國立臺灣海洋大學九十九學年度研究所碩士班暨碩士在職專班入學考試試題

考試科目： 分子生物學

系所名稱： 食品科學系碩士班生技組

1.答案以橫式由左至右書寫。2.請依題號順序作答。

I. Multiple choices and one answer (單選, 2 points for each):

1. Which of the following statements about double-stranded DNA is false?

a. Hydrogen bonds are the major forces that maintain a double helix structure.

b. Purine bases pair with pyrimidine bases.

c. There are always equal amounts of guanine and cytosine nucleotides.

d. Phosphodiester bonds link adjacent nucleotides.

e. Uracil base pairs with adenine.

2. During transcription of messenger RNA in prokaryotes, which of the following statements is false?

a. Palindromic sequences in the template can signal the termination of the process.

b. Translation can occur simultaneously.

c. The DNA template is read from a 3' to 5' direction.

d. The messenger RNA molecule is extensively modified during synthesis.

e. The DNA molecule is synthesized from a 5' to 3' direction.

3. During the elongation stage of prokaryotic translation, which of the following statements is false?

a. Aminoacyl transfer RNAs base pair with the messenger RNA codon in the A site of the ribosome.

b. The growing polypeptide chain is attached to the 50S subunit.

c. Binding of aminoacyl transfer RNA to ribosome is an energy-independent process.

d. The generation of peptide bonds is catalyzed by ribosomal RNA.

e. Methionine transfer RNAs can bind to AUG codons within messenger RNA.

4. Which of the following statements about the human genome is false?

a. It contains about 80000 genes.

b. It is organized into 46 chromosomes.

c. It is the largest of any species thus far analyzed.

d. It is mostly composed of non-coding sequences.

e. Fifteen percent of the genome is composed of repetitive sequences.

5. Which of the following statements about gene expression is true?

a. Methylation of cytosine residues with CpG islands of DNA prevents transcription.

b. RNA polymerase II transcribes genes encoding rRNA.

c. Once a sequence is transcribed it will inevitably be translated to give rise to a functional protein.
d. Euchromatin represents transcriptional active RNA.
e. RNA polymerase reads the template from a 5' to 3' direction.

6. Which of the following statements about restriction endonuclease is false?
a. Are bacterial enzymes.
b. The cut ends of the DNA may be blunt ended.
c. Cleave double-stranded DNA.
d. Cleave eukaryotic but not prokaryotic nucleic acids.
e. Recognize palindromic sequences such as 5'GGATCC3'.

7. Which of the following statements about DNA mutations is true?
a. A point mutation that changes a cytosine to a guanine residue is known as a transition.
b. A point mutation that changes an adenine to a thymine residue is known as a transversion.
c. A missense mutation generates a premature stop codon.
d. Transversions can result in frameshift mutation.
e. A deletion of 9 base pairs of DNA will result in frameshift mutation.

8. Class I and Class II aminoacyl–tRNA synthetases differ in their:
a. structural motifs.
b. anticodon recognition.
c. site of aminoacylation.
d. amino acid specificity.
e. all of the above.

9. Which of the following statements about transfer RNA is false?
a. Are exclusively found in eukaryote.
b. Usually adopt a cloverleaf structure.
c. Have an invariable sequence (CCA) at their 3' ends to which amino acids are attached.
d. Are smaller than 100 bases in length.
e. Have an anticodon triplet which base pairs with messenger RNA.

10. Which of the following statements about the fidelity of replication is false?
a. Specific repair systems repair and maintain DNA.
b. Pol I and Pol III detect and remove errors.
c. Cells do not survive DNA point mutations.
d. DNA polymerase catalyzes synthesis in a two-stage reaction, ensuring the proper base is added.
e. Cells maintain a balance of dNTPs.

II. Please fill in the following questions: (填空, 2 points for each)

1. The process whereby nucleotides are removed from the 5′ end of one DNA segment and nucleotides are added to the 3′ end of the immediately preceding DNA segment is called _____.
2. Genes without a known function are called _____ genes.
3. Human cancers are often caused by a mutation in the p53 gene, which functions as a _____.
4. A steroid hormone diffuses through the cell membrane and binds to a steroid hormone receptor in the _____.
5. _____ is cysteine proteases that participate in apoptosis.
6. Proteins are properly folded with the assistance of _____.
7. There are three protein factors necessary for *E. coli* protein synthesis: initiation factors, elongation factors, and _____.
8. The _____ is the explanation for the degeneracy observed in mRNA codon recognition by tRNA anticodons.
9. Two exons carried on different RNA molecules can be spliced together in a process called _____.
10. Transcriptional activators that can have variable positions and orientations are called _____.

III. Short answer: (解釋名辭, 3 points for each)

(1) Intergenic suppression
(2) Operon
(3) Alternative splicing
(4) DNA microsatellities
(5) Parental imprinting
(6) Mismatch repair
(7) Ames test
(8) cDNA library
(9) Contigs
(10) Kozak sequence

IV. Questions need detailed answers include the principles, purpose, graphics and examples etc.

1. Please **briefly translate** the following short paper and **give your comments**.

a. Antigenic variation through drift and shift of hemagglutinin (HA) and neuraminidase (NA) proteins enables the virus to escape host immune responses. *Drift* refers to frequent, minor changes on the HA and/or NA antigens. Antigenic drifts in the HA subtype are associated with seasonal epidemics and often reduce the effectiveness of the previous seasonal vaccines. *Shift*

refers to the introduction of an influenza A virus subtype to which the population has no preexisting immunity. Although the precise mechanism is unknown, shifts are widely assumed to be facilitated by the virus's segmented genome and the genetic diversity it achieves by infecting a varied reservoir of animals. Antigenic shifts in HA subtypes are associated with pandemics, 3 of which occurred in the past century. (7 points)

b. Apoptosis is the process of programmed cell death that may occur in multicellular organisms. Programmed cell death involves a series of biochemical events leading to a characteristic cell morphology and death; in more specific terms, a series of biochemical events that lead to a variety of morphological changes, including blebbing, changes to the cell membrane such as loss of membrane asymmetry and attachment, cell shrinkage, nuclear fragmentation, chromatin condensation, and chromosomal DNA fragmentation. Processes of disposal of cellular debris whose results do not damage the organism differentiate apoptosis from necrosis. (7 points)

2. Briefly state the principles and applications of the follow molecular biotechnology. (16 points)
(a) Single-nucleotide polymorphisms (SNP)
(b) Affinity chromatography
(c) Microarrys
(d) Gene therapy