

## 1. Questions of "Single choice". (15%)

- (1) A bacterium makes the amino acid glycine or absorb it from its surroundings. A biochemist found that glycine binds to a repressor protein and cause the repressor to bind to the bacterial chromosome, "turning off" an operon. If this is like other operons, the genes of this operon probably code for enzyme that  
(A) control bacterial cell division. (B) break down glycine. (C) produce glycine. (D) cause the bacterium to differentiate. (E) manufacture the repressor protein.
- (2) Two formal terms used to describe categories of mutational nucleotide substitutions in DNA are called  
(A) base analogues and frameshift. (B) error prone and spontaneous. (C) transversions and transitions. (D) euchromatic and heterochromatic. (E) sense and antisense.
- (3) A class of mutations which results in multiple contiguous amino acid changes in proteins is likely to be the following.  
(A) base analogue. (B) transversion. (C) transition. (D) frameshift. (E) recombinant.
- (4) Heterochromatin contains  
(A) no genes. (B) only nonfunctional genes. (C) only a few genes. (D) the same number of genes per unit of DNA as euchromatin. (E) more genes per unit of DNA than euchromatin.
- (5) Pseudouridine, an "unusual" base, is found primarily in  
(A) DNA. (B) mRNA. (C) RNA. (D) tRNA. (E) rRNA.

2. An investigator wants to study the function of eukaryotic hormone receptors. She has identified the hormone receptors for estrogens and progesterone. She finds that each has a hormone-binding domain, a transcriptional activation domain, and a DNA-binding domain. In a cell culture line, she first eliminates the genes for the endogenous

(背面仍有題目,請繼續作答)

estrogen and progesterone hormone receptors. She then introduces a chimeric receptor that contains the progesterone-binding domain fused to the transcriptional activation domain, and DNA-binding domain from the estrogen receptor. Indicate below whether estrogen and/or progesterone genes are transcribed (**induced** or **not induced**) under the given conditions. (12%)

(1)

<u>Added hormone</u>	<u>Estrogen-inducible genes</u>	<u>Progesterone-inducible genes</u>
Estrogen	<u>(A)</u>	<u>(B)</u>
Progesterone	<u>(C)</u>	<u>(D)</u>

- (2) List four differences that distinguish enhancers from proximal cis-acting elements in eukaryotes.
3. A mutation in the  $\beta$ -globin gene, a component of hemoglobin, results in a shortened polypeptide even though the immature (unspliced) mRNA transcript was the correct length. Propose two different causes for the short polypeptide. (6%)
4. Imagine you have three test tube containing identical solutions of purified, double-stranded human DNA. You expose the DNA in tube 1 to an agent that break the sugar-phosphate (phosphodiester) bonds. You expose the DNA in tube 2 to an agent that breaks the bonds that attach the bases to the sugars. You expose the DNA in tube 3 to an agent that breaks the hydrogen bonds. After treatment, how would the structure of the molecules in three tubes differ? (6%)
5. (1) With new information from the Human Genome Project, many new genes will be identified for which the function in not known. What features of the DNA sequence might help you determine the function of a newly identified gene? (3%)
- (2) How does RNA editing contribute to protein diversity in eukaryotes? (3%)
- (3) Other *polA* mutants of *E. coli* lack the 3'  $\rightarrow$  5' exonuclease activity of DNA polymerase I. Will the rate of DNA synthesis be altered in these mutants? What effect(s) will these *polA* mutations have on the pheotype of the organism? (5%)

6. Suggest two different methods that could be used to determine the number of bacteria per milliliter of culture. Would they give the same value? (5%)
7. Why does salt concentration affect the melting temperature of DNA? (10%)
8. Which of the molecules, polyalanine and polyaspartic acid, will have its three-dimensional shape altered by a change in pH, and what changes will occur? (10%)
9. Which histone is found in chromatin but not in the nucleosome unit? (5%)
10. What is the advantage of using a plasmid with two antibiotic-resistance genes as a cloning vehicle? (10%)
11. When a ribosome first attaches to an mRNA molecule, one tRNA binds to the ribosome. The tRNA that recognizes the initiation codon binds to the (5%)
  - (A) amino acid site (A site) of the ribosome only.
  - (B) peptide site (P site) of the ribosome only.
  - (C) large ribosomal subunit only.
  - (D) second tRNA before attaching to the ribosome.
  - (E) Both A and C are correct.
12. During translation, chain elongation continues until what happens? (5%)
  - (A) No further amino acids are needed by the cell.
  - (B) All tRNA are empty.
  - (C) The polypeptide is long enough.
  - (D) Chain terminator codons occur.
  - (E) The ribosomes run off the end of mRNA.