生醫所分子生物學試題 (全部 38 題, 總計 100 分)

一、 選擇題: (30 題, 每題 2 分, 共 60 分)

1. Human genome contains approximately
   (A) 300 genes　(B) 3000 genes　(C) 30000 genes　(D) 300000 genes　(E) 3000000 genes

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

3. How many hydrogen bonds are formed between one A:T base pair?
   (A) 1　(B) 2　(C) 3　(D) 4　(E) 5

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

5. Which of the following enzymes is used to join pieces of DNA?
   (A) DNA polymerase　　(B) DNA ligase　　　　(C) DNase
   (D) DNA endonuclease　　(E) DNA exonuclease

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

7. Unwinding double-stranded DNA is done by
   (A) ligase　(B) primase　(C) helicase　(D) topoisomerase　(E) exonuclease

8. Which of the following enzymes is responsible for *E. coli* DNA replication?
   (A) DNA polymerase I　(B) DNA polymerase II　(C) DNA polymerase III
   (D) DNA polymerase V　(E) RNA polymerase I

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

10. Which activity of DNA polymerase I is also called "proof reading"?
    (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) ligase activity

11. Which of the following statements about retrotransposons is correct?
    (A) They transpose via an RNA intermediate.
    (B) They contain genes for ribosomal proteins.
    (C) They possess a gene for RNA-dependent RNA polymerase.
    (D) They possess genes that encode proteins that integrate RNA into chromosomes.
    (E) They are found only in bacteria.

12. Which of the following techniques is used to amplify DNA?
    (A) PCR　　　　　　　　(B) Western blotting　　　　(C) Northern blotting
    (D) Southern blotting　　(E) Microarray

13. If a species contains 23% adenine A in its DNA, what is the percentage of guanine G would
    it also contain?
    (A) 23%　　(B) 46%　　(C) 25%　　(D) 44%　　(E) 27%

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

15. 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

16. In precursor mRNA splicing, which snRNP binds to the spliceosome first:
    (A) U1　　(B) U2　　(C) U4　　(D) U5　　(E) U6

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

18. Which enzyme does NOT participate in RNA polyadenylation?
    (A) poly(A)polymerase (PAP)　　　　　(B) poly-A binding protein (PAB)
    (C) terminal uridylyl transferase (TUTase)　　(D) RNA polymerase II (RNA Pol II)
    (E) cleavage and polyadenylation specificity factor (CPSF)

19. Which molecule can drive translocation of ribosome by displacing the aminoacryl-tRNA on the A site?
    (A) EF-Tu　　(B) EF-Ts　　(C) EF-G
    (D) Release factor (RF)　　(E) tRNA synthetase

20. During transcriptional initiation stage, the large subunit of RNA polymerase II has a C-terminal domain (CTD) with Ser/Thr sites to be phosphorylated by:
    (A) TFIIA　　(B) TFIIE　　(C) TFIIH　　(D) TAFs　　(E) TBP

21. Follow up the previous question, which factor is involved in the phosphorylation in the elongation stage?
    (A) TAT-SF1　　(B) SR protein(s)　　(C) hSPT5　　(D) p-TEFb
    (E) polyadenylation and cleavage factors (CPSF)

22. What shape of intron is released by Group II self-splicing?
    (A) triangle　　(B) Y-shape　　(C) lariat　　(D) circular　　(E) linear

23. Follow up previous question, which OH group of nucleoside is required for Group II self-splicing?
    (A) Adenine　　(B) Thymine　　(C) Guanine　　(D) Cytosine　　(E) Uracil

24. tRNA is transcribed by:
    (A) RNA polymerase I　　(B) RNA polymerase II　　(C) RNA polymerase III
    (D) RNA-dependent RNA polymerase　　(E) Reverse transcriptase

25. For the life cycle of phage λ, which protein was proved to be involved in anti-termination?
    (A) cI　　(B) cII　　(C) cro　　(D) N　　(E) O

26. Shine-Dalgarno sequence of a certain mRNA can pair with what kind of ribosomal RNA during translation?
    (A) 5S rRNA　　(B) 5.8S rRNA　　(C) 16S rRNA　　(D) 18S rRNA　　(E) 23S rRNA

27. The difference of components between bacterial core-enzyme and holo-enzyme of RNA polymerase is?
    (A) α-subunit　　(B) β-subunit　　(C) β'-subunit　　(D) σ-subunit　　(E) ω- subunit

28. Which kind of small RNA is required for rRNA processing?
    (A) miRNA　　(B) siRNA　　(C) snRNA　　(D) snoRNA　　(E) tmRNA

29. Ubiquitin is a conserved protein with 76 amino acids as a marker for proteasome degradation. To which amino acid (abbreviation in single-letter) of the target protein ubiquitin is bound?
    (A) [K]　　　(B) [H]　　　(C) [R]　　　(D) [S]　　　(E) [T]

30. For Kozak sequence, which positions are important for the translation efficiency if the underline of <u>A</u>UG as the +1?
    (A) -4 and +4　　(B) -3 and +4　　(C) -4 and -10　　(D) -10 and -35　　(E) -10 and -25

二. 問答題：(8 題, 共 40 分)

31. Please describe the functions of the following molecules: (a 至 d 任選兩個作答，每個 2 分，多寫不計分)
    a. DNA-PK
    b. RAG1 and RAG2
    c. γ subunit of DNA polymerase III
    d. MutH

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

33. Please describe the process of base-excision repair.　(4 points)

34. The double-stranded DNA genome of human herpes simplex virus 1 has a molecular mass of about 1.26×10^5 kD.
    (a) How many base pairs does this virus contain?　(b) Hoe many full double-helical turns does this DNA contain?　(c) How long is this DNA?
    (note: the molecular weight of a nucleotide is ~300, one double-helical encompasses 10.5 bp, the spacing between base pair is about 3.4 Å, or 3.4×10^{-4} μm)　(6 points)

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

36. Please explain the mechanisms of transcriptional termination in eukaryote. (5 points)

37. Please explain the" Wobble Concept" in translation. (5 points)

38. Please give two examples for deciphering the functions of alternative splicing. (5 points)