

I. 選擇題：請自下列第 1~20 題各選出一正確答案；第 1~15 題，每題 2 分；第 16~20 題，每題 3 分。

1. Histones are the most abundant proteins in chromatin. Which two histones are among the most conserved of all known proteins?  
(A) H1 and H2A            (B) H2A and H2B            (C) H2B and H4  
(D) H3 and H4            (E) H1 and H4
2. Microsatellite DNA is a type of simple-sequence DNAs in eukaryotic genomes. Which of the following statements is correct?  
(A) They are thought to have originated by forward slippage of the nascent daughter strand during DNA replication.  
(B) They have the repeats contain 1-50 base pairs.  
(C) They can be used as probes in DNA fingerprinting.  
(D) They are concentrated in specific chromosomal locations.  
(E) They occasionally occur within transcription units and expanded number of repeats may be associated with some hereditary diseases.
3. The U2 snRNA base pairs with  
(A) the 3' splice site of the intron.  
(B) the branch site/point within the intron.  
(C) a sequence spanning the first exon-intron boundary.  
(D) the 5' splice site of the intron.  
(E) a sequence spanning the intron-second exon boundary.
4. The 23S rRNA of the large subunit of bacterial ribosomes interacts with  
(A) small subunit ribosomal proteins only.  
(B) large subunit ribosomal proteins only.  
(C) the 3' CCA terminus of peptidyl tRNA in the P and A sites.  
(D) the 3' untranslated region of the mRNA.  
(E) the 5' untranslated region of the mRNA.
5. The closest known relative of mitochondria among bacteria is  
(A) cyanobacteria            (B) *E. coli*.            (C) *Salmonella*.  
(D) *Bacillus*.            (E) *Rickettsia*.
6. An increase in the rate of translation of an mRNA  
(A) is the fastest way to increase the amount of a protein.  
(B) can be due to a protein binding the 3'UTR of the mRNA.  
(C) can be due to lengthening the poly-A tail on the mRNA.  
(D) can be due to changes in the amount of translation initiation factors.  
(E) all of the above.

## 國立中山大學100學年度碩士班招生考試試題

科目：分子生物學【生科系碩士班甲組選考、乙組選考】

7. The majority of human transposable elements are  
(A) insertion sequences (B) simple transposons  
(C) composite transposons (D) non-replicative transposons  
(E) retrotransposons
8. Nucleotide excision repair primarily works on  
(A) abasic sites in DNA (B) double strand breaks  
(C) uracil in DNA (D) bulky, helix-distorting DNA damage  
(E) normal, but mismatched bases
9. Gene conversion is a consequence of:  
(A) repair of ultraviolet light damage to DNA (B) heteroduplex formation  
(C) defects in recombinational repair (D) transposition  
(E) retrotransposition
10. A common mechanism for regulated alternative splicing involves:  
(A) mutation of a 5' splice site (B) mutation of a 3' splice site  
(C) mutation of the internal branch site (D) use of a slicing repressor protein  
(E) use of mircoRNA
11. The precursor to a microRNA is:  
(A) tRNA (B) mRNA (C) rRNA  
(D) snoRNA (E) a double-stranded region of RNA
12. In *E. coli*, what marks the strand to use as template in mismatch repair?  
(A) A methyl group on adenine (B) An ethyl group on guanine  
(C) A methyl group on uracil (D) A nick in the DNA  
(E) A gap in the DNA
13. On many plasmid modern cloning vectors, the multiple cloning site used for insertion of DNAs is present  
(A) within a drug-resistance gene (B) at the origin of replication  
(C) within the *lacZ* gene (D) at the centromere  
(E) at the telomere
14. A mutation in a protein-coding sequence that does not alter the amino acid sequence is  
(A) a neutral mutation (B) a frame-shift mutation  
(C) a non-sense mutation (D) an expansion mutation  
(E) a silent mutation
15. During transcription initiation, what acts as a bridge between regulatory eukaryotic transcription factors and RNA polymerase?  
(A) The TATA box (B) CAP  
(C) Mediator (D) CREB  
(E) The carboxyl terminal domain (CTD)

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請注意：第 16~20 題，每題 3 分。

16. You prepare four different human gene libraries. One is a genomic library made from skin, the second is a genomic library made from skeletal muscle, the third is a brain cDNA library, and the fourth is a pancreatic cDNA library. Which pair of libraries will have the greatest overlap in the cloned sequences they contain?
- (A) Skeletal muscle genomic and pancreatic cDNA libraries
  - (B) Skeletal muscle cDNA and brain cDNA libraries
  - (C) Skin genomic and pancreatic cDNA libraries
  - (D) Skin genomic and brain cDNA libraries
  - (E) Skin genomic and muscle genomic libraries
17. Position effect variegation of *Drosophila* eye color provided insight into:
- (A) the effect of chromatin structure on gene expression
  - (B) the existence of mutagens
  - (C) the role of insulators in the regulation of gene expression
  - (D) the existence of eye color mutations
  - (E) the random and spontaneous nature of mutation
18. A loss-of-function mutation in a histone deacetylase gene is predicted to:
- (A) decrease mRNA stability
  - (B) increase the frequency transcription initiation
  - (C) decrease the frequency transcription initiation
  - (D) increase rates of translation
  - (E) decrease rates of translation
19. The reason an ampicillin-resistance gene is present on many cloning vectors is to provide
- (A) a site for inserting DNA fragments into the plasmid
  - (B) a means of learning which cells have taken up the cloning vector
  - (C) a means of distinguishing which cells have taken up native cloning vector and which have taken up a recombinant cloning vector
  - (D) a mechanism for blue/white colony screening
  - (E) a mechanism for protecting mammalian cells from ampicillin toxicity
20. Which of the following levels of control provides the most rapid means of changing transcription factor activity?
- (A) Transcriptional control of transcription factor activity
  - (B) Splicing control of transcription factor activity
  - (C) mRNA stability control of transcription factor activity
  - (D) Translational control of transcription factor activity
  - (E) Post-translational control of transcription factor activity

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II. 配合題：請將左邊名詞配合最適合的右邊敘述（單選）。每題 3 分。

- |                           |                                                                 |
|---------------------------|-----------------------------------------------------------------|
| 21. Xenoderma pigmentosum | A. Involved in RNA interference.                                |
| 22. AAUAAA                | B. A RNA polymerase making short RNA primers.                   |
| 23. Sex-lethal protein    | C. DNA-bending protein involved in transcription initiation     |
| 24. S-adenosylmethionine  | D. Associated with cellular aging.                              |
| 25. Primase               | E. A genetic disease defective in nucleotide excision repair    |
| 26. Operon                | F. 5' end of the intron joined to branch point A.               |
| 27. miRNA and siRNA       | G. Involved in post-translational control.                      |
| 28. TATA-binding protein  | H. A genetic disease defective in mismatch repair.              |
| 29. Lariat structure      | I. A negative regulator for alternative splicing in Drosophila. |
| 30. Telomeres             | J. Methyl donor for eukaryotic 5'-cap synthesis.                |
|                           | K. Pre-mRNA cleavage and polyadenylation.                       |
|                           | L. A DNA polymerase making short RNA primers.                   |

III. 問答題: 25 分

1. 此題 10 分 (A) How can a single RNA transcript be translated into different polypeptides in most operons, for example lac operon, of prokaryotes? (B) How can a single primary transcript be translated into different polypeptides in gene expression of eukaryotes?
2. 此題 15 分 The following techniques are very important in both research of molecular biology and biotechnology. Describe briefly the essential points of (A) DNA sequencing; (B) PCR; (C) Site-directed mutagenesis.