國 立 清 華 大 學 命 題 紙

95 學年度 資訊系統與應用研究（所） 丙 組碩士班入學考試

科目 基礎生物 科目代碼 2902 共 1 頁第 1 頁 *請在【答案卷卡】內作答

Please answer the following questions briefly. (#1-16, 6 points each; #17, 4 points)

1. List two reporter genes that are commonly used in eukaryotic gene expression analysis and explain how these reporter gene products are assayed?
2. List two methods that can be used to determine the level of human immunodeficiency virus in blood. Explain one of the methods in sufficient details.
3. Supposed you use a chemical to treat HeLa cells and found that the level of a mRNA increases ~10 folds. However, the protein encoded by the mRNA remained at the same level. What are the possible explanations for this phenomenon?
4. Supposed your group has completed a genome sequencing project of a highly virulent *E. coli* strain. Please explain how the genome information can be used to study the bacterial pathogenesis.
5. What are single nucleotide polymorphisms (SNP)? Give an example to explain how scientists identify SNP.
6. How can one promoter respond differently to hot vs. cold temperatures?
7. What is a "feedback reaction"? Please use an example to explain the phenomenon.
8. Please explain the functions of micro RNA in eucaryotic cells.
9. What does the cladogram of these 5 taxonomic groups: archae, bacteria, plants, fungi, and mammals look like? What is the commonly used basis in molecular taxonomy?
10. Many human traits do not follow Mendelian patterns of inheritance. What are the possible mechanisms?
11. Describe the minimum structural, metabolic, and genetic equipment of a "system" that you would consider to be a true primitive cell. What is the approximate number of genes required to maintain such a system?
12. What is Hardy-Weinberg theorem? In a population that is in Hardy-Weinberg equilibrium, 9% of the individuals show the recessive trait. What is the frequency of the dominant allele in the population?
13. Explain the difference between each pair of the following terms related to chromosomes: telomere and centromere; chromatid and chromatin; kinetochore and mitotic spindle.
14. Fragile X syndrome is one of the major causes of human mental retardation. The disease is associated with a phenomenon called "triplet repeat expansion" in a region near the tip of X chromosome. Please explain the possible basis of the disease and why it is more common in males.
15. What is the definition of "operon"? How do you know whether two closely inked genes are in an operon or not?
16. Some nucleotide changes cause amino acid substitutions (non-synonymous changes) in the encoded protein, and others do not (synonymous changes). In a comparison of mouse and human genes, mice were found to accumulate synonymous substitutions 1.3 times as fast. What factors could explain this difference? What conclusion can you draw from the finding?
17. Bootstrap analysis is a commonly used approach to evaluate the validity of a phylogenetic tree. What is bootstrap analysis? (4%)