

分子生物學試題 (全部 34 題, 總計 100 分)

一、選擇題: (25 題, 每題 2 分, 共 50 分)

1. Which amino acid in a protein can form disulfide bond?  
(A) Proline      (B) Cysteine      (C) Arginine      (D) Tyrosine
2. Which of the followings is not a stop condon?  
(A) UGG      (B) UGA      (C) UAG      (D) UAA
3. Which of the following statements is incorrect?  
(A) The majority of human intergenic sequences are composed of repetitive DNA  
(B) Genes make up most of the eukaryotic chromosomal DNA  
(C) Microsatellite DNA is composed of very short, tandemly repeated sequences.  
(D) E. coli has higher gene density than human
4. Which of the following description is correct?  
(A) The difference in heterochromatin and euchromatin structure is how the nucleosomes in these different chromosomal regions are assembled into larger assemblies.  
(B) Euchromatic regions of chromosomes have very limited gene expression.  
(C) Heterochromatin was characterized by dense staining with a variety of dyes and a more condensed appearance.  
(D) DNA in both types of chromatin is packaged into nucleosomes.
5. Proteins containing bromodomains interact with histone tails that are:  
(A) methylated      (B) acetylated  
(C) phosphorylated      (D) ubiquitinated
6. The retroviral reverse transcriptase enzymes are used by molecular biologists for the  
(A) synthesis of RNA with DNA as a template  
(B) synthesis of protein with RNA as messenger  
(C) synthesis of protein from DNA  
(D) synthesis of a complementary DNA strand to an RNA
7. The strand on which DNA replication is continuous is called the:  
(A) Leading strand      (B) Lagging strand  
(C) Major strand      (D) Minor strand

8. Which of the following mechanisms can not be used to repair thymine dimer?  
(A) Photoreactivation (B) Base excision repair  
(C) Nucleotide excision repair (D) Translesion DNA synthesis
9. 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.
10. Which of the following is a DNA helicase?  
(A) DnaA (B) DnaB (C) DnaG (D) Gyrase
11. The activities of RecBCD are controlled by specific DNA sequence elements known as  
(A) chi sites (B) res sites (C) ori sites (D) DSB sites
12. Which transposable element does not use an RNA intermediate to insert into new sites in the genome of the host cell?  
(A) DNA transposons (B) Viral-like retrotransposons  
(C) Retroviruses (D) Poly-A retrotransposons.
13. Which process requires participation of snoRNAs?  
(A) Pre-mRNA splicing (B) hnRNP assembly  
(C) MicroRNA production (D) Ribosome biogenesis
14. Which protein complex will recognize a Shine-Dalgarno sequence?  
(A) U1 snRNP (B) The TBP subunit of RNA polymerase II  
(C) Cre recombinase (D) The small subunit of bacterial ribosome
15. Which enzymatic process is catalyzed by RNA?  
(A) Semi-conservative DNA replication (B) RNA interference  
(C) Polypeptide synthesis (D) Protein phosphorylation
16. Which microscope is best suitable for tracking protein movement in live cells?  
(A) Scanning tunneling microscope (B) Cryo electron microscope  
(C) Scanning electron microscope (D) Multi-photon excitation microscope
17. Which RNA polymerase is responsible for expression of mRNA in eukaryotes?  
(A) RNA polymerase I (B) RNA polymerase II  
(C) RNA polymerase III (D) RNA polymerase IV

18. What is the most likely consequence to the expression level of the *lac* operon if the lactose permease is non-functional?
- (A) Expression of the *lac* operon is fully activated under all conditions  
(B) Expression of the *lac* operon remains at the basal level under all conditions  
(C) Expression of the *lac* operon is activated when lactose is present  
(D) Expression of the *lac* operon can not be suppressed by the *lac* suppressor
19. Which experimental technique can determine the length of a specific mRNA?
- (A) Electrophoretic mobility shift assay (B) Real time PCR  
(C) Footprinting assay (D) Northern blotting
20. What is the percentage of the exon sequences in human genome?
- (A) 40% (B) 15% (C) 1.5% (D) 0.15%
21. The bacterial ribosome is about 70S. Which experimental method is used to define the Svedberg unit (S)?
- (A) Ultracentrifugation (B) Electrophoresis  
(C) Mass spectrometry (D) Chromatography
22. What is the main function of SR proteins?
- (A) Defining the replication origins on chromosomes  
(B) Facilitating transcription initiation sites of genes  
(C) Defining the splice sites on pre-mRNA  
(D) Facilitating the generation of Poly-A tail
23. Which subunit of the bacterial RNA polymerase holoenzyme recognizes the promoter sequence?
- (A) The  $\alpha$  subunit (B) The  $\beta$  subunit  
(C) The  $\sigma$  subunit (D) The  $\omega$  subunit
24. How many distinct polypeptide can be produced from a mRNA if a frameshifting event occurs?
- (A) One (B) Two (C) Three (D) Four
25. Which enzyme can synthesis RNA without a template?
- (A) RNA polymerase I (B) Reverse transcriptase  
(C) Telomerase (D) Poly-A polymerase

二. 簡答題：(共6分)

26. Please describe the functions of the following molecules: (2 points each)
- a. Spo11  
b. DnaG  
c. DNA-PKcs

三. 問答題：(八題, 共 44 分)

27. Please describe the initiation of DNA replication in *E. coli*. (5 points)
28. During *E. coli* DNA replication:
  - (a) what mechanism does DNA polymerase use to make sure that it synthesized DNA correctly?
  - (b) However, mismatch (incorrect) DNA are still produced from time to time.  
Please describe in details the molecular mechanism that *E. coli* uses to remove mismatches.  
(6 points)
29. Please describe nucleotide excision repair in *E. coli*. (5 points)
30. What mechanisms do cells use to repair double-strand breaks in DNA in which both strands of the duplex are broken? (4 points)
31. Describe the steps and the enzymes required for microRNA biogenesis. (9 points)
32. What is the function of an internal ribosome entry site? (5 points)
33. If the *trp* codons of the leader peptide of the *trp* operon is mutated to encode alanine, expression of the *trp* operon will be increased or decreased? Why? (5 points)
34. What are the steps in the translation process to ensure the codon is translated into correct amino acid residue? (5 points)