

九十一學年度 生命科學院四所 碩士班研究生招生考試

科目 分子生物學 科號 0805 共 7 頁第 1 頁 \*請在試卷【答案卷】內作答

I. Choose a correct answer from each of the following questions. (40%, 2% each)

1. Which of the following RNA polymerases is most resistant to  $\alpha$ -amanitin ?  
(A). RNA polymerase I  
(B). RNA polymerase II  
(C). RNA polymerase III  
(D). B and C
2. Which of the following RNA polymerase II subunits is homologous to the  $\beta$  subunit of *E.coli* RNA polymerase.  
(A). RPB1  
(B). RPB2  
(C). RPB3  
(D). RPB4
3. Which of the following genes has an internal promoter ?  
(A).  $\beta$ -globin gene  
(B). 7S rRNA gene  
(C). 5S rRNA gene  
(D). U2 RNA gene
4. Which of the following transcription factors contains a TATA binding protein ?  
(A). TFII A  
(B). TFII B  
(C). TFII C  
(D). TFII D
5. Phage promoters that have been engineered into pBluescript to transcribe *in vitro* by one phage polymerase to produce strand specific RNA are:  
(A). T3 and SP6 promoters  
(B). SP6 and T7 promoters  
(C). T7 and T3 promoters  
(D). All above

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6. Select a correct statement about bacterium *B. subtilis*.
- (A). The sporulation-specific  $\sigma^k$  rearranged with  $\sigma^H$  during sporulation.
  - (B). The rearrangement process is irreversible.
  - (C). The rearrangement process usually occurs during development.
  - (D). All above.
7. The co-crystal structure of a  $\lambda$  repressor fragment with an operator fragment shows the information about protein-DNA interaction.
- (A). The most important contacts occur in the major groove.
  - (B). The most important contacts occur in the minor groove.
  - (C). The hydrogen bonds are not very important in the interaction.
  - (D). All above.
8. Select a correct statement.
- (A). The phage  $\sigma^{55}$  factor, like  $\sigma^{54}$  of *E. coli*, is defective.
  - (B). The phage  $\sigma^{55}$  factor needs  $\sigma^{70}$ .
  - (C). The T4 enhancer is a fixed region.
  - (D). All above.
9. Which of the following items does not induce apoptosis?
- (A). E2F-1
  - (B). p53
  - (C). RB
  - (D). Myc
10. Which of the following statements about transcription factors is not true?
- (A). Myc dimerized with Mad that interacts with mSin3 to repress transcription through E-box.
  - (B). CBP/p300 is a co-activator for transcription.
  - (C). R-Smad/Co-Smad complex translocates to the nucleus in response to TGF- $\beta$  signaling.
  - (D). p53 can function as both a transcription activator and a transcription repressor.

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11. Which of the following properties about the signaling pathways is not true?
- (A). Nitric oxide can induce cGMP.
  - (B). PKB/Akt is phosphorylated and activated by PI-3 kinases.
  - (C). Phosphorylation of EGF receptor by PKC decreases its affinity for EGF.
  - (D).  $G_{\beta\gamma}$  can direct inhibit the activity of some isoforms of adenylyl cyclase.
12. What is the direction of DNA synthesis by DNA polymerases?
- (A) 3' to 3'
  - (B) 2' to 5'
  - (C) 3' to 5'
  - (D) 5' to 3'
  - (E) 5' to 5'
13. Which of the following is not required by DNA polymerase for *in vitro* synthesis of DNA?
- (A) template
  - (B) ATP
  - (C) primer
  - (D) deoxynucleoside triphosphates
  - (E) Amino acids
14. Which of the following values is significantly unreasonable?
- (A) An Okazaki fragment is 1,000 to 2,000 bases long.
  - (B) An RNA primer is 5 to 15 bases long.
  - (C) The *E. coli* genome is 5,386 base pairs long.
  - (D) The human genome is 3 billion base pairs long.
  - (E) A DNA primer is 500 to 1500 bases long.
15. Which one of the following proteins and enzymes do not function at the origin of replication in *E. coli*?
- (A) DNA ligase
  - (B) SSBPs
  - (C) DNA gyrase
  - (D) DnaA, DnaB and DnaC proteins
  - (E) helicase

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16. Who discovered the first transposable elements in a study of maize (Corn) in the late 1940s ?

- (A). Rosalind Franklin
- (B). Thomas Morgan
- (C). Barbara McClintock
- (D). James D. Watson
- (E). Kary B. Mullis

17. In *E. coli* glucose repressed the gene expression of many sugar utilization genes (ie. lactose operon). Choose the correct statement(s)

- I. The glucose effect is mediated by the operator site of lactose operon.
- II. The glucose effect is mediated by the lactose repressor.
- III. The glucose effect is by a negative regulation.
- IV. The glucose effect is mediated by the concentration of cAMP.

- (A). III
- (B). IV
- (C). I and II
- (D). III and IV
- (E). I, II, and III

18. Which of the following enzymes or enzyme activities is not needed for the synthesis of Okazaki fragment during replication of *E. coli* chromosome.

- I. DNA polymerase I
- II. DNA polymerase III
- III. primase
- IV. Helicase

- (A). I
- (B). III
- (C). I and III
- (D). II, III and IV
- (E). I, III, and IV



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19. Which of the following is not used in the regulation of eukaryotic gene expression?

- I Inactivating or altering DNA
- II Controlling transcription with specific transcription factors
- III Splicing precursor mRNAs differently
- IV Operons with polycistronic mRNA

- (A). I
- (B). II
- (C). IV
- (D). I and III
- (E). III and IV

20. Which of the following statements concerning the telomeres is not true?

- I Hairpin DNA configurations
- II Repeated sequence
- III Template-free sequence additions
- IV G:G base pairs

- (A). I
- (B). III
- (C). IV
- (D). II and IV
- (E). III and IV

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II. Fill the blanks in the following questions.

(30%, 2% each)

1. Transcription activator GAL4 stimulates transcription by facilitating binding of \_\_\_\_\_ to the preinitiation complex.
2. Classical class III genes require two factors \_\_\_\_\_ and \_\_\_\_\_ to form a preinitiation complex with the polymerase.
3. The eukaryotic initiation factor eIF-4F is a \_\_\_\_\_ protein. eIF-4A is a subunit of eIF-4F and has \_\_\_\_\_.
4. Phage  $\lambda$  establishes lysogeny by causing production of enough \_\_\_\_\_ to bind to the early operators.
5. Centrosome is the primary microtubule-organizing center that contains a pair of \_\_\_\_\_.
6. Binding of ligand causes dimerization and auto-phosphorylation of receptor tyrosine kinases, and the phospho-tyrosines subsequently serve as docking sites for proteins having \_\_\_\_\_ or \_\_\_\_\_ domains to transmit signaling.
7. The *N*-terminal glycine of Src protein is modified by \_\_\_\_\_ in order to bind to the cytosolic face of the cell membrane.
8. Margaret Kidwell and her colleagues investigated the \_\_\_\_\_ that inserted into the white locus of dysgenic flies. They found that these elements had great similarities in base sequences but differed considerably in size. Furthermore, they had direct repeats and were flanked by short direct repeats of host DNA, both signatures of transposons.
9. Technically, \_\_\_\_\_ can occur by either independent assortment of chromosomes or by crossing over between chromosomes. However, the term usually refers to the latter.
10. A structure at the end of a eukaryotic chromosome, containing tandem repeats of a short DNA sequence is called \_\_\_\_\_.

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11. Assuming wobble base pairing can occur, which two codons could be recognized by the anticodon 3'-GAG-5'? Write the codon in the 5'-3' direction.  
\_\_\_\_\_.
12. According to which hypothesis is protein degradation controlled by regions rich in proline, glutamic acid, serine, and threonine? \_\_\_\_\_.
13. An *E. coli* repair system utilizes adenine methylation to remove the unpaired nucleotide of the newly synthesized DNA strand. What is the name of this repair system? \_\_\_\_\_.

III. Short Essays

(30%, 6% each).

1. Explain why can histone acetylation enhance transcription of many genes.
2. (1). How do we know that mRNA are read in 5' → 3' direction?  
(2). Describe the similar and different parts in translation termination within prokaryotes and eukaryotes?
3. Describe the functions of mitosis-promoting factor (MPF) and anaphase-promoting complex (APC) in the regulation of cell cycle progression.
4. Describe the mismatch repair mechanism in *E. coli*.
5. You have cloned a gene from tobacco that is regulated by the presence or absence of light. In the presence of light, the gene is turned on and in the absence of light the gene is off. You want to determine what upstream sequences in your clone are involved in light regulation. You have an *Agrobacterium Ti*-plasmid with a  $\beta$ -glucuronidase gene (whose expression is easily detected in plant tissue) without a promoter. This plasmid also contains a multiple cloning site near the start site of the  $\beta$ -glucuronidase gene. How would you determine what upstream sequences of your cloned gene are important for light-regulated gene expression?