

國立臺灣海洋大學 103 學年度研究所碩士班招生考試試題

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。

一、Multiple choices and one answer (單選, 2 points for each):

1. The following statements are wrong regarding G protein-coupled receptors
 - a. Have seven transmembrane spanning domains
 - b. Have an N-terminus that is glycosylated
 - c. Have a large intracellular loop that interacts with G proteins
 - d. When activated by ligand, bind to GTP
 - e. When activated, cause an increase in intracellular cyclic GMP concentration

2. The following statements are true regarding transcription in eukaryotes
 - a. Transcription is usually polycistronic.
 - b. Transfer RNA is produced in the nucleoplasm by the action of RNA polymerase III.
 - c. The sigma subunit of the DNA polymerase complex is required for the initiation of the RNA synthesis
 - d. The Pribnow box is a region upstream of genes which is involved in the initiation of transcription.
 - e. Ribosomal RNA is produced in the nucleoplasm by the action of RNA polymerase I.

3. The following statements are true regarding receptor agonists
 - a. Agonist binding activates receptors by inducing a conformational change
 - b. Partial agonists have high efficacy though they elicit a lower receptor response than full agonists
 - c. Increasing the dose of a partial agonist will eventually lead to a maximal receptor response
 - d. An increase in agonist concentration always produces a proportional increase in receptor

response

e. Acetylcholine is an antagonists of muscarinic receptors

4. The following statements are wrong regarding the structure of amino acids

- a. Only the L-enantiomers of amino acids are found in proteins
- b. Some amino acids do not have a carboxyl group
- c. The side groups are attached to the alpha carbon atom
- d. Most amino acids exist in solution as zwitterions at pH 7
- e. All amino acids have an amino group

5. The following statements are wrong regarding translation in eukaryotes

- a. Requires transfer RNAs
- b. Requires ribosomes
- c. Terminates at the AUG codon
- d. Results in a polypeptide with methionine as the first amino acid
- e. Occurs on the cytosol

二、 Please fill in the following questions: (填空, 2 points for each)

1. The substitution of a purine for a purine or a pyrimidine for a pyrimidine residue is called _____.
2. Activation of _____ causes a rise in intracellular inositol triphosphate concentration.
3. RNA can be converted to cDNA using an enzyme called _____.
4. A genetic test for mutations in bacteria that is widely used for the detection of chemical mutagens is the _____.
5. The most notable achievement to date in *C. elegans* research has been the elucidation of the molecular pathway that regulates _____.

三、 Short answer: (解釋名辭, 2 points for each)

1. Gene conversion
2. CpG island
3. Attenuator
4. Aptamer
5. Transposition target immunity

四、 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, 8 points)

In recent decades, nanotechnology has attracted major interests in view of drug delivery systems and therapies against diseases, such as cancer, neurodegenerative diseases, and many others. Nanotechnology provides the opportunity for nanoscale particles or molecules (so called "Nanomedicine") to be delivered to the targeted sites, thereby, reducing toxicity (or side effects) and improving drug bioavailability. Nowadays, a great deal of nano-structured particles/vehicles has been discovered, including polymeric nanoparticles, lipid-based nanoparticles, and mesoporous silica nanoparticles. Nanomedical utilizations have already been well developed in many different aspects, including disease treatment, diagnostic, medical devices designing, and visualization (i.e., cell trafficking). However, while quite a few successful progressions on chemotherapy using nanotechnology have been developed, the implementations of nanoparticles on stem cell research are still sparsely populated.

2. Briefly state the **principles** and **applications** of the follow molecular biotechnology. (原理及應用之說明, 3 points for each)
 - (a) Edman degradation
 - (b) Chromosomes conformation capture assays

(c) Electrophoretic mobility-shift assay

(d) Yeast two-hybrid assay

五、Please define the following terms briefly. (15%)

(1) Nonsense codons

(2) Transposons

(3) Nonsense-mediated mRNA decay

(4) Watson-Crick base pairing

(5) DNA denaturation

六、Please choose the one (on the right) that applies (the left). (Single choice) (10%)

(1) Genotype

A. Physical appearance of any organisms

(2) Degradosome

B. Involved in the breakdown of mRNA

(3) General transcriptional factors

C. Involved in elongation of RNA synthesis

(4) Complimentary DNA

D. Activators of pre-mRNA splicing

(5) Riboswitch

E. Synthesized from mRNA by reverse transcription

F. Genetic composition of an individual

G. Nonstop-mediated decay

H. Involved in the initiation of transcription

I. Regulatory RNA element that bind and respond to small molecules

七、Single choice questions. (25%)

(1) TATA box is

a. A DNA sequence which involves in transcription

b. A protein sequence which involves in binding to DNA

c. A RNA sequence which involves in the elongation of protein synthesis

d. An experiment which defines the melting temperature of DNA

e. None of the above

(2) Which of the followings are not true regarding *lac* operon

a. Mostly found in prokaryotes

b. Regulated by the presence of allolactose

c. Encode the proteins involved in lactose export

d. Could be transcribed into polycistronic mRNA

e. None of the above

(3) Which of the following is true regarding the genetic code?

- a. The code can be overlapping
- b. Genetic code is universal in all organisms
- c. Deciphered by Watson and Crick
- d. One code may encode for 1-6 amino acids.
- e. None of the above

(4) Alternative RNA splicing may result in

- a. The production of two or more proteins with identical function
- b. Attachment of the poly(A) tail to the 5' end of an mRNA
- c. 5' cap modification of mRNA
- d. More than one protein isoforms from a single gene
- e. Degradation of group I intron

(5) Which of the followings is not true regarding "A-to-I RNA editing" ?

- a. Particularly prevalent in neuron
- b. Enable amino acid substitution
- c. Mediated by Adenosine Deaminases Acting on RNA (ADAR) enzymes
- d. Only found in *Drosophila melanogaster*
- e. None of the above

(6) Translation elongation factors EF-Tu/eEF1 can

- a. Be used by ribosome as energy for polypeptide elongation
- b. Escort amino-acyl tRNA to the A site of ribosome
- c. Help to recognize ribosomal binding site/5' Cap of mRNA
- d. Combine with the core enzyme to confer specific binding to a promoter
- e. Catalyze protein synthesis

(7) Which of the followings regarding ribosome is true?

- a. It is ribosomal protein rather than rRNA to catalyze protein synthesis
- b. Consists of DNA, RNA and Proteins
- c. Can recognizes ribosomal binding sites of mRNA in prokaryotes
- d. The two large subunits of ribosome are always associated in cells.
- e. The large and small subunits of ribosome are named according to the velocity of their sedimentation when subjected to a gravity force.

- (8) DNA footprinting experiment is to
- Determine the melting temperature of DNA
 - Determine the DNA sequence
 - Label DNA for better solubility
 - Replicate huge amounts of DNA fragments
 - Identify the binding site of DNA fragment to other molecules
- (9) A bacterial plasmid is
- Capable of replicating on its own in cells.
 - Always embedded into the bacterium's chromosomal DNA
 - Not possible to be passed between cells
 - Often in linear conformation
 - Often single stranded
- (10) That DNA replication is semiconservative was discovered by
- James Watson and Francis Crick
 - Wendell M. Stanley
 - Marshall W. Nirenberg and Heinrich Matthaei
 - Matthew Meselson and Franklin Stahl
 - Alfred Hershey and Martha Chase