

1. (a) Is a genomic library smaller or larger than a cDNA library derived from a given organism, and why? (5%)
(b) Would cDNA libraries derived from different cell types within the same organism be different from or identical to each other, and why? (5%)
2. The molecular weight of a certain protein can be estimated by running SDS-PAGE with 2-mercaptoethanol. What are the purposes of use for each components, SDS, PAGE, and 2-mercaptoethanol? (10%)
3. You are performing site-directed mutagenesis to test predictions about which residues are essential for a protein's function. Which of the each pair of amino acid substitutions listed below would you consider a better choice, and why?
(a) Val replaced by Ala or Phe. (5%)
(b) Lys replaced by Asp or Arg. (5%)
(c) Gln replaced by Glu or Asn. (5%)
(d) Pro replaced by His or Gly. (5%)
4. Most hormones, such as peptide hormones, exert their effects by binding to cell-surface receptors. However, steroid hormones do so by binding to cytosolic receptors. How is this possible? (10%)
5. A hypothetical three-step metabolic pathway consists of intermediates W, X, Y, and Z and enzymes A, B, and C. Deduce the order of the enzymatic steps in the pathway from the following information: (10%)
(a) Compound Q, a metabolic inhibitor of enzyme B, causes Z to build up.
(b) A mutant in enzyme C requires Y for growth.
(c) An inhibitor of enzyme A causes W, Y, and Z to accumulate.
(d) Compound P, a metabolic inhibitor of enzyme C, causes W and Z to build up.

(背面仍有題目,請繼續作答)

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

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6. There are two types of diabetics, type I and II. Please explain the causes of disease for each type and how they affect the levels of circulating glucose immediately after a meal. (10%)

7. A growth factor that acts through a receptor tyrosine kinase stimulates cell division. Predict the effect of a viral protein that inhibits the corresponding protein tyrosine phosphatase. (10%)

8. Explain why natural selection has favored the instability of RNA. (10%)

9. (a) Using electrophoresis to separate DNA fragments, you need to use higher or lower percentages of agarose gel to distinguish small DNA fragments with better resolution, and why? (5%)
(b) When you start running the electrophoresis, you realize the buffer being overheated. Can you troubleshoot the possible problems in this experiment? (5%)