系所組別： 生物化學暨分子生物學研究所甲、乙組

考試科目： 分子生物學

考試日期：0307，節次：2

※ 考生請注意：本試題 □可 ☑不可 使用計算機

1. Elizabeth H. Blackburn, Carol W. Greider and Jack W. Szostak shared the Nobel Prize in Physiology or Medicine 2009 for their discovery of how chromosomes are protected by telomeres and the enzyme telomerase. Please describe in detail about (1) the mechanism of action of telomerase, (2) how telomeres can protect chromosomes, and (3) the implications of targeting telomerase in cancer treatment. (15%)

2. Epistasis is a form of gene interaction in which one gene masks the phenotypic expression of another, and epistasis analysis is a very power tool and can be used to learn about the order of gene action. Let's say you find lost-of-function mutation in the gene A produces X phenotype, lost-of-function mutation in the gene B produces Y phenotype, and mutations in both gene A and gene B produce Y phenotype only. Please draw the possible order of these two genes if there are in (1) a substrate dependent pathway (2) a switch regulation pathway, and (3) provide the possible molecular mechanisms for both predictions. (15%)

3. Please define the term 'Epigenetics' and provide at least three possible mechanisms that can control the epigenome. (20%)

4. Let's say you surmise the protein X might be a transcriptional factor that possibly upregulates the transcription of the gene Y and induces the phenotype Z of the cells. Please design at lest four independent experiments to prove your hypothesis. (20%)

5. Please define the concept of hybridization; and describe the processes and applications for Southern and Northern blots. (10%)

6. Please compare the main differences between small interfering RNA (siRNA) and microRNA (miRNA); and describe the biogenesis and biological function of miRNAs. (10%)

7. Please describe the cellular proteolytic systems in the degradation of various classes of eukaryotic cell proteins; and compare the differences between ubiquitination and SUMOlation. (10%)