

1. A cDNA encoding a novel gene was recently cloned from a human liver library. To test whether this gene is an oncogene, please 1) define "oncogene"; 2) propose two experiments to test the oncogenic potential of this cDNA. (10%)
2. Please 1) describe the common structure of an eukaryotic gene and its major difference with that of a prokaryotic gene, and 2) list all the potential steps involved in regulating the protein synthesis from an eukaryotic gene. (10 %)
3. Cells often exchange small molecules and macromolecules with their environment. Please name three processes involved in this exchange and discuss their differences in terms of the involved components and their specific functions. (10 %)
4. Please illustrate the "signal hypothesis" and briefly describe functions of the organelles involved in this process. (10 %)
5. Please 1) name three classes of RNA, 2) illustrate the feature of each class and the key enzymes involved in their synthesis, and 3) list the biological functions served by each class of RNA in the cell. (10 %)
6. The binding of growth factor or cytokine to its cell surface receptor often leads to a profound change of cellular properties, including cell growth, differentiation and an induction of gene expression. These changes often involve phosphorylation of proteins and transcriptional factors, etc. Please use at least two different examples (eg, IFN- $\gamma$ , TNF- $\alpha$ , EGF, etc) to explain these genetic and biochemical changes involved in these signal transduction processes. (10 %)
7. Signal recognition particle (SRP) is critical in the initiation and targeting of secretory proteins to ER membrane. What are the compositions of SRP? And which protein is involved in binding with signal sequence of secretory proteins? And which protein functions in interaction with SRP receptor and how? (8 %)
8. A number of genetic elements located within the promoter proximal region, upstream region and/or within the gene can regulate gene expression. Please list at least three different types of genetic elements. Briefly, describe their structures. How are they localized and determined? (14 %)
9. What is a pseudogene? Please describe its features and explain how it differs from a functional gene. (8 %)
10. Define the term of monozygotic twins, and explain how they are similar to and different from each other in term of genes and gene products. And if there are differences between them, please list them and explain them.(10 %)