

所別：生命科學系碩士班 分子與細胞生物組(一般生) 科目：分子生物學

一、單選題 (每題三分；共六十分)。

1. What is a major source of restriction enzymes?
(a) red blood cells (b) leukocytes or white blood cells (c) yeast (d) bacteria (e) archaea
2. Which of the following is **false**?
(a) Long stretches of repetitive DNA are prominent at centromeres and ends of chromosomes. (b) Telomeres seem to have a protective function. (c) Scientists think that the typical human gene probably specifies just one polypeptide. (d) Current estimates are that there are 25,000-30,000 genes in the human genome. (e) Much of the DNA between genes consists of repetitive DNA.
3. A nucleosome is composed of a core of eight histone molecules and a DNA of approximately (a) 200 bp (b) 150 bp (c) 100 bp (d) 50 bp (e) 25 bp in length.
4. Which of the following statements about mRNA stability is **incorrect**?
(a) The cap (a modification at the 5' end of mRNA) prevents 5'-3' exonucleases from attacking the 5' end. (b) The poly(A) prevents 3'-5' exonucleases from attacking the 3' end. (c) The most common location for destabilizing elements is within the 5' untranslated region. (d) Within the coding region, mutations that create termination codons trigger a surveillance system that degrades the mRNA. (e) Degradation of mRNA in yeast starts with removal of the poly(A) tail.
5. Which of the following elements is **not** a component of class II promoters?
(a) a TFIIB recognition element (BRE) (b) a GC box (c) a TATA box (d) box A and box C sequences (e) a CCAAT box (f) an initiator (g) a downstream promoter element
6. The *lac* operon in *E. coli*
(a) is expressed only at a very low (basal) level when β -galactosides are absent from the environment. (b) allows the bacterium to resist antibiotics in the penicillin family. (c) is unregulated when the repressor is bound to β -galactosides. (d) uses activators to initiate the production of enzymes that break down β -galactosides. (e) controls the production of tryptophan-utilizing enzymes.
7. Which of the following methods is **not** used to map and/or quantify transcripts?
(a) Northern blotting (b) S1 nuclease mapping (c) Restriction mapping (d) Primer extension (e) RNase mapping (RNase protection assay) (f) Run-off transcription.
8. Which of the following is **not** true about cDNA library and cDNA cloning
(a) A cDNA library is a set of clones representing as many as possible of the mRNAs in a given cell type. (b) Particular clones in a cDNA library can be detected by colony hybridization with radioactive DNA probes.

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- (c) Particular clones in a cDNA library can be detected by colony hybridization with antibodies if an expression vector is used. (d) Cosmids behave both as plasmids and as phages, thus they have been popular as cDNA cloning vectors. (e) cDNA fragments cloned into the M13 phage vectors can be recovered in single-stranded form.
9. Which one of the following about restriction fragment length polymorphism (RFLP) is **false**?
(a) RFLP can be used for genetic mapping. (b) RFLP denotes a difference in restriction maps between two individuals. (c) RFLP can be used as a genetic marker in exactly the same way as any other marker. (d) RFLPs are useful for establishing parent-progeny relationships. (e) None of the above
10. *E. coli* DNA polymerase I (pol I) lacks which of the following activities.
(a) 5' → 3' synthesis (b) 5' → 3' exonuclease (c) 3' → 5' synthesis (d) 3' → 5' exonuclease (e) activities of Klenow fragment
11. A DNA fragment whose sequence is 5'GGAACTCTGCCTTCA3'
3'CCTTGAGACGGAAGT5'
Its mRNA sequence from transcription is 5'GGAACUCUGCCUUCA3'. Which of the following is true?
(a) The DNA sequence is mostly likely an intron sequence. (b) The lower DNA strand is the sense strand. (c) The upper DNA strand is the template strand. (d) The upper DNA strand is the coding strand. (e) None of the above is true
12. Which of the following about enhancers is **not true**?
(a) An enhancer is required to turn on gene expression when transcription factors are in short supply. (b) An enhancer is a DNA element that stimulates transcription of a gene or genes. (c) Enhancers are usually found upstream of the genes they influence. (d) Enhancers can function if inverted or moved hundreds or even thousands of base pairs away. (e) Enhancers are the site on DNA to which activators bind.
13. Segments of eukaryotic DNA that can move or be copied from one site to another in the genome are called (a) exons (b) introns (c) transposons (d) vectors (e) enhancers
14. A "homeobox"
(a) is a promoter-enhancing element present in genes of many or even all eukaryotes. (b) is a sequence important in binding of transcriptional factors. (c) functions as a repressor for gene expression. (d) encodes a homeodomain with three α -helices important in protein-protein interaction. (e) is a common coding motif in homeotic genes important in controlling the developmental fate of groups of cells.
15. Which of the following about "splicing" is **false**?
(a) The spliceosome is a complex of the snRNPs and many additional protein factors that are required for

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splicing. (b) snRNAs can recognize the 5'- and 3'-splicing signals of an mRNA precursor. (c) snoRNPs participate in splicing of pre-mRNAs. (d) The GU-AG motif is commonly used to predict the intron splicing sites.

16. The cDNA sequence of a newly cloned gene is shown below.

5'- gagccggtcaggATGgaggc.....ttgtcctgacacgTAAcagt-3'

The initiation and stop codons of the gene are bolded. Which of the following primer pairs can be the choice for PCR amplification of the coding region of the gene?

- (a) 5'-gagccggtcaggATGgaggc-3' / 5'-ttgtcctgacacgTAAcagt-3'
- (b) 5'-gagccggtcaggATGgaggc-3' / 5'-aacaggactgtgcATTgtca-3'
- (c) 5'-ctcggccagtccTACctccg-3' / 5'- ttgtcctgacacgTAAcagt-3'
- (d) 5'-ctcggccagtccTACctccg-3' / 5'-aacaggactgtgcATTgtca-3'
- (e) 5'-gagccggtcaggATGgaggc-3' / 5'-actgTTAcgtgtcaggacaa-3'
- (f) 5'-gcctcCATcctgaccggctc-3' / 5'-actgTTAcgtgtcaggacaa-3'

17. There is an mRNA sample. After diluting 10 times, its absorbance measured at 260 nm is 0.2. What is the concentration of this mRNA sample before dilution?

- (a) 20 µg/ml (b) 40 µg/ml (c) 60 µg/ml (d) 80 µg/ml (e) 100 µg/ml

18. Which of the following eukaryotic initiation factors is involved in binding Met-tRNA^{Met} to the ribosome?

- (a) eIF2 (b) eIF2B (c) eIF3 (d) eIF4F (e) eIF5 (f) eIF6

19. The class II preinitiation complex contains polymerase II and six general transcription factors. Which of the following transcription factors binds to the TATA box?

- (a) TFIIA (b) TFIID (c) TFIIIE (d) TFIIF (e) TFIIH (f) TFIIIS

20. Which of the following statements about DNA replication is false?

- (a) DNA replicates in a semiconservative manner. (b) DNA polymerase synthesizes the leading strand continuously in the 5'→ 3' direction. (c) DNA polymerase synthesizes the lagging strand continuously in the 5'→ 3' direction. (d) Okazaki fragments in E. coli are initiated with RNA primers 10-12 nt long. (e) Circular DNAs can replicate by a rolling circle mechanism.

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二、簡答題 (共四十分)

1. What are Western blotting, Southern blotting, and Northern blotting analyses? Briefly describe each method to distinguish their differences. (6%)
2. What are the most commonly found translation initiation and termination codons in *Candida albicans*? (4%)
3. What are (a) two-hybrid yeast screening and (b) co-immunoprecipitation assay? (4%)
4. What is the principle of α -complementation in a blue-white screening? For example, cloning of a gene of interest into pBluescript. (6%)
5. Please define the following terms: (a) operon and (b) operator. (4%)
6. Describe briefly how to clone the gene coding for alanyl-tRNA synthetase of *Drosophila melanogaster* into an *E. coli* vector for expression? (6%)
7. Describe the major differences between the structures of prokaryotic and eukaryotic mRNA molecules. (4%)
8. What are the major functions of the C-terminal domain of RNA polymerase II in eukaryotes? (6%)