

中山醫學大學 100 學年度碩士班入學招生考試試題

生物醫學科學系碩士班（甲組）

考試科目：分子生物學

時間：80 分鐘

※請注意本試題共(5)張，如發現頁數不足，應當場請求補齊，否則缺頁部份概以零分計算。 第(1)頁

本試題共三大題，總分 100 分。

一、單選題 (60%)

1. When introduced into living cells, RNAi molecules bind
(A). to complementary DNA sequences and block RNA synthesis.
(B). to the sense strand of DNA and block RNA synthesis.
(C). to complementary RNA sequences and block protein synthesis.
(D) proteins called RISC and cleave the complementary mRNA.
(E) Both a and c
2. A dominant inhibitory mutant is typically one that
(A). produces a protein that interferes with the function of the protein produced by the normal gene.
(B). deletes the normal gene.
(C). blocks transcription of the normal gene.
(D). blocks translation of the normal mRNA.
(E). produces a nonfunctional product.
3. In sickle-cell disease, one amino acid is substituted for another. This type of mutation is referred to as a _____ mutation. (A) nonsense (B) missense (C) frame-shift (D) temperature sensitive (E) silent
4. DNA can be introduced into cells by
(A). microinjection into the nucleus of a cell.
(B). fusion of DNA-containing liposomes with cells.
(C). electroporation of DNA into cells.
(D). Both a and b
(E). All of the above
5. The experimental introduction of DNA into eukaryotic cells is called
(A). infection. (B). transfection. (C). transient expression. (D). transcription.
(E). transfusion.

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6. Mutational “hot spots” often occur when a methyl group has been added to
(A)adenine. (B)cytosine. (C)guanine.(D) thymine.(E) uracil.
7. To clone genes, a plasmid vector should contain a(n)
(A). origin of replication. (B). restriction nuclease cut site. (C). antibiotic resistance gene.
(D). Both a and c (E). All of the above
8. Which of the following would be used to express a human protein in *E. coli*?
(A). An expression plasmid containing cDNA made from the mRNA for the protein.
(B). An expression plasmid containing an *EcoRI*-cut piece of the gene for that protein.
(C). A yeast artificial chromosome containing the human gene for the protein.
(D). A human chromosome containing the gene for the protein.
(E). None of above.
9. The regions of DNA in a eukaryotic gene that contain noncoding base sequences are called (A)enhancers. (B)mRNAs.(C) hnRNAs. (D)introns. (E).leader sequences.
10. A codon is a
(A). region of DNA coding for one protein.
(B). sequence of three nucleotides on a tRNA that binds to an mRNA.
(C). sequence of three nucleotides on an mRNA that binds to specific tRNAs.
(D). sequence of three nucleotides on the coding strand of DNA.
(E). sequence of a transcript removed in the formation of an mRNA.
11. In Meselson and Stahl’s experiment, cells were grown in media containing ^{15}N in place of ^{14}N , and then their DNA was separated by equilibrium centrifugation. This experiment demonstrated that DNA
(A). is replicated by DNA polymerase.
(B). replication is conservative.
(C). replication is semiconservative.
(D). forms double helices by means of hydrogen bonding between base pairs.
(E). replication occurs in opposite directions on complementary strands.

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12. Deduction of the structure of DNA was based on X-ray crystallographic studies done by
- (A). Avery, MacLeod, and McCarty.
 - (B). Beadle and Tatum.
 - (C). Meselson and Stahl.
 - (D). Wilkins and Franklin.
 - (E). Watson and Crick.
13. RNA polymerase differs from DNA polymerase in that it
- (A). synthesizes new strands of RNA in a 3' to 5' direction.
 - (B). is a monomeric protein.
 - (C). can synthesize a complementary strand without the two strands of DNA being separated.
 - (D). does not require a primer to initiate synthesis of RNA.
 - (E). Both a and d
14. RNA polymerase I genes code for
- (A). mRNAs.
 - (B). tRNAs.
 - (C). small nuclear RNAs and small cytoplasmic RNAs.
 - (D). ribosomal RNAs.
 - (E). RNAs
15. The pioneering studies of gene regulation in *E. coli* were done in the 1950s by
- (A). Miller and Urey.
 - (B). Watson and Crick.
 - (C). Jacob and Monod.
 - (D). Lerner and Lowe.
 - (E). Franklin and Wilkins.
16. One would expect the mRNA produced from the *lac* operon of *E. coli* to hybridize to the
- (A). *lac i⁺* gene.
 - (B). *lac o* region.
 - (C). β -galactosidase gene.
 - (D). All of the above
 - (E). None of the above

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17. The first step in forming a transcription complex for mRNA transcription is binding of which of the following to the TATA box?

- (A). TFIA
- (B). TFIIA
- (C). TFIIIA
- (D). TFIID
- (E). TFIIIB

18. An electrophoresis assay used to identify the sequences of DNA to which specific regulatory proteins bind is called

- (A). DNA affinity chromatography.
- (B). an electrophoretic-mobility shift assay.
- (C). Western blotting.
- (D). Southern blotting.
- (E). Northern blotting.

19. The signal for addition of a poly-A tail to pre-mRNA is

- (A). UUUUUUU.
- (B). TTTTTTTT.
- (C). AAUAAA.
- (D). GCGCUGC.
- (E). CCGCCC.

20. During translation initiation, the first site occupied by a charged tRNA is the

- (A) A site. (B) B site. (C) large subunit. (D) T site. (E) P site.

二、是非題 (20%)

1. The polymerase chain reaction is used to amplify specific fragments of DNA *in vitro*.
2. The leading and lagging strands at a replication fork are synthesized in opposite directions, but both are synthesized in a continuous manner
3. Telomerase is a reverse transcriptase.

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4. Mitochondria have their own unique DNA polymerase.
5. A cDNA is especially useful for expression of a eukaryotic protein in a bacterium.
6. Heterochromatin gets its name from the fact that it contains a mixture of active and inactive genes.
7. The human genome has more genes than plant genomes.
8. The *lac* operon is regulated by the binding of an enhancer to sequences just upstream from the promoter.
9. Genes with methylated DNA tend to be more active than unmethylated genes in eukaryotic cells.
10. Chargaff found that in DNA the amount of A is equal to that of T and the amount of G is equal to that of C.

三、問答題 (20%)

1. Imagine that you are a student trying to decode the genetic code. An artificial mRNA molecule consisting of poly-CA (5'.....CACACACACACAC.....3') yields a polypeptide consisting solely of histidines and threonines, and another artificial mRNA consisting of poly-CAA (5'.....CAACAACAACAACA.....3') yields three different polypeptides: polythreonine, polyglutamine, and polyasparagine. On the basis of this information, which codons can you assign to which amino acids? (10 %)
2. You are studying a mammalian transcription factor that you would like to express in bacteria so that you can purify large quantities of it for biochemical studies. You introduce the cDNA encoding the transcription factor into an expression plasmid and transform *E. coli* with the new recombinant vector. You find no expression. What might be occurring? (10 %)