國立中正大學 109 學年度碩士班招生考試試題

科目名稱：分子生物學　　本科目共 4 頁　第 1 頁

系所組別：生物醫學科學系分子生物

一、 選擇題：(30 題，每題 2 分，共 60 分)

1. Which of the following amino acids contains sulfur?
   (A) Alanine (B) Cysteine (C) Serine (D) Valine

2. The strand on which DNA replication is discontinuous is called the:
   (A) Leading strand (B) Lagging strand
   (C) Template strand (D) Major strand

3. DNA replicates through what process?
   (A) Continuous replication (B) Conservative replication
   (C) Semi-conservative replication (D) Dispersive replication

4. Which of the following statements is true?
   (A) RNA lacks the base thymine (which is found in DNA) and has uracil instead.
   (B) RNA is usually double-stranded, but DNA is usually single-stranded.
   (C) RNA has the sugar deoxyribose, but DNA has the sugar ribose.
   (D) RNA contains three different nucleotides, but DNA contains four different nucleotides.

5. What protein synthesizes RNA primers during DNA replication in *E.coli*?
   (A) DnaA (B) DnaB (C) DnaC (D) DnaG

6. Which activity of DNA polymerase I is also called "proof reading" activity?
   (A) 5' to 3' polymerase activity (B) 3' to 5' polymerase activity
   (C) 5' to 3' exonuclease activity (D) 3' to 5' exonuclease activity

7. Which subunit of DNA polymerase III increases its processivity?
   (A) α subunit (B) γ complex
   (C) ε subunit (D) β subunit

8. Which of the following statements is true about DNA polymerase
   (A) It is a processive enzyme. (B) It is a holoenzyme.
   (C) It contains proofreading activity. (D) All of the above

9. Which of the following histone proteins is not in the core nucleosome particle?
   (A) H1 (B) H2A (C) H3 (D) H4

10. Which of the following proteins is not required for DNA replication in *E. coli*?
(A) DNA helicase (B) Primase
(C) DNA glycosylase. (D) Topoisomerase

11. In *E. coli*, which of the following protein is responsible for detecting mismatched DNA?
(A) MutL (B) MutH (C) MutS (D) RecJ

12. The unique enzyme that retrotransposons encode and does not exist in human cells is:
(A) DNA polymerase (B) Topoisomerase
(C) Reverse Transcriptase (D) DNA ligase.

13. Which of the following techniques is used for amplifying DNA?
(A) PCR (B) Western blotting
(C) Southern blotting (D) Microarray

14. If the a species contains 28% adenine A in its DNA, what is the percentage of guanine G would it also contain?
(A) 28% (B) 56% (C) 44% (D) 22%

15. Which of the following molecules is not involved in the homologous recombination?
(A) RecBCD (B) Ku70 (C) RuvA (D) RecA

16. The TATA box is bound by which subunit of the RNA polymerase in prokaryote?
(A) α (B) β (C) β' (D) σ

17. Which region in DNA structure does TBP (TATA box binding protein) bind to?
(A) Backbone (B) Major groove
(C) Minor groove (D) Random region except GC rich

18. 5S rRNA is transcribed by:
(A) RNA polymerase I (B) RNA polymerase II
(C) RNA polymerase III (D) reverse transcriptase

19. Which structure is <u>NOT</u> classified as the DNA binding motifs?
(A) Zinc finger (B) bZIP/bHLH (C) Glutamine-rich (D) Homeodomains

20. Proteins that phosphorylate the CTD of RNA polymerase in transcriptional initiation and elongation steps, respectively are:
(A) both TAF1 (B) both TFIIH (C) TFIIH and pTEFb (D) TFIIH and TFIIS

21. For Kozak sequence, which positions and the corresponding bases are proved to be important for the translation efficiency if the underline of AUG as the +1?
(A) –4 (C/U) and +4 (U) (B) -3 (G/A) and +4 (G)
(C) -10 (UAUA) and -25 (G) (D) -10 (UAUA) and -35 (U)

22. The shape of intron released by Group I self-splicing is?
(A) circular (B) lariat (C) linear (D) Y-shape

23. In the structure of mature tRNA, the three bases in the most 3' end are:
(A) 5'-AAC-3' (B) 5'-CCA-3' (C) 5'-ACC-3' (D) 5'-CAA-3'

24. In precursor mRNA splicing, U6 snRNA can pair with two snRNAs. These two snRNAs are:
(A) U1 and U2 (B) U1 and U4 (C) U2 and U4 (D) U2 and U5

25. In the infection of *E. coli* by λ phage, which description for binding ability of cI is correct?
(A) $O_R1 > O_R2 > O_R3$ (B) $O_L1 < O_L2 < O_L3$
(C) $O_R1 < O_R2 < O_R3$ (D) $O_L1 = O_L2 = O_L3$

26. Which rRNA can pair with the ribosome-binding site of mRNA (Shine-Dalgarno sequence) during translation?
(A) 5S rRNA (B) 5.8S rRNA (C) 16S rRNA (D) 23S rRNA

27. Pre-miRNA can be digested to mature miRNA by?
(A) Argonaute (B) Dicer (C) DGCR8/ Pasha (D) Slicer

28. The antibiotic puromycin can terminates translation by mimicking the structure of?
(A) 16S rRNA (B) 23S rRNA (C) tyrosyl-tRNA (D) 5' UTR of mRNA

29. Which enzyme does NOT involved in RNA editing?
(A) endo-nuclease (B) terminal uridylyl transferase (TUTase)
(C) exo-nuclease (D) RNA triphosphatase

30. The protein-protein interaction can be detected by:
(A) Yeast two-hybrid assay (B) Western blot (C) Northern blot (D) Southern blot

二. 簡答題：(10題, 每題2分，共20分)

31. Name two most common secondary structures of protein.

32. What enzyme removes excessive supercoiling ahead of the replication fork?

33. Name two types of histone modification.

34. Name two molecules that are involved in V(D)J DNA recombination.

35. In yeast, what molecule initiates the homologous recombination by creating double-strand break DNA?

36. The two types for transcriptional termination in prokaryote.

37. The special RNA that is required for mRNA splicing.

38. Please write down the three translational stop codons of mRNA.

39. Please list the three components of translational complex eIF4F.

40. Please explain the context of Nobel Prize in the RNA in Physiology or Medicine.

三. 問答題：(4題，共計20分)

41. Please describe the molecular mechanism of the initiation process during *E. coli* DNA replication. (6 points)

42. Please describe the molecular process of base-excision repair in *E. coli*. (4 points)

43. Please describe the regulation for non-stop mRNA in prokaryote and eukaryote, respectively. (5 points)

44. Please explain what is CRISPR? (5 points)