

生命科學分為兩部分：

第一部份單選題二十五題，請將答案寫在答案卷第一頁之表格內。

第一部份 Life Science (2 points/question)

1. The site for peptide degradation in the cell locates at

- (A) Endosomes
- (B) Lysosomes
- (C) Golgi complex
- (D) Peroxisomes
- (E) Proteosomes

2. The cytoplasmic organelles can be separated by the method of

- (A) Gel filtration
- (B) Ion exchangers
- (C) Centrifugal elutriation
- (D) Sucrose density gradient centrifugation
- (E) Isopycnic centrifugation

3. Chemokines is a family of small protein molecules crucial for the chemoattraction of inflammatory cells to the site of need. Which chemokine is a specific chemoattractant for polymorphonuclear neutrophil?

- (A) TNF- α
- (B) IL-1
- (C) IL-8
- (D) INF- γ
- (E) TGF- β

接背面

4. Which gene is involved in the cell apoptosis?
- (A) Fas
 - (B) Rb
 - (C) Neu-2
 - (D) Bcl-2
 - (E) I κ B
5. Scatchard analysis is a mathematical method to determine the value of
- (A) The conformation of tertiary protein structure
 - (B) The binding affinity of receptor-ligand interaction
 - (C) The lattice formation of antigen-antibody complexes
 - (D) The reaction rate of enzyme-substrate interaction
 - (E) The number of tandem repeats of the genes
6. The binding force responsible for maintaining tertiary structure of protein molecules are multiple, but;
- (A) Van den Waals force
 - (B) Hydrogen bond
 - (C) Metal-ion coordination complexes
 - (D) Ionic bond
 - (E) Hydrophobic cluster
7. Which description is correct for the biological function of lipid?
- (A) Triacylglycerols serve as hydrophobic anchors of the cells
 - (B) Phospholipids make up the biological membranes of the cells
 - (C) Arachidonic acids can be used to store the bioenergy
 - (D) Waxes exist in different biological fluid as emulsifying vehicle
 - (E) Sterols act as enzyme cofactors
8. Which cytokine in the followings can mediate cellular immunity?
- (A) Interleukin 4
 - (B) Tumor necrosis factor- α
 - (C) Interferon- γ
 - (D) Interleukin 10
 - (E) Transforming growth factor- β

9. Eicosanoids are small compounds derived from reaction of oxygen with phospholipids on the cell membrane. Which statement is correct in light of the biological property of these small lipid metabolites?
- (A) They are only synthesized by the inflammatory cells
 - (B) There is no eicosanoid receptor have been found till now
 - (C) All of them are quite stable
 - (D) They do not accumulate within the cells
 - (E) They all possess inflammatory, but not vascular, effects
10. Which molecule becomes the major structure component of extracellular matrix in the connective tissues of animal cells?
- (A) Celluloses
 - (B) Vimentins
 - (C) Glycolipids
 - (D) Chitins
 - (E) Glycosaminoglycans
11. A number of membrane transporters were found to carry solute across the cellular lipid membrane. Please select the correct pair of transporter system and their carried solute or biological functions.
- (A) Na^+ - K^+ -ATPase—production of ATP to simultaneous movement of Na^+ and K^+ cross the cell membrane
 - (B) Antiport system—mediate solute against concentration gradient
 - (C) Symport system—carry two solutes simultaneously in the same direction
 - (D) Permease—facilitate amino acid transport into living cells
 - (E) Ion-selective channel—shuttle ions across membrane by ionophores
12. Nitric oxide (NO) is an important second messenger in many cells. Which description of NO is correct?
- (A) Inhibit leukocyte adhesion to vascular endothelium
 - (B) Enhance oxygen metabolism in the cells
 - (C) Immunosuppression
 - (D) Suppress cyclooxygenase pathway in phagocytes
 - (E) Increase erythrocyte flexibility in the capillary
13. Which protein belongs to the category of adhesion molecule?
- (A) Acute phase reactants
 - (B) Transferrins
 - (C) Integrins
 - (D) Haptoglobulins
 - (E) Complements

14. Which description is not true for the biological activity of G proteins?
- (A) Transduce the cell apoptosis signals
 - (B) Crucial for arachidonic acid metabolism
 - (C) The molecules bind to and convert GTP to GDP
 - (D) As a downstream transducer for chemokine signaling
 - (E) One of the signal pathways for cell activation
15. Which assay method is most sensitive for the protein detection in solution?
- (A) Spectrophotometry
 - (B) Colorimetry
 - (C) Flow cytometry
 - (D) Western blot
 - (E) Enzyme-linked immunosorbent assay
16. Which technique can directly detect the presence of specific mRNA in the cells?
- (A) Southern blot
 - (B) *In situ* hybridization
 - (C) ELISPOT
 - (D) FISH
 - (E) SDS-PAGE
17. Inflammatory reaction can be elicited by many causes except
- (A) Chemical irritants
 - (B) Hypoxia
 - (C) Infections
 - (D) Immune reactions
 - (E) Arachidonic acid metabolites
18. "Specific activity" of an enzyme can be defined as
- (A) The total units of enzyme in the reacting solution
 - (B) The number of enzyme units/mg of protein
 - (C) 1 unit enzyme can cause transformation of 1 μ mole of substrate/min at 37^oC under optimal reaction condition
 - (D) 1 unit enzyme can elicit transformation of 1 μ mole of substrate/min at 25^oC under optimal reaction condition
 - (E) The specific activity of enzyme should be determined in the pure compound

19. Which pair is correct regarding the biological function of the specific enzyme?
- (A) Hydrolase—transfer of functional group to water
 - (B) Isomerase—mediate the formation of C-C or C-S bonds by condensation reactions
 - (C) Ligase—mediate the addition of groups to double bonds
 - (D) Transferase—transfer of electrons to oxygen
 - (E) Lyase—mediate group transfer reaction
20. The enzyme activity can be modified by the molecule of
- (A) Cofactors
 - (B) Coenzymes
 - (C) Phosphorylation
 - (D) Glycosylation
 - (E) All of the above
21. Acute phase reactants are protein molecules responsible for tissue damage or cell necrosis. The major site for the synthesis of these proteins is
- (A) Pancreas
 - (B) Lymphoid tissues
 - (C) Adrenal glands
 - (D) Liver
 - (E) Bone marrow
22. Which description is correct for "affinity" and "avidity" in the biological sense?
- (A) Affinity is the sum of total binding strength between two molecules
 - (B) The binding rate of a monoclonal antibody to a cognate antigen is called avidity
 - (C) Avidity is the binding strength of one molecule to another molecule at a single site
 - (D) Affinity denotes the total binding strength between the active site of the enzymes with its substrate
 - (E) None of the above
23. Which protein is physiologically not present in normal human plasma
- (A) Amyloid substance
 - (B) Haptoglobulin
 - (C) Ferritin
 - (D) Ceruloplasmin
 - (E) Fibronectin

24. Cell-mediated immune responses may contain

- (A) Phagocytosis of pathogens
- (B) Allograft reaction
- (C) Allergic reaction
- (D) Transfusion reaction
- (E) Complement-mediated cytotoxicity

25. Which amino acid is classified as basic moiety?

- (A) Tryptophan
- (B) Histidine
- (C) Arginine
- (D) Aspartate
- (E) Glutamate



接次頁

第二部份，請在答案卷第二頁起作答。

1. (5%) Suppose that a pure enzyme has a specific activity of $30 \mu\text{mol}\cdot\text{sec}^{-1}\cdot\text{mg}^{-1}$ enzyme. The enzyme is a homotetramer with 4 identical active sites, one active site per monomer. The tetramer M_r is 100 kDa (i.e., 100,000 g/mol). The turnover number for this enzyme is (a) 250/sec, (b) 350/sec, (c) 550/sec, (d) 750/sec, (e) 950/sec, (f) 1150/sec.
2. (5%) The Michaelis-Menten equation that describes the velocity of an enzyme-catalyzed reaction when $K_m \gg [S]$ is (a) $v = V_{\max} K_m/[S]$, (b) $v = V_{\max} [S]/K_m$, (c) $v = K_m [S]/V_{\max}$, (d) $v = V_{\max}/K_m [S]$, (e) $v = K_m/V_{\max} [S]$.
3. (5%) The molecular motor used in bacteria cytoplasm for transport is (a) myosin, (b) dynein, (c) flagella motor, (d) cilia motor, (e) kinesin.
4. (5%) Calmodulin is activated by Ca^{++} with an apparent K of $\sim 1 \mu\text{M}$ while troponin C has a K of $\sim 10 \mu\text{M}$. The physiological significance of the difference in K of these calcium-binding proteins is (a) calmodulin is a faster switch than troponin C, (b) troponin C is a faster switch than calmodulin, (c) troponin C and calmodulin regulate different protein kinases, (d) the activation of calmodulin depends on the activation of troponin C, (e) the activation of troponin C depends on the activation of calmodulin.
5. (5%) Quantitative determination of a protein is important for biochemical and functional analysis. Which one of the following methods offers the most accurate estimation of a protein of about 100 μg ? (a) weighing, (b) biuret method, (c) A280, (d) Lowry's method, (e) silver staining, (f) Coomassie blue staining, (g) Western blot analysis.
6. (10%) In order to study the biochemical properties of a protein "X", the cell-free extracts were fractionated by the following procedures: (A) Gel filtration column chromatography (resolution up to 1000 kDa) and (B) Ion-exchange chromatography. The "X" was found in the 600-700 kilodaltons (kDa) and 70 kDa fractions of the gel filtration column. The ratio of "X" protein appeared in these two peaks (i.e., the ratio of 600-700 kDa and 70 kDa peaks) estimated to be 3:1. The protein concentrations in these two peaks are 5 mg/ml and 0.5 mg/ml, respectively. The specific activity of "X" in the 600-700 peak was 1/10 of that in the 70 kDa peak. When further purified by ion exchange column, the specific activity of "X" derived from the 600-700 kDa peak was dramatically increased 10,000 folds, while that derived from the 70 kDa peak was increased merely two folds. The yield of protein from these procedures was $\sim 80\%$. When analyzed by Western blot, the purified protein from both peaks has a M_r of 70 kDa.
 - (1) The reason(s) that protein "X" appeared in two peaks from the gel filtration column could be (a) "X" is partially soluble, (b) "X" is a dimer in the 70 kDa peak, (c) "X" is a trimer in the 70 kDa peak, (d) "X" is a trimer in the 600-700 kDa peak, (e) "X" is a tetramer in the 600-700 kDa peak, (f) "X" could associate with other proteins.
 - (2) (a) "X" may be associated with an inhibitor(s) in the 600-700 kDa peak, (b) "X" may be associated with an activator(s) in the 600-700 kDa peak, (c) "X" protein is likely to depend on other cofactors for activity, (d) none of these are true.

接背面

7. (5%) Ribonucleotide reductase (RR) is the key allosteric enzyme for regulating DNA synthesis. The major reducing power is from NADPH. Which of the following statements is true? (a) RR is activated by dATP, (b) RR is inhibited by ATP, (c) RR is activated by UDP-glucose, (d) RR is inhibited by ATP- γ -S, (e) RR is activated by deoxy-glucose.
8. (5%) The peptide, LVPYQPPF1CQWQPHQPSWKPLMNSFVLTYT can be divided into four regions, A, B, C, and D:
A: LVPYQPPF, B: 1CQWQPH, C: QPSWKPLMN, D: SFVLTYT
Which region is more likely to assume an alpha-helix conformation?
9. (5%) Which of the following statements is true? (a) Translational machinery functions only in proliferating cells, (b) Plant cells do not have centrosomes, (c) Cytokinesis is the final stage of cell differentiation, (d) The half-life of the mRNAs is more tightly regulated than the proteins, (e) The levels of proteins are responsible mainly for their biological activities.

