105學年度分生所分子生物學試題 (全部38題, 總計100分)

一、 **選擇題:** (30題, 每題2分, 共60分)

1. **What is average size of DNA fragments that are generated after digesting the mouse genome with a restriction enzyme that recognizes the 6bp sequence GAATTC?**
   (A) 4bp (B) 256bp (C) 1024bp (D) 4096bp

2. **Which of the following is not an RNA base?**
   (A) Adenine (B) Uracil (C) Thymine (D) Cytosine

3. **Which of the following is a true statement regarding DNA Polymerase?**
   (A) It is a processive enzyme
   (B) It contains proofreading activity
   (C) It requires a short primer or oligonucleotide to start synthesizing new DNA strands
   (D) All of the above

4. **Which of the following does not play a role in DNA replication?**
   (A) DNA polymerase (B) Helicase
   (C) Single-stranded binding protein (D) Guanyl transferase

5. **Which statement is true**
   (A) nucleosomes contain histones (B) chromosomes contain centrosomes
   (C) cytosine contains phosphorus (D) the nucleus contains the Golgi apparatus

6. **Which of the following molecules increases the processivity of DNA polymerase holoenzyme?**
   (A) γ complex (B) β clamp (C) δ subunit (D) ε subunit

7. **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

8. **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

9. **If you want to detect the protein encoded by a specific gene in different tissues (heart, lung, brain, ...), what technique would you use?**
   (A) Southern blotting **(B) Northern blotting**
   (C) Western blotting **(D) South-Western blotting**

10. **Which of the following removes excessive supercoiling ahead of the replication fork?**
   (A) DNA Helicase **(B) Topoisomerase**
   (C) Single Stranded Binding Protein **(D) DNA Polymerase**

11. **Which of the following components is not used during PCR?**
   (A) DNA Polymerase **(B) Oligonucleotide Primers**
   (C) DNA Ligase **(D) Template DNA**

12. **Which statement about homologous recombination is not correct?**
   (A) The RecBCD enzyme processes DNA at the site of the DSB (Double-Stranded Break) to generate single-stranded regions.
   (B) The activities of RecBCD are controlled by specific DNA sequence elements known as chi sites.
   (C) RuvA catalyzes the pairing and strand-exchange of homologous DNA molecules.
   (D) RuvC cleaves specific DNA strands at the Holliday Junction to finish recombination.

13. **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.

14. **Which of the following molecules is involved in DNA nucleotide excision repair?**
   (A) RecBCD **(B) MutH** **(C) UvrC** **(D) Spo11**

15. **Which of the followings is not in the pre-replicative complexes (pre-RCs)?**
   (A) ORC **(B) Cdc6** **(C) Rad51** **(D) Mcm 2-7**

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

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

18. What is the genus/species name for nematodes?
(A) *Danio rerio*　　(B) *Caenorhabditis elegans*
(C) *Homo Sapien*　　(D) *Drosophila melanogaster*

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

20. 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 -35 (U)
(D) -10 (UAUA) and -25 (G)

21. Which kind of small RNA is required for mRNA splicing?
(A) siRNA　(B) miRNA　(C) snoRNA　(D) snRNA

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

23. 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

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

25. In tRNA structure, 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'

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) 23S RNA

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

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 protein contains the cap binding activity in translational complex eIF4F?
(A) eIF4G (B) eIF4A (C) eIF4B (D) eIF4E

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

二. 問答題：(8題, 共40分)

31. Please describe the initiation process of DNA replication in *E. coli.* (5 points)

32. Please describe the "SOS" error-prone process in *E. coli.* (5 points)

33. The double-stranded DNA genome of human herpes simplex virus 1 has a molecular mass of about 2.52 X 105 kD.
(a) How many base pairs does this virus contain?
(b) Hoe many full double-helical turn does this DNA contain?
(c) You have purified 240 micro grams (μg) of the virus DNA. How many Strands of the virus genomic DNA do you have? (6 points)
(note: the molecular weight of a nucleotide is ~300 dalton, one double-helical encompasses 10.5 bp)

34. Name two major histone modifications. (4 points)

35. Please explain the mechanism of Trp attenuation model in *E. coli.* (4 points)

36. Please describe the mechanisms of transcriptional termination in prokaryote. (4 points)

37. Please describe the regulation for non-stop mRNA in prokaryote and prokaryote, repectively. (6 points)

38. Please explain the context of RNA interference. (6 points)