

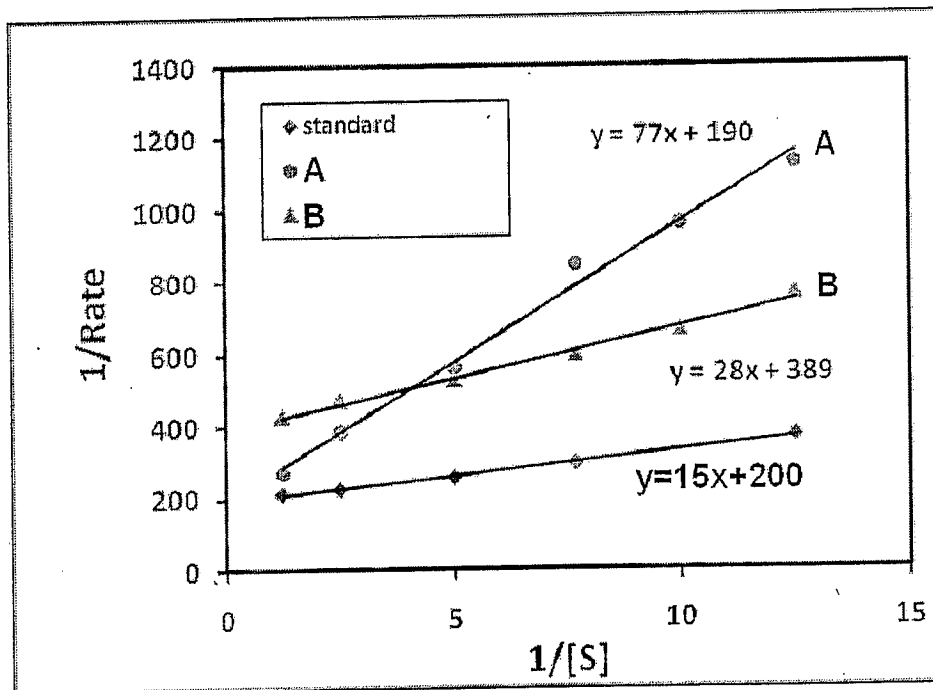
國立中山大學100學年度碩士班招生考試試題

科目：生物化學【生醫所碩士班】

- (1).(共 20 分,每子題 4 分) 請簡要描述解釋下列分子之功能或機轉
- (4 分) allosteric enzyme
 - (4 分) ubiquitin
 - (4 分) peptidyl prolyl isomerase
 - (4 分) okazaki fragments
 - (4 分) phospholipase C
- (2).(10 分) 請寫出細胞在有氧及無氧情況下，如何利用 glucose 生產 ATP?

(3).(10 分) 下圖為酵素 A 之 double reciprocal plot,

- (6 分) 計算此酵素(standard)之 V_{max} and K_M ?
- (4 分) line A, line B 何者為 competitive inhibitor, 何者為 non-competitive inhibitor?



- (4).(10 分) Describe the axon membrane depolarization process, point out how membrane potential, sodium ion and potassium ion changes during the process.

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(5).(10分) 7TM receptors activate G proteins and the downstream effector enzymes.

- a. What is the major features of 7TM receptors? (3分)
- b. What is the activation mechanism of G proteins? (4分)
- c. What is the difference of Gs, Gi, G_{o/13}, and G_q. (3分)

(6).(10分) 請描述 major histocompatibility protein I (MHC I) 及 MHC II 在免疫系統中扮演的角色及機制。

(7).(10分) What is the difference of O-linked glycosylation and N-linked glycosylation of protein? What are the biological roles of glycosylation of protein?

(8).(10分) What is siRNA, shRNA, miRNA and their in vivo mechanisms?

(9).(10分) 假設目前實驗室有一段 DNA 為某基因前區段，請設計實驗

- a.(5分) 如何找出這段 DNA 中控制基因表現的區域。
- b.(5分) 如何證明 transcriptional factors 的確結合到此區域。

一、單選題：第一題至第二十五題，每題兩分(50%)

1. How many chromosomes are contained in a human diploid cell? (A) 12, (B) 24, (C) 23, (D) 46.
2. DNA mutation CANNOT be caused by (A) reactive oxygen species, (B) Ethidium bromide, (C) Ultraviolet radiation, (D) replication slippage during DNA synthesis.
3. DNA methylation may prevent transcription. Which nucleotide is usually methylated? (A) Adenine, (B) Cytosine, (C) Guanine, (D) Thymine.
4. Which of the following statements is INCORRECT concerning DNA and its binding proteins? (A) The primary structure units of chromatin are nucleosomes, (B) DNA binding proteins mainly bind to the minor groove of the DNA double helix, (C) Eukaryotic nuclear DNA associates with histone proteins (H1, H2A, H2B, H3 and H4) to form chromatin, (D) Histone 1 links adjacent nucleosomes.
5. What kinds of genes are transcribed by RNA polymerase I? (A) Genes encoding precursor ribosomal RNA, (B) Genes encoding 5S ribosomal RNA, (C) Genes encoding transfer RNA, (D) Genes encoding messenger RNA.
6. What residues are usually methylated during post-translational modification of protein? (A) Methionine or Tyrosine, (B) Serine or Threonine, (C) Tyrosine or Glutamine, (D) Arginine or Lysine
7. Which protein is not a member of apoptosome? (A) Apaf-1, (B) Cyt *c*, (C) Procaspase 9, (D) Procaspase 7.
8. Which of the following molecules do not involve in the protein ubiquitination? (A) Ubiquitin, (B) SUMO-1, (C) Activating enzyme E1, (D) Conjugating enzyme E2.
9. The membrane lipids usually distributed in the exoplasmic leaflets are: (A) Sphingomyelins and Phosphatidylcholine, (B) Sphingomyelins and Phosphatidylinositol, (C) Phosphatidylcholine and Phosphatidylserine, (D) Phosphatidylethanolamine and Phosphatidylserine.
10. What phospholipids aggregations are often found in the cytoplasmic phase of membrane curvature? (A) Sphingomyelins, (B) Phosphatidylethanolamine, (C) Phosphatidylcholine, (D) Phosphatidylinositol.
11. The membrane lipid that is essential of lipid signalling: (A) Sphingomyelins, (B) Phosphatidylcholine, (C) Phosphatidylserine, (D) Phosphatidylinositol.

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12. The lipid fractions isolated from raft-like lipid microdomains contain: (A) Phosphatidylcholine and Cholesterol, (B) Glycopeptidolipids and Cholesterol, (C) Sphingolipids and Phosphatidylserine, (D) Sphingolipids and Cholesterol.
13. Which is correct regarding tyrosine kinase receptors? (A) They have no membrane spanning domains, (B) They cannot become autophosphorylated, (C) They move to the nucleus once bound to ligand, (D) They have an extracellular domain that binds to ligand.
14. Which of the following protein is associated with Ca^{2+} ions during activation? (A) Calmodulin, (B) Cyclic AMP, (C) Collagen, (D) Ceramide.
15. Which protein domain of human surface membrane proteins could bind sialic acid-rich glycoproteins (sialoglycoproteins), such as glycolipids, glycoproteins and proteoglycans. (A) Immunoglobulin domain, (B) Arginine-glycine-aspartic acid domain, (C) Lysine rich domain, (D) Lectin domain.
16. Name the tubulin that is only found in the nucleation ring complex during microtubule starting assembly. (A) α -tublin, (B) β -tublin, (C) γ -tublin, (D) δ -tublin.
17. Paclitaxel is approved for the treatment of many cancers. Which phenomenon is not observed in the paclitaxel treated cells? (A) The cells have defects in mitotic spindle assembly, (B) The cells have defects in chromatid DNA replication, (C) The cells have defects in chromosome segregation, (D) The cells have defects, and cell division.
18. The following statements about actin assembly are true EXCEPT: (A) Profilin bound ADP-actin complexes enhance actin growth, (B) The binding of activated Rho to formin stimulates actin assembly, (C) Actin nucleation occurs at the FH2 domain of formin-Rho-GTP complex, (D) Actin nucleation by Arp2/3-WASp complexes is observed during branching chain assembly.
19. Which is INCORRECT about Elastin? (A) The elastic fiber is formed from the reticular microfibril sheath, (B) Polypeptides of elastin are covalently bonded together via lysine residues, (C) Elastin is rich in alanine, valine, proline and glycine residues, (D) Elastin is found in arteries and lungs.
20. Various types of collagen are found in the basement membrane. Which is the major sheet-forming collagen found in the basement membrane? (A) Collagen type I, (B) Collagen type II, (C) Collagen type IV, (D) Collagen type V.

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21. Which is INCORRECT about anchored protein? (A) An anchored protein is covalently interacted with the lipid leaflet, (B) Ras is a GPI anchored protein, (C) Ras is acylated and prenylated in the cell membrane with cysteine amino acids, (D) v-Src is a membrane anchored protein through acylation.
22. Which is INCORRECT concerning active transport across a cell membrane? (A) It does not require ATP expenditure, (B) It occurs against the concentration gradient, (C) It requires the action of specialized proteins, (D) It has a maximum rate at which diffusion can take place.
23. Which is correct about antibodies? (A) Antibodies are produced by plasma cells, (B) Antibodies are composed of two heavy and one light chains, (C) Antibodies cannot be cleaved by papain, (D) The antigen binding domain is located on the Fc fragment of antibody.
24. Which is correct regarding transporter of biological membranes? (A) Uni-porters move a single type substance across a membrane, (B) The Na⁺/K⁺ ATPase is an example of a sym-porter, (C) Biological membrane is permeable for ATP, (D) The glucose transporter GLUT 1 is an anti-porter.
25. Which molecules are at the same direction as the long axis of cells (cell polarity)? (A) Microtubules, (B) Lamins, (C) Desmin, (D) Profilin.

二、單選題：第二十六題至第四十題，每題兩分(30%)

26. 下列何者為 DNA 複製的機轉 (mechanism of DNA replication)? (A) 半保留機轉 (Semiconservative mechanism), (B) 非保留機轉 (Nonconservative mechanism), (C) 雙保留機轉 (Doubleconservative mechanism), (D) 全保留機轉 (Allconservative mechanism).
27. 下列何者非為基因轉錄時的順式調節因子 (Cis-regulatory element)? (A) 包含解旋酶 TFIID 的早期起始複合物 (Pre-initiation complex), (B) 核心啟動子 (core promoter), (C) 加強子 (enhancer), (D) 遠端啟動子 (distal promoter).

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28. 關於 Pre-mRNA 的剪接 (splicing) 下列何者不正確? (A) 剪接體 (spliceosome) 的 small nuclear RNAs (snRNAs) 都含豐富的胞嘧啶 (Cytosine), (B) snRNAs 通常以史密斯序列 (Smith sequences) 和史密斯 (Smith) 蛋白結合或和其他蛋白結合成 snRNPs。 (C) 剪接體 U2 snRNA 的 3' 端序列可和 pre-mRNA intron 3' 端的序列配對而讓 A-branching point 突出, 以利剪接之進行, (D) Pre-mRNA 的剪接是經過二次 transesterification 而完成。
29. 關於 mRNA 3' untranslated region 可能的功能下列何者為正確? (A) 可預防 mRNA 被酵素分解, (B) 可幫助 mRNA 被酵素分解, (C) 可帶 mRNA 到對的位置去, (D) 是一段多餘的 mRNA, 沒有任何功能。
30. 動物細胞的大小 (size of a cell) 約為多少? (A) 10-20 cm, (B) 10-20 mm, (C) 10-20 μm , (D) 10-20 nm.
31. 超級細菌(新德里金屬乙內醯胺酶-1 腸內菌, NDM-1) 被衛生署列為何種傳染病? (A) 第一類法定傳染病, (B) 第二類法定傳染病, (C) 第三類法定傳染病, (D) 第四類法定傳染病。
32. 下列何者非為轉錄因子的 DNA 結合區? (A) calcium-finger protein, (B) Homeodomain (helix-turn-helix motif), (C) Leucine-zipper proteins (basic zipper), (D) Helix-loop-helix proteins.
33. 下列何種生物不適合做為生物體發育之研究? (A) 酵母菌 (Yeast), (B) 果蠅 (Fruit fly), (C) 斑馬魚 (Zebrafish), (D) 線蟲 (Roundworm)
34. 下列何者不是生物細胞產生的細胞外間質 (Extracellular matrix, ECM)? (A) 膠原蛋白 (Collagen), (B) 肌動蛋白 (Actin), (C) 細胞黏合分子 (Cell adhesion molecules), (D) 纖維醣蛋白 (Fibronectins)
35. 下列何種分子無法自由通過細胞膜? (A) 二氧化碳 (CO_2), (B) 氧氣 (O_2), (C) 水 (H_2O), (D) 酒精 ($\text{C}_2\text{H}_5\text{OH}$).
36. 關於膠原蛋白 (Collagen) 下列何者為正確? (A) 人體中的膠原蛋白只存於皮下, (B) 膠原蛋白為只能形成線狀或面狀的聚合分子且人體中並無水溶性的膠原蛋白存在, (C) 膠原蛋白 alpha chain 分子含有豐富的 proline 及 lysine 或 hydroxyproline, 但不含 glycine, (D) 網狀結締組織 (Reticular connective tissue) 由第三型膠原蛋白所組成 (type III collagen).

37. 關於核孔及其運輸下列何者為正確？(A) rRNA 的出核是由運出因子 NXF1 與含 FXFG or GLFG 氨基酸重複序列的核孔蛋白 (nucleoporins) 及 mRNP 上的 adapter protein 一起作用運送出核, (B) Exportin-1 (CRM1) 與 RanGTP 一起循環運送含有豐富 leucine 的 NLSs 蛋白進入細胞核, (C) 核孔複合物 (NPCs) 為單種核孔蛋白 (Nucleoporin) 形成的對稱聚合體, (D) 核孔通常與 euchromatin 緊緊相鄰 co-localization.
38. 關於分子馬達 (molecular motor) 下列何者為正確？(A) 分子馬達能量的可由水解 ATP/GTP 而來, (B) 分子馬達無法由 ion gradients 之變化而獲得能量, (C) Myosin 及 dynein 為延著 actin 運動的分子馬達, (D) 分子馬達的運動是沒有方向性的。
39. 下列何者非為紡錘體的微管 (MTs) 紡錘絲？
(A) Astral MTs, (B) Kinetocore MTs, (C) Cohesins MTs, (D) Polar MTs.
40. 下列何者為無設限的離子通道 (Non-gated ion channel)？(A) Aquaporin, (B) Nicotinic acetylcholine receptor, (C) Resting K^+ channels, (D) Calcium channels.

三、問答題：共 4 題，(20%)

1. Lamins, Laminin 與 lamina 之區別為何？(6%)
2. Aggrecan 與 Glycosaminoglycans 之區別為何？(4%)
3. 何種細胞骨架 (Cytoskeletons) 在細胞中固定 Adherence junction 及 Desmosome？(4%)
4. 心臟肌細胞中的鈣離子濃度如何上升？(4%) 此上升為何會造成肌肉的收縮？(2%)