

國立高雄大學 104 學年度研究所碩士班招生考試試題

科目：分子生物學  
考試時間：100 分鐘

系所：生命科學系  
本科原始成績：100 分

是否使用計算機：否

一、單選題(62%；每題 2 分。請選出最適當者):

1. An experiment was designed to obtain nonspecific transcription from both strands of a DNA molecule. Which of the following strategies would be most effective in achieving this?
  - A. Include the RNA holoenzyme in the reaction.
  - B. Use the core enzyme of RNA polymerase.
  - C. Enrich the preparation with sigma subunit.
  - D. Use intact DNA .
  - E. Include the RNA holoenzyme in the reaction and use the core enzyme of RNA polymerase are both effective.
2. Which of the following is not present in the core RNA polymerase in prokaryotes?
  - A.  $\beta$
  - B.  $\beta'$
  - C.  $\sigma$
  - D. both  $\beta$  and  $\sigma$
  - E. none of the choices are correct.
3. Which of the following statement is false regarding the sigma-factor in a bacterial cell?
  - A. It does not have a DNA-binding domain.
  - B. Interaction with the core enzyme unmask the DNA-binding region.
  - C. Subregions 2.4 and 4.4 are involved in promoter recognition.
  - D. It can also bind to the nontemplate strand.
  - E. It can bind to the -10 box.
4. Which of the following is absent in an operon in prokaryotes?
  - A. operator
  - B. promoter
  - C. intron
  - D. both operator and promoter
  - E. both promoter and intron
5. Which of the following is mostly likely to occur if the level of glucose is low in a bacterial cell?
  - A. Cyclic-AMP levels will be depressed.
  - B. CAP will assist in stimulating transcription of the *lac* operon.
  - C. CRP activity will be inhibited.
  - D. Both Cyclic-AMP levels will be depressed and CRP activity will be inhibited are correct.
  - E. None of the choices is correct.

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6. Which of the following is an example of an allosteric interaction?
- A. allolactose binding to a repressor
  - B. an aptamer binding to a riboswitch
  - C. polymerase binding to the promoter
  - D. repressor binding to the operator
  - E. both allolactose binding to a repressor and an aptamer binding to a riboswitch
7. Which of the following conditions does not lead to a change in gene expression patterns in bacterial cells?
- A. sporulation
  - B. heat shock
  - C. nutrient availability
  - D. nitrogen deprivation
  - E. none of the choices are correct.
8. During an experiment to study the rate of infection of bacteria with T4, the bacterial cultures were accidentally exposed to a UV light source. Which of the following would be expected for this exposure?
- A. *recA* gene is turned off.
  - B. Coprotease activity in RecA protein is activated.
  - C. SOS response is induced.
  - D. Coprotease activity in RecA protein is activated and SOS response is induced are correct.
  - E. *recA* gene is turned off and coprotease activity in RecA protein is activated are correct.
9. Select the correct statement about enhancers
- A. They are proteins that promote transcription of RNA.
  - B. They stimulate the binding of repressor to DNA.
  - C. They bind protein factors and stimulate transcription.
  - D. They are nonpromoter protein elements.
  - E. None of the choices is correct.
10. Which of the following is true about the elongation complex?
- A. The clamp does not come in contact with the RNA:DNA complex.
  - B. Processivity is slowed by the closing of the clamp.
  - C. The clamp closes over the RNS:DNA hybrid in the enzyme's cleft.
  - D. Five loops in the clamps play a role in the movement of the enzyme.
  - E. The active site of the enzyme lies at the end of pore 2.

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11. Which of the following is not a part of the core class II promoter?
  - A. TATA box
  - B. upstream element
  - C. BRE (TFIIB-recognition elements)
  - D. DPE (downstream promoter element)
  - E. Initiator
12. Which of the following are products of RNA polymerase II activity?
  - A. tRNA
  - B. snRNA
  - C. hnRNA
  - D. tRNA and snRNA
  - E. snRNA and hnRNA
13. Which of the following are typical features of transcriptional activators?
  - A. transcription-activation domain
  - B. DNA-binding domain
  - C. kinase domain
  - D. transcription-activation domain and DNA-binding domain
  - E. transcription-activation domain and kinase domain
14. The glucocorticoid receptor is activated by binding to
  - A. its hormone ligand then moving to the nucleus.
  - B. its hormone ligand protein partner and then moving to the nucleus.
  - C. its hormone partner in the nucleus.
  - D. DNA and then to its hormone ligand.
  - E. None of the choices are correct.
15. Which of the following statements is not true concerning DNA replication in prokaryotes?
  - A. DNA replication is semiconservative.
  - B. DNA replication is semidiscontinuous.
  - C. DNA replication is RNA dependent.
  - D. DNA replication requires only one enzyme.
  - E. There is one origin of replication.
16. The fact that rifampicin inhibits M13 phage replication helped support the fact that
  - A. antibiotics can be used to study DNA replication.\_
  - B. RNA polymerase is used to make primers for DNA synthesis.
  - C. DNA polymerase is necessary for DNA synthesis.
  - D. Helicases are necessary for DNA synthesis.

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- E. DNA ligase is necessary to connect Okazaki fragments.
17. Which of the following scientists discovered the introns in genes ?
- A. Charles Darwin
  - B. Gregor Mendel
  - C. Paul Berg
  - D. Phillip Sharp and Richard Roberts
  - E. Craig Venter and Hamiton Smith.
18. Which of the following is not a product of transcription?
- A. DNA
  - B. miRNA
  - C. mRNA
  - D. tRNA
  - E. rRNA
19. The analytic tools used to show that DNA was the transforming substance include all of the following except
- A. chemical analysis.
  - B. electrophoresis.
  - C. heat inactivation.
  - D. ultracentrifugation.
  - E. UV absorption spectrophotometry.
20. All of the following are found in DNA except
- A. adenine.
  - B. cytosine.
  - C. guanine.
  - D. thymine
  - E. uracil.
21. Which of the following is prevalent in protein secondary structures?
- A. disulfide bonds
  - B. hydrogen bonds
  - C. hydrophobic interactions
  - D. ionic bonds
  - E. all of the choices are correct.

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22. Which of following codons would be recognized by release factors during translation?
- A. AUG
  - B. CUU
  - C. CUC
  - D. UAA
  - E. UGG.
23. Rapid purification of proteins based on size can best be done using
- A. gel filtration.
  - B. cation-exchange chromatography.
  - C. ion-exchange chromatography.
  - D. 2-D gel electrophoresis.
  - E. native gel electrophoresis.
24. Which of the following techniques is not used to quantify the level of gene expression?
- A. RNase protection
  - B. S1 mapping
  - C. southern blotting
  - D. northern blotting
  - E. nuclear run-off
25. Which of the following is the first snRNP to bind during the assembly stage of the spliceosome cycle?
- A. U6
  - B. U5
  - C. U4
  - D. U2
  - E. U1
26. When does capping of the pre-mRNA occur?
- A. It occurs after splicing has occurred.
  - B. It occurs before the mRNA reaches a chain length of 30 nt.
  - C. It is the first nucleotide added by RNA polymerase.
  - D. It occurs after export of the mRNA into the cytoplasm.
  - E. It occurs after the poly(A) tail has been added.

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27. In which of the following organisms is trans-splicing of mRNA known to occur?

- A. bacteria
- B. mammals
- C. plants
- D. trypanosomes
- E. yeast.

28. Which of the following is not part of the 30S initiation complex?

- A. 5S rRNA
- B. 16S rRNA
- C. mRNA
- D. IF1, IF2, and IF3
- E. amino-acyl tRNA.

29. Which of the following characteristics is not a characteristic of a G protein?

- A. They cycle between three conformational states.
- B. Cleavage of bound GTP to GDP inactivates them.
- C. They bind GMP for activation.
- D. Binding of GTP activates their function.
- E. They have intrinsic GTPase activity.

30. Which portion of tRNA base pairs with mRNA.?

- A. variable loop
- B. D loop
- C. T loop
- D. acceptor stem
- E. anticodon loop

31. Which portion of tRNA contains a number of modified uracils?

- A. variable loop
- B. D loop
- C. T loop
- D. acceptor stem
- E. anticodon loop

二、是非題(20%；每題 1 分):

1. The catalytic centers of some polymerase cores contain magnesium ions.
2. The core RNA polymerase must bind tightly to the promoter in order to initiate transcription.
3. Attenuation causes the length of the RNA molecules to be significantly extended.

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4. If an operon is under negative control it means that the operon is never operational.
5. When phage infects a bacterium, it usually subverts the host's transcription machinery to use as its own.
6. Enhancers and repressors can be tissue-specific based on the types of DNA-binding proteins that are present.
7. Transcription activators help to boost transcription by recruiting RNA polymerase to promoters.
8. Many genes have more than one activator-binding site, so that they respond to multiple stimuli and establish fine control of gene expression.
9. Nucleosome remodeling can either activate or repress transcription.
10. Chromatin remodeling usually occurs on euchromatin, while heterochromatin is very condensed and genetically inactive.
11. High ionic strength and low pH promote DNA denaturation.
12. DNA and RNA are chain-like molecules composed of subunits called nucleosides.
13. SDS-PAGE is used to separate polypeptides according to their masses.
14. High-throughput sequencing allows very rapid sequencing of an organism's genome.
15. Riboprobe used in RNase protection assay.
16. Group II introns can be removed in vitro with no help from protein.
17. Poly(A) turns over in the nucleus.
18. Nuclear mRNA precursors are spliced via a lariat-shaped intermediate.
19. Bacterial rRNA precursors contain tRNAs as well as all three rRNAs.
20. Mitochondria are the cell's protein factories.

三、名詞解釋(18%；每題 3 分):

1. Central dogma of molecular biology
2. Chi sites (in bacteria genome)
3. Epigenetics
4. Directional cloning
5. Ti plasmid
6. miRNA