國立嘉義大學99學年度

微生物免疫與生物藥學系碩士班(乙組)招生考試試題

科目：分子生物學

1. What are the differences between siRNA (small interfering RNA), miRNA (micro RNA) and antisense RNA, including structural characteristics, what are their functions in gene regulation? (20 分)

2. Define the following terms: a. transposons; b. prion; c. sigma factor; d. intron; e. CpG islands (每小題 3 分，共計 15 分)

3. 請問何為 Q-PCR? 試各別說明如何應用 Q-PCR 技術於真核及原核細胞的特定基因表現的研究。(20 分)

4. 何謂 recombinant DNA? 進行 recombinant DNA 實驗時，需包括那些要件？這些要件應具有什麼特點，請詳述之。(20 分)

5. Mark is working on producing a recombinant cytoplasmic protein, 'X', in *E. coli*. However, when an 'X'-specific antibody was used to probe the cell lysate of the JM109 with the expression plasmid, two bands were probed, one is of the predicted molecular size, but one is a bit larger. Interestingly, when Mark transforms the same expression plasmid into BL21 cells, there is only one band probed with the right size. Mark examined the genotypes of these two strains of *E. coli*, which is listed as follow. Please explain why there is a larger undesired protein produced in JM109? (5 分) If Mark replace the amber stop codon (TAG) in the 'X' gene with an ochre codon (TAA), will there be two bands probed in the lysate of JM109 transformants? Why? (10 分)

   JM109: *endA*1, *recA*1, *gyr*A96, *thi*-1, *hsdR*17(r_K-, m_K+), *relA*1, *supE*44, Δ(*lac-proAB*), [F', *traD*36, *proAB*, *lac*I^qZΔM15]

   BL21: *E. coli* B F- *dcm ompT hsdS*(r_{B-} m_{B-}) gal [$malB^+$]$_{K-12}$(λ^S)

6. Eric planed to mass produce and purify the human basic fibroblast growth factor (bFGF) in *E. coli* system with the nucleotide sequence retrieved from NCBI database, but failed. Can you suggest Eric how many factors should be aware of in preparation of such a plasmid construction? (5 分) Laura advised Eric to check the codon usage bias. Please use the following table to generate an optimized nt sequence to replace the 5'-gtgacgccgcggcccggcggg-3' that encodes the peptide "VTPRPGG" in human. (5 分)

AA	Codons	Codon frequency (%)	
		E. coli	Primates
Pro	CCU	15	27
	CCC	10	35
	CCA	19	26
	CCG	56	11
Arg	CGU	43	9
	CGC	37	22
	CGA	5	10
	CGG	8	20
	AGA	4	19
	AGG	2	21