

(全部 38 題, 總計 100 分)

一、選擇題: (30 題, 每題 2 分, 共 60 分)

1. Which amino acid is hydrophobic?
(A) Glutamate (B) Cysteine (C) Serine (D) Lysine (E) Leucine
2. Which statement is wrong:
(A) The higher the percentage of A:T base pairs in the DNA, the higher the melting point.
(B) The major grooves in DNA specify the base identity more than the minor grooves.
(C) A nucleoside contains base and deoxyribose.
(D) The B form DNA average 10.5 bps per turn.
(E) Francis H. Crick and James D. Watson solve the structure of DNA to be a complementary double helix.
3. If a species contains 18% adenine A in its DNA, what is the percentage of guanine G would it also contain?
(A) 18% (B) 32% (C) 36% (D) 41% (E) 82%
4. 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
5. What is average size of DNA fragments that are generated after digesting the mouse genome with a restriction enzyme that recognizes the 6bp sequence GGATCC?
(A) 4bp (B) 16bp (C) 256bp (D) 1024bp (E) 4096bp
6. What is the function of helicase?
(A) It forms bonds between DNA nucleotides (B) It adds new nucleotides to the DNA helix
(C) It forms the DNA helix (D) It stitches two DNA helices together
(E) It separates DNA strands
7. Which subunit of DNA polymerase III increases its processivity?
(A) α subunit (B) γ complex (C) ϵ subunit
(D) β subunit (E) ϕ subunit
8. Which of the following histone proteins is not in the core nucleosome particle?
(A) H1 (B) H2A (C) H2B (D) H3 (E) H4

9. Which of the following molecules is involved in non-homologous end-joining?
(A) ORC (B) RecA (C) LexA (D) DnaA (E) DNA-PK
10. The activities of RecBCD are controlled by specific DNA sequence elements known as:
(A) chi sites (B) res sites (C) DSB sites (D) ori sites (E) hix sites
11. In *E. coli*, DNA polymerase I does not have which of the following 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
(E) None of the above
12. The phenomenon "hybrid dysgenesis" in *Drosophila* is caused by:
(A) viruses (B) transposons (C) mutations
(D) DNA repairing (E) homologous recombinations.
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. If you want to detect the RNA of a specific gene expressed in different tissues (heart, lung, brain, ...), what technique would you use?
(A) Southern blotting (B) Northern blotting (C) Western blotting
(D) South-Western blotting (E) Gel Mobility Shift assay
15. Which of the following descriptions is not true?
(A) An antibody consists of two light chains and two heavy chains.
(B) The size of an antibody is about 150 kDa.
(C) The antigen-binding region of an antibody is constructed from VL and VH domains of the antibody molecule.
(D) The principal mechanism cells use to generate antibodies with diversity relies on a specialized set of RNA splicing reaction.
(E) RAG1 and RAG2 proteins are required to generate antibody diversity.
16. The function and components of SL1 factor in Polymerase I promoter transcription resemble:
(A) TFIIB (B) TFIID (C) TFIIF (D) TFIIH (E) TFIIS

17. The TATA box is bound by which subunit of RNA polymerase in prokaryote?
(A) α (B) β (C) β' (D) σ (E) ω
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. 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
20. In the infection of *E. coli* by λ phage, which protein was proved to be as the factor for anti-termination at the RNA level during phage life cycle?
(A) cI (B) cII (C) cIII (D) cro (E) N
21. Following up the previous question, which protein was important for establishing the lysogeny in PRE promoter?
(A) cI (B) cII (C) cIII (D) cro (E) N
22. What shape of intron is released by Group I self-splicing?
(A) lariat (B) Y-shape (C) triangle (D) circular (E) linear
23. Follow up the previous question, which OH group of nucleoside is required for Group I self-splicing?
(A) Uracil (B) Adenine (C) Thymine (D) Guanine (E) Cytosine
24. microRNA is transcribed by:
(A) Reverse transcriptase (B) RNA-dependent RNA polymerase (RdRp)
(C) RNA polymerase I (D) RNA polymerase II (E) RNA polymerase III
25. The peptidyl transferase activity residue in
(A) 5S rRNA (B) 16S rRNA (C) 23S rRNA
(D) proteins in large subunit (E) proteins in small subunit
26. 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
27. Preliminary miRNA (pre-miRNA) can be digested to miRNA by?
(A) Dicer (B) Slicer (C) Drosha (D) Pasha (E) Argonaute

28. Which protein contains the helicase activity in translational complex eIF4F?

- (A) eIF2 (B) eIF4A (C) eIF4B (D) eIF4E (E) eIF4G

29. Which enzyme does NOT involved in RNA editing?

- (A) RNA ligase (B) terminal uridylyl transferase (TUTase)
(C) Telomerase (D) exo-nuclease (E) endo-nuclease

30. What is the correct composition of histone core of a 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

二. 問答題：(8 題, 共 40 分)

31. Please describe the functions of the following molecules (6 points)

- a. RecA
b. Telomerase
c. DNA glycosylase

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

33. In *E. coli*, during mismatch repair, how do cells know which strand to cut? (4 points)

34. How does a Poly-A retrotransposon transpose? (4 points)

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

36. Please explain the regulations of araBAD operon. (5 points)

37. Please describe the principle of Far-Western and its application. (5 points)

38. Please give an example of regulatory RNA either in prokaryote or eukaryote and explain it briefly. (5 points)