

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 (E) Arginine
2. The strand on which DNA replication is continuous is called the:
(A) Leading strand (B) Lagging strand (C) Template strand
(D) Major strand (E) Minor strand
3. Which of the following removes excessive supercoils ahead of the replication fork?
(A) DNA Helicase (B) Topoisomerase (C) DNA Polymerase
(D) DNA Ligase (E) Single Strand Binding Protein
4. DNA replicates through what process?
(A) Continuous replication (B) Disparative replication (C) Conservative replication
(D) Semi-conservative replication (E) Dispersive replication
5. Okazaki fragments are found on which of the following strands of DNA?
(A) leading strand (B) lagging strand (C) template strand
(D) all of the above (E) none of the above
6. What protein synthesizes RNA primers during DNA replication in *E.coli*?
(A) DnaA (B) DnaB (C) DnaC (D) DnaG (E) RNaseH
7. 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) It requires a short primer or oligonucleotide to start synthesizing new DNA strands.
(E) All of the above
8. Which subunit of DNA polymerase III increases its processivity?
(A) α subunit (B) γ complex (C) ϵ subunit
(D) β subunit (E) ϕ subunit
9. Which of the following mechanisms cannot be used to repair thymine dimer?
(A) Photoreactivation (B) Base excision repair (C) Nucleotide excision repair
(D) Translesion DNA synthesis (E) Homologous recombination

10. Northern blotting is used for separation and detection of:
(A) DNA (B) mRNA (C) protein (D) protein-DNA interaction (E) organelles
11. Telomerase:
(A) joins Okazaki fragments on the lagging strand
(B) catalyzes DNA replication at the ends of chromosomes
(C) initiates DNA replication at the origin
(D) requires ATP
(E) enhances transcription
12. Which of the following proteins is not required for DNA replication in *E. coli*?
(A) DNA helicase (B) Primase (C) DNA ligase
(D) DNA glycosylase. (E) Topoisomerase
13. In *E. coli*, which of the following protein is responsible for detecting mismatched DNA?
(A) MutL (B) MutH (C) MutJ (D) MutS (E) RecJ
14. 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. (E) DNA helixase
15. What is the main function of DNA polymerase I in *E. coli*?
(A) Repair (B) Methylation (C) Splicing
(D) Degradation (E) Transcription
16. The TATA box is bound by?
(A) TFIIB (B) TFIID (C) TFIIIE (D) TFIIIF (E) TFIIF
17. The function and components of SL1 factor in Polymerase I promoter transcription resemble:
(A) TFIIB (B) TFIID (C) TFIIIF (D) TFIIF (E) TFIIS
18. The antibiotic puromycin can terminate translation by mimicking the structure of?
(A) 23S rRNA (B) 16S rRNA (C) tRNA (D) 5' cap (E) ncRNA (noncoding RNA)
19. Which molecule can drive translocation of ribosome by displacing the tRNA on the A site?
(A) EF-Tu (B) EF-Ts (C) EF-G (D) ATP (E) tRNA synthetase

20. The large subunit of RNA polymerase II has a C-terminal domain (CTD), which contains serine/threonine sites to be phosphorylated by:
(A) TFIIA (B) TFIIB (C) TFIIIE (D) TFIIF (E) TFIIF
21. The shape of intron released by Group I self-splicing is?
(A) linear (B) Y-shape (C) lariat (D) circular (E) triangle
22. Follow up the previous question, which nucleotide is required for Group I self-splicing?
(A) ATP (B) TTP (C) GTP (D) CTP (E) UTP
23. microRNA is transcribed by:
(A) Reverse transcriptase (B) RNA-dependent RNA polymerase
(C) RNA polymerase III (D) RNA polymerase II (E) RNA polymerase I
24. When *E. coli* is infected by phage λ , which viral protein is proved to be the factor for regulating anti-termination at RNA level during life cycle of phage?
(A) cI (B) cII (C) cro (D) N (E) Q
25. Which rRNA can pair with the ribosome-binding site of mRNA (Shine-Dalgarno sequence) during translation?
(A) 5S RNA (B) 5.8S RNA (C) 16S RNA (D) 18S RNA (E) 23S RNA
26. Which factor can convert core-enzyme into holo-enzyme in bacterial RNA polymerase?
(A) α -subunit (B) β -subunit (C) β' -subunit
(D) σ -subunit (E) ω -subunit
27. What is the correct composition of histone core of nucleosome?
(A) (H2A, H2B)₃ (H3, H4)₁ (B) (H2A, H2B)₂ (H3, H4)₂
(C) (H2A, H2B)₁ (H3, H4)₃ (D) (H2A, H2B)₂ (H1, H3)₂ (E) (H2A, H2B)₃ (H1, H3)₁
28. 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 (E) U4 and U5
29. Which enzyme does NOT involved in RNA editing?
(A) RNA ligase (B) terminal uridylyl transferase (TUTase) (C) aminase
(D) exo-nuclease (E) endo-nuclease

30. Which protein is the cap-binding protein during translation?

- (A) eIF2 (B) eIF4A (C) eIF4E (D) eIF4G (E) eIF5B

二. 問答題：(7 題, 共 40 分)

31. Please describe the functions of the following molecules: (a 至 h 任選四個作答，每個 2 分，多寫不計分)

- a. DNA-PK
- b. RAG1 and RAG2
- c. γ subunit of DNA polymerase III
- d. UvrAB
- e. MutH
- f. DNA glycosylase
- g. Spo11
- h. LexA

32. Please describe the initiation process of DNA replication in *E. coli*. (6 points)

33. Please describe the homologous recombination process in *E. coli*. (6 points)

34. Please explain how does the cell deal with the translational problem of non-stop mRNA both in prokaryote and eukaryote? (5 points)

35. Please explain the Trp attenuation model in *E. coli*. (5 points)

36. Please describe the mechanisms of transcriptional termination in prokaryote. (5 points)

37. Please draw the structure of tRNA and point out the direction (5' to 3') as well as the positions of the acceptor arm, T ψ C arm, anticodon arm, D arm and extra arm, respectively. (5 points)