

# 國立中山大學 114 學年度 碩士班考試入學招生考試試題

科目名稱：生物化學與分子生物學【生科系碩士班選考】

## — 作答注意事項 —

考試時間：100 分鐘

- 考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- 答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，請衡酌作答。
- 答案卡請以 2B 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，後果由考生自負。
- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶書籍、紙張（應考證不得做計算紙書寫）、具有通訊、記憶、傳輸或收發等功能之相關電子產品或其他有礙試場安寧、考試公平之各類器材入場。
- 試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。
- 試題採雙面列印，考生應注意試題頁數確實作答。
- 違規者依本校招生考試試場規則及違規處理辦法處理。

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※本科目依簡章規定「不可以」使用計算機(混合題)

共 5 頁第 1 頁

選擇題 30 題 (單選)每題兩分

1	In protein folding, which type of interaction stabilizes the $\alpha$ -helix structure? A. Disulfide bonds B. Hydrogen bonds C. Ionic interactions D. Hydrophobic interactions E. Van der Waals forces
2	Which enzyme catalyzes the rate-limiting step of glycolysis? A. Hexokinase B. Phosphofructokinase-1 C. Pyruvate kinase D. Aldolase E. Glucose-6-phosphate dehydrogenase
3	Which of the following processes occurs in the mitochondria? A. Glycolysis B. Fatty acid synthesis C. Oxidative phosphorylation D. Pentose phosphate pathway E. Protein translation
4	The enzyme responsible for unwinding DNA during replication is: A. DNA polymerase B. Ligase C. Helicase D. Topoisomerase E. Primase
5	Which of the following is a product of the urea cycle? A. Uric acid B. Ammonia C. Urea D. Creatinine E. Bilirubin
6	What is the role of chaperone proteins in the cell? A. Facilitate protein folding B. Catalyze enzymatic reactions C. Transport molecules across membranes D. Anchor cytoskeletal filaments E. Promote cell signaling
7	Which molecule is the main acceptor of electrons in the electron transport chain? A. NAD <sup>+</sup> B. FAD C. Coenzyme Q D. Oxygen E. Cytochrome c
8	What is the function of telomerase? A. Repair DNA damage B. Remove RNA primers C. Join Okazaki fragments

試題請隨卷繳回，請留意背面是否有題

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	D. Initiate DNA replication E. Replicate the ends of chromosomes
9	Which molecule is required for the activation of fatty acids before $\beta$ -oxidation? A. Coenzyme A B. NADH C. FADH <sub>2</sub> D. ATP E. Malonyl-CoA
10	Which type of RNA carries amino acids to the ribosome during protein synthesis? A. mRNA B. miRNA C. rRNA D. snRNA E. tRNA
11	Which of the following is a major component of the lipid bilayer in cell membranes? A. Cholesterol B. Glycolipids C. Phospholipids D. Sphingolipids E. Triglycerides
12	Which of the following techniques is used to amplify DNA? A. Southern blotting B. Northern blotting C. Gel electrophoresis D. Polymerase Chain Reaction (PCR) E. DNA sequencing
13	What is the role of restriction enzymes in molecular biology? A. Ligate DNA fragments B. Repair DNA mutations C. Amplify RNA sequences D. Convert RNA to DNA E. Cut DNA at specific sequences
14	Which technique is used for the separation of proteins based on their size? A. SDS-PAGE B. Western blotting C. ELISA D. PCR E. Northern blotting
15	In CRISPR-Cas9, the Cas9 protein functions as: A. A DNA-binding protein B. A DNA-cleaving enzyme C. A DNA-polymerizing enzyme D. An RNA-editing enzyme E. A protein-folding catalyst
16	Which type of cloning involves the transfer of a somatic cell nucleus into an enucleated egg cell? A. Gene cloning

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	<p>B. Molecular cloning</p> <p>C. Reproductive cloning</p> <p>D. Therapeutic cloning</p> <p>E. Tissue cloning</p>
17	<p>The enzyme reverse transcriptase is used in which process?</p> <p>A. DNA replication</p> <p>B. RNA splicing</p> <p>C. cDNA synthesis</p> <p>D. Protein translation</p> <p>E. DNA repair</p>
18	<p>Which of the following techniques separates DNA fragments based on their size?</p> <p>A. Gel electrophoresis</p> <p>B. Centrifugation</p> <p>C. Southern blotting</p> <p>D. DNA hybridization</p> <p>E. PCR</p>
19	<p>What does "knockout" refer to in genetic research?</p> <p>A. Removing a gene to study its function</p> <p>B. Introducing a new gene into an organism</p> <p>C. Altering the gene sequence with CRISPR</p> <p>D. Silencing RNA expression</p> <p>E. Amplifying gene expression</p>
20	<p>What is the purpose of electroporation in genetic engineering?</p> <p>A. To synthesize proteins from mRNA</p> <p>B. To amplify DNA sequences</p> <p>C. To deliver DNA into cells by creating temporary pores in the membrane</p> <p>D. To degrade unwanted DNA</p> <p>E. To separate DNA fragments</p>
21	<p>Which molecule is used as a probe in Southern blotting?</p> <p>A. Restriction enzymes</p> <p>B. Antibodies</p> <p>C. RNA fragments</p> <p>D. Radioactive or fluorescently labeled DNA</p> <p>E. Proteins</p>
22	<p>What is the function of a promoter in a plasmid vector?</p> <p>A. It encodes for antibiotic resistance</p> <p>B. It cleaves DNA at specific sequences</p> <p>C. It facilitates the initiation of transcription</p> <p>D. It enables DNA replication</p> <p>E. It binds restriction enzymes</p>
23	<p>Which of the following is an example of ex vivo gene therapy?</p> <p>A. Administering a virus to infect diseased cells in situ</p> <p>B. Delivering a gene directly into the bloodstream</p> <p>C. Using CRISPR to edit genes in the patient's body</p> <p>D. Treating blood cells with a therapeutic gene outside the body and reintroducing them</p> <p>E. Vaccination with DNA plasmids</p>
24	<p>Which of the following methods is used to determine the three-dimensional structure of</p>

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	<p>proteins?</p> <p>A. PVR</p> <p>B. Gel electrophoresis</p> <p>C. X-ray crystallography</p> <p>D. Northern blotting</p> <p>E. Flow cytometry</p>
25	<p>What is the primary role of MHC class I molecules?</p> <p>A. Present antigens to helper T cells</p> <p>B. Present antigens to cytotoxic T cells</p> <p>C. Activate B cells</p> <p>D. Bind to antibodies</p> <p>E. Stimulate macrophages</p>
26	<p>Which immunoglobulin is primarily found in mucosal secretions?</p> <p>A. IgA</p> <p>B. IgM</p> <p>C. IgG</p> <p>D. IgE</p> <p>E. IgD</p>
27	<p>Which of the following is an example of passive immunity?</p> <p>A. Vaccination with live attenuated virus</p> <p>B. Transfer of maternal antibodies to the fetus</p> <p>C. Natural infection</p> <p>D. Immunization with inactivated toxin</p> <p>E. Activation of T cells</p>
28	<p>Which cells express both CD4 and CD8 markers during development?</p> <p>A. Naive T cells</p> <p>B. Memory T cells</p> <p>C. Double-positive thymocytes</p> <p>D. Effector T cells</p> <p>E. Regulatory T cells</p>
29	<p>What is the primary function of dendritic cells in the immune system?</p> <p>A. Produce antibodies</p> <p>B. Activate cytotoxic T cells</p> <p>C. Act as antigen-presenting cells</p> <p>D. Secrete inflammatory cytokines</p> <p>E. Kill virus-infected cells</p>
30	<p>Which cytokine is primarily involved in stimulating the production of antiviral proteins?</p> <p>A. Interleukin-2 (IL-2)</p> <p>B. Tumor necrosis factor-alpha (TNF-<math>\alpha</math>)</p> <p>C. Interleukin-4 (IL-4)</p> <p>D. Interferon-alpha (IFN-<math>\alpha</math>)</p> <p>E. Transforming growth factor-beta (TGF-<math>\beta</math>)</p>

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簡答題四題 每題 10 分

1. Provide two examples illustrating the mechanisms of immune checkpoints. (10%)
2. Please describe the intracellular proteolytic cascade involved in apoptosis, mediated by caspases. (10%)
3. Explain the key biochemical features of ferroptosis and how it differs from other forms of regulated cell death, such as apoptosis and necroptosis. (10%)
4. How is the enormous diversity of immunoglobulin molecules generated, enabling the production of antibodies against an almost unlimited range of antigens? (10%)