注意：考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。

國立清華大學 108 學年度碩士班考試入學試題

系所班組別：**生命科學院 甲組**

考試科目(代碼)：**分子生物學(0404)**

—作答注意事項—

1. 請核對答案卷（卡）上之准考證號、科目名稱是否正確。
2. 作答中如有發現試題印刷不清，得舉手請監試人員處理，但不得要求解釋題意。
3. 考生限在答案卷上標記「┏由此開始作答」區內作答，且不可書寫姓名、准考證號或與作答無關之其他文字或符號。
4. 答案卷用盡不得要求加頁。
5. 答案卷可用任何書寫工具作答，惟為方便閱卷辨識，請儘量使用藍色或黑色書寫；答案卡限用 2B 鉛筆畫記；如畫記不清（含未依範例畫記）致光學閱讀機無法辨識答案者，其後果一律由考生自行負責。
6. 其他應考規則、違規處理及扣分方式，請自行詳閱准考證明上「**國立清華大學試場規則及違規處理辦法**」，無法因本試題封面作答注意事項中未列明而稱未知悉。

國立清華大學 108 學年度碩士班考試入學試題

系所班組別：生命科學院甲組、丁組

考試科目（代碼）：分子生物學(0404、0704)

I. 選擇題 (每題 2 分，共 40 分)

1. Which of the following is the correct order of chromatin folding?
   (A). 30 nM fiber formation, nucleosome formation, radial loop formation
   (B). radial loop structure, 30 nM fiber formation, nucleosome formation
   (C). nucleosome formation, 30 nM fiber formation, radial loop structure
   (D). 30 nM fiber formation, radial loop formation, nucleosome formation
   (E). nucleosome formation, radial loop formation, nucleosome formation

2. Which of the following descriptions of chromatin remodeling is **NOT** correct?
   (A). Remodeling requires ATP for energy
   (B). BRG1 associates with BAFs
   (C). BRG1 is an ATPase
   (D). SWI/SNF binds to DNA through SANT domain
   (E). All SWI/SNF, ISWI, NuRD and INO80 family proteins make the DNA more accessible

3. The binding of which of the following snRNPs to spliceosome requires ATP?
   (A). U1
   (B). U2
   (C). U4
   (D). U5
   (E). U6

4. The catalytic center of the spliceosome appears to include
   (A). Mg2+
   (B). U2 and U6 snRNP
   (C). the branch point region of the intron.
   (D). Mg2+ and the branch point region of the intron.
   (E). Mg2+, U2, and U6 snRNP, and the branch point region of the intron.

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5. Which of the following is **NOT** the possible action for miRNA?
   (A). targets viral DNAs
   (B). mRNA degradation
   (C). stimulate translation
   (D). translation initiation blockade
   (E). translation elongation blockade

6. Which of the following is responsible for the binding between the 30S ribosomal subunit and the initiation site of a message?
   (A). Kozak sequence
   (B). Shine-Dalgarno sequence
   (C). TATA Box sequence
   (D). Internal Ribosome Entry sequence
   (E). Ribosome Exit sequence

7. Which of the following initiation factor is a target for translation control by heme-controlled repressor (HCR) in heme-starved reticulocytes?
   (A). eIF1
   (B). eIF2
   (C). eIF3
   (D). eIF4F
   (E). eIF6

8. Which of the following factor is a guanine nucleotide exchange factor (GEF) involved in protein translation?
   (A). eIF5A
   (B). eIF5B
   (C). EF-Tu
   (D). EF-Ts
   (E). EF-G

9. Which of the following description is **NOT** correct for translocation in translational elongation during protein synthesis?
   (A). GTP and EF-G facilitate translocation.
   (B). Translocation activity appears to be inherent in the ribosome.
   (C). Translocation activity can be expressed without EF-G and GTP in vitro.
   (D). GTP hydrolysis occurs after translocation.
   (E). New round of elongation cannot occur if EF-G is not released from the ribosome.

10. Which of the following factor does **NOT** bind to the A site of ribosome?
   (A). IF2/tRNA
   (B). EF-Tu/tRNA
   (C). EF-G
   (D). RF3/RF1
   (E). RRF

11. Which of the following is the primase that synthesizes primers during DNA replication in *E. coli*?
   (A). RNA polymerase
   (B). HU protein
   (C). DnaA
   (D). DnaB
   (E). DnaG

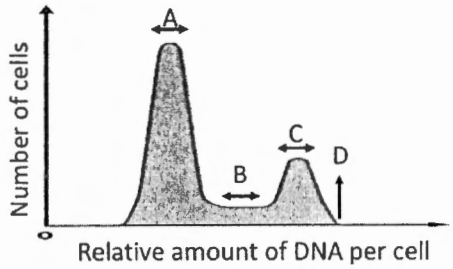
12. Which of the following subunits of DNA polymerase III holoenzyme is referred to as the "sliding clamp"?
   (A). α
   (B). β
   (C). γ
   (D). χ
   (E). θ

13. Which of the following is **NOT** part of the *E. coli* primosome?
    (A). DnaA
    (B). DnaB
    (C). DnaG
    (D). *TerE*
    (E). *oriC*

14. Chi sites stimulate which of the following recombination pathways?
    (A). λ Red
    (B). λ Int
    (C). *E. coli* RecBCD
    (D). *E. coli* RecE
    (E). *E. coli* RecF

15. Hybrid dysgenesis refers to the fact that in Drosophila a cross between a P male and an M female produce offspring that are
    (A). blind.
    (B). dead.
    (C). hairless.
    (D). sterile.
    (E). wingless.

16. Bromodeoxyuridine (BrdU) is a synthetic nucleoside that is an analog of thymidine and therefore can be used to label newly synthesized DNA. Lily has treated cells with BrdU transiently for 2 hours, and then immediately uses the cell sorting machine to collect cells with different DNA content. Which fraction of the cell do you expect to detect BrdU signal?



(A). A
(B). B
(C). C
(D). D
(E). C+D

17. A typical Tag DNA polymerase makes 1 nucleotide mistake in every 10^5 nucleotide copies. However, the error rate of DNA replication in a human cell is about 1/10^9. Which of the following is **NOT** the reason for this high fidelity?
(A). DNA polymerase can proofread
(B). DNA polymerase is still active at 95 degree in Celsius.
(C). DNA polymerase can couple with the mismatch repair
(D). DNA methylation serves as a template for correcting mistakes
(E). DNA polymerization occurs only from 5' to 3'

18. Which of the following pairs of codons might you expect to be read by the same tRNA as a result of wobble?
    (A). CUU and UUU
    (B). GAU and GAA
    (C). CAC and CAU
    (D). AAU and AGU
    (E). UAG and UAA

19. Which of the following RNA may block translation of targeted proteins?
    (A). miRNA
    (B). mRNA
    (C). siRNA
    (D). lnc RNA
    (E). dsRNA

20. Which of the following is a stop codon?
    (A). AUG
    (B). UGG
    (C). GAG
    (D). CGA
    (E). UAG

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II. 問答題 (共 60 分)

21. Please describe what is the "CTD code" of RNA polymerase II (3 points), and the roles of CTD code in gene expression? (4 points).

22. Please describe the mechanism for transcription termination by RNA polymerase II (8 points).

23. Amber mutations and Amber suppressors:
    a. What are Amber mutations (4 points)?
    b. How can Amber suppressors reverse the effect of Amber mutations (4 points)?

24. Poliovirus and host protein translation
    a. How is the poliovirus genetic material different from a typical cellular mRNA (2 points)?
    b. How does the poliovirus take advantage of this difference during translation (5 points)?

25. Please describe the differences between viral retrotransposons (Ty element), LINES (L1 element) and SINES (Alu element) (9 points).

26. Please describe the mechanisms of regulating Error-Prone Repair (SOS response) to turn on/off in *E. coli* (6 points).

27. The two strands of DNA double helix can be separated by heating. If you raised the temperature of a solution containing the following three DNA molecules, in what order do you suppose they would "melt"? Explain your answer (10 points).
    A. 5'-GCGGGCCAGCCCGAGTGGGTAGCCCAGG-3'
       3'-CGCCCGGTCGGGCTCACCCATCGGGTCC-5'
    B. 5'-ATTATAAAATATTTAGATACTATATTTACAA-3'
       3'-TAATATTTTATAAATCTATGATATAAATGTT-5'
    C. 5'-AGAGCTAGATCGAT-3'
       3'-TCTCGATCTAGCTA-5'

28. Epigenetic modulation can control gene expression without changing DNA sequences. Please explain how this is achieved (5 points).