

國立中央大學八十九學年度碩士班研究生入學試題卷

所別: 生命科學系 不分组 科目: 分子生物學 共 / 頁 第 / 頁

1. When studying the reassociation kinetics of eukaryotic genomic DNA, you found there are three distinct areas called fast, intermediate and slow components shown on the renaturation curve. What are the features of each component in the term of molecular biology? (6 points)
2. Please describe the major functions of DNA polymerase I, DNA polymerase III, helicase and DNA gyrase in the process of bacterial DNA replication. (8 points)
3. How does RNA polymerase know where to stop? Briefly describe the mechanism in prokaryotic system. (6 points)
4. There are two major regulation factors which control the gene expression of *lac* operon in *E.coli*. Please explain how these two accessory factors work with or without the presence of lactose. (6 points)
5. What are the three major events to produce mature mRNA from the primary transcripts in eucaryotes? Just name the three events. (6 points)
6. What are the two major roles that guide RNAs (gRNAs) play in RNA processing? (6 points)
7. What is nick translation? (6 points)
8. How does a translation machinery assembly for the initiation of protein biosynthesis in bacteria? (6 points)
9. As to apply for research funding from National Science Council at Taiwan, you are asked to design two approaches with each to study differential gene expression with regard to mRNA and protein biosynthesis levels respectively in human liver cells treated by heavy metal cadmium. Provided you have determined the effective concentration and timing of cadmium treatments, please describe the required experiments to accomplish these two approaches. (16 points)
10. You have identified gene X which expression in mRNA level greatly decreased soon after the treatment of cadmium described above. You then generated several reporter genes under the control of the isolated upstream region of gene X and successfully transformed the liver cells. Amazingly, all the mRNA levels of the reporter genes remained unchanged after the same cadmium treatments. You suspected the isolated upstream region of gene X is not complete. However, after reconstructing the gene X under the control of the identical upstream region used for the reporter genes and again successfully transforming the liver cells, the mRNA level of gene X decreased as demonstrated previously after the same cadmium treatment. How do you explain the changed mRNA levels of gene X before and after the cadmium treatments? Please also describe how you carry out the required experiments to prove your thoughts. (15 points)
11. Your company has paid the legal fee to use the genetic information of tomato hormone systemin and your job is to produce this protein in the laboratory using bacteria *E.coli*. You only have the cDNA sequence of this hormone provided by the gene owner. Please design an experimental procedure in detail as if you are a skillful molecular biologist to establish your business starting from the bench works in the laboratory. (15 points)
12. Very recently, scientists in USA have developed a bionic chip which can trap a single cell at one time for electroporation. In your own sense, please describe how this invention is good for biotechnology. (4 points)