



國立臺灣海洋大學一〇〇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. One difference between DNA and RNA is:
 - A. DNA is encoded 5' → 3', while RNA is encoded 3' → 5'.
 - B. RNA has a hydroxyl group on its 2' sugar carbon, while DNA does not.
 - C. Phosphodiester bonds only exist in DNA.
 - D. DNA contains purines, while RNA contains pyrimidines.
 - E. Uracil is found in DNA, while thymine is found in RNA.

2. All of the following statements about DNA coiling are true **except**:
 - A. Both bacterial and eukaryotic cells contain histones.
 - B. Eukaryotic DNA contains much more complex supercoiling than bacterial DNA.
 - C. Supercoiling is necessary to fit DNA into cells.
 - D. Nucleosomes consist of a DNA-histone complex.
 - E. Gyrase and topoisomerase are two enzymes involved in supercoiling.

3. All of the following statements about transposons are true **except**:
 - A. The enzyme transposase is required for transposition.
 - B. Conservative transposition causes a double-stranded break in the donor DNA molecule.
 - C. Transposons are also known as “mobile DNA” or “jumping genes.”
 - D. Transposons are not considered to be replicons.
 - E. Transposition almost never damages the host's DNA.

4. All of the following statements about transcription are true **except**:

- A. Bacteria often have several genes encoded on the same mRNA molecule.
 - B. Eukaryotic RNA polymerase II always requires transcription factors.
 - C. Rho-dependent terminators utilize a long string of adenine residues.
 - D. The coding strand of the DNA is identical in sequence to the mRNA (except for the substitution of uracil for thymine).
 - E. The sigma subunit of RNA polymerase recognizes the -10 and -35 regions on the DNA.
5. All of the following are important in the regulation of eukaryotic gene transcription by altering DNA structure **except**:
- A. Histone acetyl transferases
 - B. CG islands
 - C. Chromatin density
 - D. RNA processing
 - E. Methylcytosine binding proteins
6. The most important feature of an expression vector is the:
- A. Tightly regulated promoter region.
 - B. Ability to be expressed in both prokaryotic and eukaryotic hosts.
 - C. Transcription stop sites.
 - D. Protein tag.
 - E. All of the above.
7. All of the following statements about replication are true **except**:
- A. Eukaryotic chromosomes shorten after each round of replication.
 - B. Eukaryotic chromosomes contain several origins of replication.
 - C. Bacteria replicate their chromosomes during the S phase of the cell cycle.
 - D. Many bacteria perform theta-replication.

E. Rolling circle replication is used by some viruses to synthesize several copies of their genome.

8. PCR:

- A. Utilizes either an upstream or downstream primer, but not both simultaneously.
- B. Utilizes the DNA polymerase of a thermophilic bacterium.
- C. Requires a large amount of template DNA to be successful.
- D. Can only be used to amplify DNA if the sequence is precisely known.
- E. Incorporates dideoxynucleotides to help produce DNA fragments of the proper length.

9. All of the following statements about ribozymes are true except:

- A. Some ribozymes, like the group I and II introns, can only act on themselves.
- B. Ribozymes usually catalyze cleavage and ligation reactions.
- C. Viroids are an example of a naturally occurring ribozyme.
- D. Ribozymes are enzymatically active RNA molecules.
- E. Ribozymes can infect plants but not humans.

10. A gene knockout is:

- A. A dominant gene that “knocks-out” expression of other genes.
- B. A particularly attractive gene.
- C. A gene inserted in place of another gene.
- D. A gene that has been inactivated or removed from an organism.
- E. None of the above.

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

1. Proteins are properly folded with the assistance of _____.
2. The observation that heat-denatured DNA exhibits increased UV absorbance, is called the _____ effect.
3. In prokaryotes, many of the repressors that bind to DNA contain the _____ motif.
4. A set of DNA fragments made from the expressed sequences found in a particular cell of an organism is called a _____ library.
5. When a section of DNA is damaged and polymerization cannot proceed, _____ repair can reconstitute the damaged replication fork.

6. The correct amino acid is covalently attached to a tRNA by the corresponding _____.
7. Mitosis and cell division take place during _____ of the cell cycle.
8. A purine is substituted for a pyrimidine residue is called a _____ mutation.
9. In eukaryotic cells, methylated bases are present in palindromic _____, which are often found in upstream promoter regions.
10. Enhancer activity can be blocked by the presence of sequences called _____.

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

1. Wobble concept
2. Suppressor mutations
3. Holliday junction
4. Gene conversion
5. Intercalating agents
6. Transposition target immunity
7. Tryptophan operon
8. Specialized transduction
9. RNA editing
10. Self splicing

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**. (翻譯及讀後心得, 7 points for each)

(a) Hepatocellular carcinoma (HCC) is a serious public health hazard. MicroRNAs (miRNAs), a class of short endogenous RNAs, regulate the gene expression at the post-transcriptional level through imperfect base pairing with the 3'-untranslated region of target mRNAs. miRNAs, especially the liver-specific miRNA: miR-122, have multiple functions in liver development and

abnormal expression of miRNAs could lead to liver diseases. Altered miRNA expressions have been observed in HCCs, viral hepatitis and hepatic fibrosis. The different expression profiles of miRNAs in HCC suggest that miRNAs may serve as either novel potential targets acting directly as oncogenes or therapeutic molecules working as tumor suppressor genes.

(b) Antimicrobial peptides (AMPs) of innate origin are agents of the most ancient form of defense systems. They can be found in a wide variety of species ranging from bacteria through insects to humans. Through the course of evolution, host organisms developed arsenals of AMPs that protect them against a large variety of invading pathogens including both Gram-negative and Gram-positive bacteria. At a time of increasing bacterial resistance, AMPs have been the focus of investigation in a number of laboratories worldwide. Although recent studies show that some of the peptides are likely to have intracellular targets, the vast majority of AMPs appear to act by permeabilization of the bacterial cell membrane. Their activity and selectivity are governed by the physicochemical parameters of the peptide chains as well as the properties of the membrane system itself.

2. Briefly state the **principles** and **applications** of the follow molecular biotechnology. (原理及應用之說明, 4 points for each)

- (a) Two hybrid system
- (b) Hierarchical shot gun
- (c) Chromatin immunoprecipitation
- (d) Chloroplast transformation