

**Part I : 50%****一、多重選擇題 (2% each)**

1. 下列何者可作為遺傳物質：

- (A) 醣類 (B) 蛋白質 (C) 核醣核酸 (D) 脂肪 (E) 去氧核醣核酸

2. 下列何種氨基酸具有非極性側鏈(side chain)？

- (A) arginine (B) aspartic acid  
(C) phenylalanine (D) tryptophen  
(E) leucine

3. NO 可以活化下列何種酵素？

- (A) phospholipase A (B) protein kinase A  
(C) phospholipase D (D) adenylyl cyclase  
(E) guanylyl cyclase

4. 正常人在飯後，血中何種激素會上升？

- (A) 胰島素 (B) 升糖激素  
(C) 甲狀腺素 (D) 腎上腺素  
(E) 生長激素

5. 下列何種酵素參與 DNA 複製？

- (A) DNA polymerases (B) reverse transcriptase  
(C) hexokinase (D) topoisomerases  
(E) telomerase

6. 在 adenine 與 uracil 的配對中，有多少個氫鍵形成？

- (A) 1 個 (B) 2 個 (C) 3 個 (D) 4 個

7. glutamate 與 oxaloacetate 在 aminotransferase 作用後可以形成

- (A)  $\alpha$ -ketoglutarate and aspartate  
(B)  $\alpha$ -ketoglutarate and alanine  
(C) citrate and aspartate  
(D) citrate and asparagine

8. 在氨基酸代謝的轉氨作用中所使用的輔酵素 (coenzyme)，主要為下列那一個？

(背面仍有題目,請繼續作答)

(A) 維生素 B<sub>2</sub> (B) 維生素 B<sub>6</sub> (C) 維生素 A (D) 維生素 C

9. 下列那一種 RNA 可以合成蛋白質？

(A) mRNA (B) rRNA (C) tRNA (D) small nuclear RNA  
(E) hnRNA

10. 當酵素的 K<sub>m</sub> 值越小，代表

(A) 酵素與受質的親和性 (affinity) 越強  
(B) 酵素與受質的親和性 (affinity) 越弱  
(C) 酵素的 V<sub>max</sub> 越大  
(D) 酵素的 V<sub>max</sub> 越小

11. 細胞內產生 ATP 的主要胞器為下列何者？

(A) 細胞核 (B) 粒線體 (C) 溶脢體 (lysosome) (D) 內質網 (E) 高基氏體

12. 一條 polypeptide 可組成下列何種結構？

(A) 一級結構 (B) 二級結構 (C) 三級結構 (D) 四級結構

13. 肝糖 (glycogen) 是由 glucose 與下列那一個糖分子以糖苷鍵鍵結而成？

(A) glucose (B) mannose (C) sucrose (D) galactose

14. 下列何者為抑癌蛋白 (tumor suppressor)？

(A) Ras (B) Myc (C) Rb (D) Src (E) p53

15. 在 DNA 的組成中含有 thymine 而不是 uracil (雖然兩者都能與 adenine 形成 base pair)。這是由於在自然界中 cytosine 會進行下列何種反應？造成 DNA 突變的可能。幸好細胞內有 uracil DNA glycosylase 會幫忙將其修補回來。

(A) hydroxylation (B) deamination (C) glycosylation  
(D) acetylation (E) methylation

16. 下列何者為 G protein？

(A) EGF receptor (B) Ras  
(C) insulin receptor (D) protein kinase C (PKC)  
(E) phospholipase C

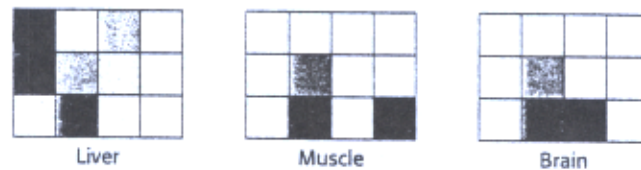
17. 一分子 FADH<sub>2</sub> 經由呼吸鏈進行氧化磷酸化作用，共可產生多少 ATP？

(A) 1 個 (B) 2 個 (C) 3 個 (D) 4 個

18. 在呼吸鏈 (respiratory chain) 上，唯一可將電子傳至 氧分子 ( $O_2$ ) 的為  
 (A) cytochrome a      (B) cytochrome a<sub>3</sub>  
 (C) cytochrome b      (D) cytochrome c
19. 當真核細胞 (eukaryotes) 之 hnRNA 在細胞核中進行 splicing 時，所移除的部分為：  
 (A) exons      (B) introns      (C) poly (A) tail      (D) the cap site
20. 下列何者不屬於 second messengers ?  
 (A) protein kinase C      (B)  $Ca^{+2}$       (C) cAMP      (D)  $IP_3$       (E) cGMP

## 二、簡答題(5% each)

1. 由大腦、肝、及骨骼肌所分離的細胞核，在  $\alpha\text{-}^{32}\text{P}\text{-UTP}$  存在下進行 RNA 合成 (initiation step 以加入抑制劑來抑制其發生)。含有放射活性的 RNA 再分別純化出來，然後利用這些 RNA 分別去 hybridize cDNA-晶片(每一小格子內含固定量的一種 gene 的 cDNA)，其結果如下圖：



試問晶片上不同基因顯現出不同深淺的訊號所代表的意義？

2. 如上題，同一基因在這三組晶片的結果顯現出不同或相同的訊號，這分別代表有何意義？

(背面仍有題目,請繼續作答)

**Part II : 50%**

1. A mutation that changes an alanine residue in the interior of a protein to a valine is found to lead to a loss of activity. However, activity is regained when a second mutation at a different position changes an isoleucine residue to a glycine. How might this second mutation lead to a restoration of activity? (5%)
2. The shape of hair is determined in part by the pattern of disulfide bonds in keratin, its major protein. How can curls be induced? (5%)
3. Fluorescence-activated cell sorting (FACS) is a powerful technique for separating cells according to their content of particular molecules. For example, a fluorescent-labeled antibody specific for a cell-surface protein can be used to detect cells containing such a molecule. Suppose that you want to isolate cells that possess a receptor enabling them to detect bacterial degradation products. However, you do not yet have an antibody directed against this receptor. Which fluorescent-labeled molecule would you prepare to identify such cells? (5%)
4. Suppose that a human genomic library is prepared by exhaustive digestion of human DNA with the EcoRI restriction enzyme. Fragments averaging about 4 kb in length would be generated.
  - (a) Is this procedure suitable for cloning large genes? Why? (4%)
  - (b) Is this procedure suitable for mapping extensive stretches of the genome by chromosome walking? Why? (3%)
5. What is the effect of each of the following treatments on the oxygen affinity of hemoglobin A in vitro? (4%)
  - (a) Increase in pH from 7.2 to 7.4.
  - (b) Increase in  $p\text{CO}_2$  from 10 to 40 torrs.
  - (c) Increase in [BPG] from  $2 \times 10^{-4}$  to  $8 \times 10^{-4}$  M.
  - (d) Dissociation of  $\alpha_2\beta_2$  into monomer subunits.
6. *r*-Aminobutyric acid (GABA) opens channels that are specific for chloride ions. The GABA<sub>A</sub> receptor channel is pharmacologically important because it is the target of Valium, which is used to diminish anxiety. (6%)
  - (a) The extracellular concentration of Cl<sup>-</sup> is 123 mM and the intracellular

concentration is 4 mM. In which direction does  $\text{Cl}^-$  flow through an open channel when the membrane potential is in the -60 mV to +30 mV range?

- (b) What is the effect of chloride channel opening on the excitability of a neuron?
- (c) The hydropathy profile of the  $\text{GABA}_A$  receptor resembles that of the acetylcholine receptor. Predict the number of subunits in this chloride channel.
7. Many proteins in signal transduction pathways are activated by the removal of an inhibitory constraint. Give three examples of this recurring mechanism. (3%)
8. Receptor tyrosine kinases are potential drug targets in cancer therapy. How might the effect of an oncogenic mutation be reversed by a small molecule? Propose a search strategy for such a drug. (5%)
9. Mutant forms of ras oncogene that are persistently in the GTP state accelerate the progression of many tumors. Propose a new class of anticancer agents based on altered targeting of ras oncogene. (5%)
10. Suppose that you have cloned a new cDNA that encodes a protein resembling members of the nuclear receptor superfamily. The ligand that activates this new receptor is unknown. How would you identify the target of this receptor and the battery of genes that it activates? (5%)