

國立中正大學
114 學年度碩士班招生考試
試題

[第 2 節]

科目名稱	分子生物學
系所組別	生物醫學科學系分子生物

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

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一、選擇題：(30 題, 每題 2 分, 共 60 分)

1. Amino acids are the building blocks of:

- (A) DNAs (B) RNAs (C) Proteins (D) Polysaccharides

2. Which nitrogenous base is found in RNA but not in DNA?

- (A) Thymine (B) Uracil (C) Cytosine (D) Adenine

3. Which of the following protein is not required for DNA replication in *E. coli*?

- (A) DNA helicase (B) Primase (C) DNA ligase (D) DNA glycosylase

4. Which of the following is a true statement regarding DNA polymerase I?

- (A) It is a processive enzyme
(B) It contains proofreading activity
(C) It requires a short primer or oligonucleotide to start synthesizing new DNA strands
(D) All of the above

5. Which subunit of DNA polymerase III increases its processivity?

- (A) α subunit (B) γ complex
(C) ϵ subunit (D) β subunit

6. What is the role of DNA ligase during DNA replication?

- (A) Break hydrogen bonds between bases (B) Synthesize new DNA strands
(C) Seal gaps between Okazaki fragments (D) Unwind the DNA helix

7. Which statement is correct?

- (A) Histone proteins are mainly positively charged.
(B) The core histones include H1, H2A, H2B, H3, and H4.
(C) Histone proteins interact mainly with the bases of the DNA.
(D) None of the above.

8. In eukaryotes, DNA replication occurs during:

- (A) G1 phase (B) G2 phase (C) M phase (D) S phase

9. Which of the following molecules is involved in non-homologous end-joining?

- (A) RecBCD (B) Ku70 (C) MutS (D) Glycosylase

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10. What are Okazaki fragments?

- (A) Segments of mRNA (B) Short RNA primers
(D) Sections of rRNA (C) Short DNA fragments synthesized on the lagging strand

11. What is the role of telomerase?

- (A) Initiates DNA replication (B) Repairs DNA damage
(C) Adds repetitive sequences to chromosome ends (D) Unwinds DNA strands

12. Which organelle contains its own DNA?

- (A) Ribosome (B) Endoplasmic reticulum
(C) Mitochondria (D) Golgi apparatus

13. If a species contains 35% adenine (A) in its DNA, what percentage of guanine (G) would it also have?

- (A) 20% (B) 30% (C) 15% (D) 40%

14. What is a plasmid?

- (A) A circular DNA molecule in prokaryotes (B) A segment of mRNA
(C) A protein involved in replication (D) A type of ribosome

15. Which of the following is not in the pre-replicative complexes (pre-RCs)?

- (A) ORC (B) Rad51 (C) Cdc6 (D) Mcm 2-7

16. What subunits that are common in all three kinds of the RNA polymerase in eukaryote?

- (A) Rpb1/Rpb2/Rpb3 (B) Rpb5/Rpb6/Rpb8 (C) Rpb3/Rpb4/Rpb7 (D) Rpb3/Rpb4/Rpb8

17. The resistance ability to α -amanitin for three kinds of RNA polymerase (Pol I, Pol II and Pol III) in eukaryote is:

- (A) Pol I > Pol II > Pol III (B) Pol I > Pol III > Pol II
(C) Pol II > Pol III > Pol I (D) Pol III > Pol II > Pol I

18. snRNA (small nuclear RNA except U6) and 5S rRNA are transcribed respectively by:

- (A) RNA polymerase I/II (B) RNA polymerase II/III
(C) RNA polymerase II/I (D) RNA polymerase III/II

19. Following the previous question, the tRNA(transfer RNA) is transcribed by?

- (A) RNA polymerase I (B) RNA polymerase II
(C) RNA polymerase III (D) RNA dependent RNA polymerase

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20. Which one is classified as the DNA binding domain of a transcriptional factor?
(A) Zinc finger domain (B) Glutamine-rich domain
(C) Proline-rich domain (D) Acidic domain
21. Which protein contains the helicase activity in eukaryotic transcription?
(A) TFIID (B) TFIIIE (C) TFIIH (D) TFIIIS
22. The triphosphate linkage in the cap structure of a mRNA from 5' to 3' direction is:
(A) $\alpha \beta \gamma$ (B) $\gamma \beta \alpha$ (C) $\gamma \beta \gamma$ (D) $\alpha \beta \alpha$
23. The shape of the intron released after group I self-splicing is?
(A) linear (B) lariat (C) circular (D) Y-shape
24. Following previous question, which one is necessary for the Group I self-splicing?
(A) ATP (B) TTP (C) CTP (D) GTP
25. In the infection of *E. coli* by λ phage, which description for the binding ability of cI is correct?
(A) $O_{L1} < O_{L2} < O_{L3}$ (B) $O_{R1} > O_{R2} > O_{R3}$
(C) $O_{R1} = O_{R2} = O_{R3}$ (D) $O_{L1} = O_{L2} < O_{L3}$
26. The ribosome-binding site in a mRNA is named as?
(A) Okazaki sequence (B) Kozak sequence
(C) Shine-Dalgarno sequence (D) Upstream Activating Sequence (UAS)
27. Following the previous question, which rRNA can pair with the ribosome-binding site?
(A) 16S rRNA (B) 23S rRNA (C) 5S rRNA (D) 5.8S rRNA
28. The first amino acid that incorporated into the P site of ribosome during the protein synthesis in eukaryote is:
(A) N-formyl (B) either N-formyl Methionine or Methionine (random)
(C) Methionine (D) Serine or Threonine
29. The property for tRNA 5' end processing in prokaryote is confirmed as?
(A) RNA (B) either RNA or protein (C) protein (D) unidentified yet
30. Which method is NOT used to detect protein-protein interaction directly or indirectly:
(A) Co-immunoprecipitation (B) Yeast two-hybrid assay
(C) Western blot (D) Far-Western blot

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二、簡答題：(10 題，每題 2 分，共計 20 分)

31. Name two kinds of DNA damages.
32. What enzyme can use RNA as a template to synthesize DNA?
33. Name three types of transposons.
34. In *E. coli*, what molecule loads the β subunit of DNA polymerase III onto DNA?
35. Name two kinds of histone modifications.
36. Two ways for transcriptional termination in prokaryote.
37. Following the previous question, list the mechanism of transcriptional termination in eukaryote.
38. Explain the Kozak's rule for translation and its biological function.
39. The proteins that prevent from the association of two subunits of ribosome in large subunit and small subunit in eukaryote, respectively.
40. List at least two functions for the polyadenylation (polyA) structure of mRNA.

三、問答題：(5 題，共計 20 分)

41. Please describe the molecular mechanism of the initiation process during *E. coli* DNA replication. (5 points)
42. a. Please describe the molecular process of DNA mismatch repair in *E. coli*. (3 points)
b. During mismatch repair, how does the enzyme know which strand to cut? (2 points)
43. Please distinguish the terms of knock in, knock out and knock down. (4 points)
44. Please describe the positive and negative regulation of lac operon, including the terms of repressor, operator, inducer, and cAMP. (3 points)
45. Please explain the Wobble concept. (3 points)