

國立彰化師範大學 101 學年度碩士班招生考試試題

系所： 生物技術研究所

科目： 分子生物學

☆☆請在答案卷上作答☆☆

共 4 頁，第 1 頁

Section I: 單選題，Please choose **the best answer** for each question. Each 2%

1. The process for transfer a plasmid into *E. coli* was called _____.
(a) Transfection, (b) Transformation, (c) Transgenic, (d) Transduction, (e) Transferring
2. Which of the following is **NOT** usually found in RNA structure?
(a) Adenine, (b) Guanine, (c) Cytosine, (d) Uracil, (e) Thymine
3. Which of the following is **NOT** required for cDNA synthesis?
(a) DNA, (b) dNTP, (c) reverse transcriptase, (d) oligo(dT), (e) none of the above
4. Which of the following is used for study protein-DNA interaction?
(a) SDA-PAGE, (b) DNA microarray, (c) DNA fingerprinting,
(d) Two-dimensional gel electrophoresis, (e) DNase footprinting
5. Which of the following belong to prokaryotic promoters?
(a) Pribnow box and TATA box, (b) TATA box and CAAT box, (c) -10 box and TATA box,
(d) Pribnow box and -35 box, (e) TATA box and -35 box
6. Which of the following play an important role in prokaryotic transcription termination?
(a) sigma factor, (b) alpha factor, (c) beta factor, (d) Rho factor, (e) none of the above
7. Which of the following can induce the most gene expression in *E. coli lac* operon?
(a) Glucose high and lactose high, (b) Glucose low and lactose high,
(c) Glucose high and lactose low, (d) Glucose low and lactose low, (e) all of the above
8. How many RNA polymerase in *E. coli*? and How many RNA polymerase in yeast?
(a) 3 and 3, (b) 1 and 3, (c) 1 and 1, (d) 3 and 1, (e) none of the above
9. In eukaryotic transcription of class II genes, which transcription factor can stimulate elongation?
(a) TFIID, (b) TFIIIE, (c) TFIIIS, (d) TFIIB, (e) TFIIIF
10. In eukaryotic transcription of class I genes, which are class I transcription factors in mammals?
(a) TFIID and TFIIIS, (b) TFIID and TFIIB, (c) SL1 and UBF,
(d) SL1 and TFIIB, (e) UBF and TFIIB
11. Which of the following gene with internal promoter in eukaryotic transcription?
(a) 5.8S rRNA, (b) 18S rRNA, (c) 5S rRNA, (d) U6 snRNA, (e) 28S rRNA
12. In *E. coli trp* operon, what is the function of tryptophan?
(a) activator, (b) repressor, (c) co-activator, (d) co-repressor, (e) silencer

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共 4 頁，第 2 頁

13. In prokaryotic translational initiation step, which of the following is **NOT** involve in 30S initiation complex?
(a) mRNA, (b) GTP, (c) IF2, (d) 23S rRNA, (e) 16S rRNA.
14. In prokaryotic translational elongation step, how many GTPs are required for each amino acid synthesis?
(a) 1, (b) 2, (c) 3, (d) 4, (e) none of the above
15. In eukaryotic transcription, 5.8S rRNA is produced by ?
(a) RNA polymerase I, (b) RNA polymerase II, (c) RNA polymerase III,
(d) DNA polymerase I, (e) RNA polymerase I and RNA polymerase III
16. The codons in the genetic code that do not specify amino acids are called _____.
(a) missense codons, (b) start codons, (c) stop codons, (d) promoters, (e) initiator codons
17. For the DNA strand 5'-TACGATCATAA-3' the correct complementary DNA strand is:
(a) 3'-TACGATCATAA-5', (b) 3'-ATGCTAGTATT-5', (c) 3'-AUGCUAGUAUU-5',
(d) 3'-GCATATACGCC-5', (e) 3'-AATACTAGCAT-5'
18. Which of the following tools of recombinant DNA technology is **INCORRECTLY** paired with one of its uses?
(a) restriction endonuclease - production of DNA fragments for gene cloning
(b) DNA polymerase - copies DNA sequences in the polymerase chain reaction
(c) reverse transcriptase - production of cDNA from mRNA
(d) electrophoresis - RLFP analysis
(e) DNA ligase - enzyme that cuts DNA, creating sticky ends
19. In homologous DNA recombination via the Holliday model, the Holliday junction is _____.
(a) a 2-stranded structure,
(b) generated by the action of DNA polymerase I, helicase, SSB and DNA ligase,
(c) generated by cutting, exchanging and rejoining (intermolecularly) homologous strands,
(d) b and c,
(e) none of the above
20. Which of the following statements about the 3' poly(A) tail of mRNA is **FALSE**?
(a) It helps align eukaryotic mRNA on the ribosome during translation.
(b) It is added to the primary transcript in the nucleus.
(c) It is not essential for protein synthesis.
(d) It protects mRNA from degradation.
(e) It promotes export mRNA from the nucleus and translation.

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共 4 頁，第 3 頁

For questions 21~25, choose the best answer to fill in the blank in the following statement about the process of “**DNA replication**”.

The two antiparallel strands are replicated simultaneously in both directions. RNA primers are used to initiate a new strand. The parent strand at the 3' end of the template determines the **(21)** _____ strand in continuous replication. The parent strand at the 5' end of the template produces the **(22)** _____ strand as short pieces of DNA (100-200 nucleotides in eukaryotes and longer in prokaryotes). The **(23)** _____ strand fragments are called Okazaki fragments after their discoverer, Reiji Okazaki. The RNA primers are removed by **(24)** _____ and the fragments are joined by **(25)** _____.

21. (a) leading, (b) lagging, (c) DNA, (d) RNA, (e) none of the above
22. (a) leading, (b) lagging, (c) DNA, (d) RNA, (e) none of the above
23. (a) leading, (b) lagging, (c) DNA, (d) RNA, (e) none of the above
24. (a) RNase, (b) DNase, (c) DNA polymerase, (d) RNA polymerase, (e) DNA ligase
25. (a) RNase, (b) DNase, (c) DNA polymerase, (d) RNA polymerase, (e) DNA ligase
26. How do dideoxynucleoside triphosphates (ddNTPs) terminate a nascent DNA strand?
 - (a) They possess a bulky additional group which causes DNA polymerase to dissociate.
 - (b) They have no 3' hydroxyl group, so cannot form a phosphodiester bond with the 5' phosphate group of the next nucleotide.
 - (c) They form abnormal hydrogen bonds causing the DNA duplex to unwind.
 - (d) They form a hair pin structure which stop DNA polymerase activity.
 - (e) They form a cross-link between DNA polymerase and the DNA duplex.
27. Telomerase is important to eukaryotic cells because _____.
 - (a) the leading strand of DNA causes the telomeres to shorten.
 - (b) telomeres attach to MTOC during cell division.
 - (c) telomerase digests telomeres to proper length.
 - (d) telomeres tend to get shortened with each cell division.
 - (e) telomerase activates cyclin B for cell cycle progression.
28. Which of these might be an advantage to genetic testing of individuals via microarrays?
 - (a) Many different potential mutations in a single gene could be tested at once.
 - (b) Expression patterns of many different genes can be analyzed simultaneously.
 - (c) Microarray analysis can provide information on relative levels of expression of particular genes.
 - (d) All of the above.
 - (e) None of the above.

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29. Branch migration is promoted by

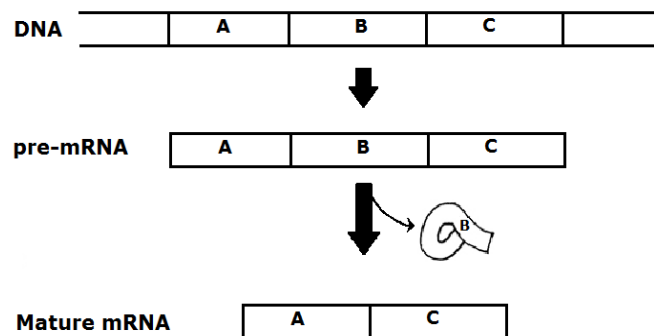
- (a) recA, (b) recBCD, (c) ruvA & ruvB, (d) recF, (e) SSB

30. Nuclear mRNA splicing is performed_____.

- (a) in nucleosomes, (b) in spliceosomes, (c) in the nucleolus, (d) by RNA only, (e) b and c

Section II：問答題

1. Please describe how to make a 250 mL protein extraction buffer, that is 0.5% Nonidet (v/v), 150 mM Tris-HCl, pH 7.5, and 10 mM EDTA, from the given following stock solutions: 100% Nonidet P-40, 1 M Tris-HCl, pH 7.5, and 0.5 M EDTA. (10%)
2. Below is a typical eukaryotic gene, its pre-mRNA, and its mature mRNA. The direction of transcription is from left to right. **Label** the diagram with the following structures: start codon(s), stop codon(s), 3'UTR(s), 5'UTR(s), 5'cap(s), open reading frame(s), promoter(s), poly(A)tail(s), transcription termination signal(s), intron(s), and exon(s). (10%)



3. Please diagram and describe the four-step transcription initiation process in *E. coli*. (5%)
4. What is iPS and its application? Please give at least one example. (5%)
5. What is DNA microarray and its application? Please give at least one example. (5%)
6. Please describe detail about how to produce recombinant insulin from *E. coli* BL21(DE3)pLysS. (5%)