國立嘉義大學 100 學年度

生化科技學系碩士班招生考試試題

科目：分子生物學

一、選擇題（每題2.5分，共25分）

1. Which of the following is not associated with a prokaryotic cell?
   A) Genetic information is contained within a nucleoid region.
   B) Genetic material is organized as a single circular chromosome.
   C) They have a cell wall surrounding their plasma membrane.
   D) They have membrane-bound organelles in their cytoplasm.
   E) All of the answers are associated with prokaryotic cells.

2. The location of a gene on a chromosome is called its _____.
   A) karyotype
   B) allele
   C) loci
   D) homologue

3. At the molecular level, type A and type B blood differ in which of the following characteristics?
   A) the antigens present on the surface of the red blood cells
   B) the type of sugar found in each type
   C) the antibodies that are generated against the other type of blood
   D) all of the answers are correct

4. Which of the following defines the principle of linkage?
   A) two or more genes that are physically connected on a chromosome
   B) genes that are transmitted to the next generation as a group
   C) the process by which genetic information is exchanged between homologous chromosomes
   D) all of the answers are correct
   E) both two or more genes that are physically connected on a chromosome and genes that are transmitted to the next generation as a group

5. How many Barr bodies would an individual with a XXY genotype possess?
   A) 0
   B) 1
   C) 2
   D) none of the answers are correct

6. Variations in chromosome structure are important for which of the following reason(s)?
   A) evolution of new species
   B) may result in the production of abnormal offspring
   C) may alter the phenotype of an organism
   D) all of the answers are correct

7. Given the following sequence of genes on a chromosome, determine what change in chromosome structure occurred. (the * indicates the centromere)
   before A B C D * E F G H
   after A B G F E * D C H
   A) reciprocal translocation
   B) pericentric inversion
   C) gene duplication
   D) none of the answers are correct

8. Which of the following correctly depicts the directionality of the DNA molecule?
   A) right to left
   B) top to bottom
   C) 5' to 3'
   D) 3' to 5'
   E) All DNA molecules are different in their directionality.

背面尚有試題

9. How many origins of replication are there in bacteria?
   A) 0
   B) 1
   C) 2
   D) more than two

10. Which of the following is a goal of the Human Genome Project?
   A) to develop technological advances in molecular genetics
   B) to analyze the genomes of model organisms
   C) to obtain a physical map of the human genome
   D) to obtain the DNA sequence of the human genome
   E) all of the answers are correct

二、簡答題

1. Please examine the post-transcriptional and post-translational modifications. (5 分) Please list five types of post-translational modifications and make one example for each type. You need to point out which amino acid would be modified. (15 分) How can you detect these post-translational modifications in the cells? Please give one example. (5 分)

2. For class I gene transcription, the preinitiation complex contains only polymerase I, SL1, and UBF. Which of these factor(s) is/are correlated to the transcription functions described below:
   (1) The factor(s) that is/are required for accurate transcription of rRNA (2 分)
   (2) The factor(s) that exhibit(s) species specificity. (2 分)
   (3) The factor(s) by itself could bind to A site of UPE element. (2 分)
   (4) The factor(s) consist(s) of TBP and three TAFs. (2 分)

3. Besides polymerase III, class III gene transcription requires three transcription factors, i.e. TFIIIA, TFIIIB, and TFIIIC. Which of these factor(s) is/are correlated to the following functions or properties?
   (1) The factor(s) not involved in the transcription of tRNA genes (2 分)
   (2) The factor(s) by itself does/do not bind to tRNA gene and its binding is totally dependent of other factor. (2 分)
   (3) The factor(s) that is the last to join the preinitiation complex. (2 分)
   (4) The factor(s) that contain(s) TBP and other TAFs. (2 分)
   (5) The factor(s) that remain(s) bound on the gene after elongation phase has proceeded, and ready for another round of transcription. (2 分)
   (6) The factor(s) that required for the transcription of 5S RNA genes. (2 分)

4. Fill in the following blanks with appropriate answers.
   (1) _____ is the transposable element that disrupts the C gene in the kernels of Indian corns. (1 分)
   (2) _____ is the transposable element that causes hybrid dysgenesis in drosophila. (1 分)
   (3) _____ is an autonomous transposable element related to the color of the kernels of corn. (1 分)
   (4) _____ is a general rule for immunoglobulin gene rearrangement. (1 分)
   (5) _____ is a human non-autonomous retrotransposon containing no LTR and encoding no protein(1 分)

5. The *lac* operon is an operon required for the transport and metabolism of lactose in *Escherichia coli*. The *lac* operon is regulated by several factors including the availability of glucose and of lactose. Gene regulation of the *lac* operon was the first complex genetic regulatory mechanism to be elucidated and is one of the foremost examples of prokaryotic gene regulation.
   (1) Define the term “operon”. (5 分)
   (2) Illustrate the structure of *lac* operon. (5 分)
   (3) What is the role of the *lac* operon in *E. coli*? (5 分)
   (4) Explain negative control and positive control of *lac* operon. (10 分)