 nuclease

問答題

- 一. 說明 polymerase chain reaction (PCR) 之原理、一般實驗流程、及引子(primer)設計應注意事項。(17%)
- 二. 說明(1) polyacrylamide gel electrophoresis (PAGE)之原理; (2) disc-PAGE 及 SDS-PAGE 之差異。(17%)