

一、Basic concepts of molecular biology (18 分；除非要求以英文答題，皆可用中文或英文簡答；若覺有需要，可佐以簡圖回答之)

- (1) Write down the full spelling of "tRNA" in English. (RNA 全名也請寫出；3%)
- (2) Interpret the relationship between "DNA" and "gene". (3%)
- (3) Interpret the relationship between "gene" and "genome". (3%)
- (4) Interpret the relationship between "genome" and "chromosome". (3%)
- (5) Define "gene products". (3%)
- (6) Explain why DNA denaturation can be achieved by sodium hydroxide (NaOH) treatment. (3%)

二、DNA replication, repair, transcription, and RNA processing (42 分；除非要求以英文回答，皆可用中文或英文簡答；若覺有需要，可佐以簡圖回答之)

- (1) In eukaryotes, does disassociation of histone protein from DNA occur before DNA replication? Why? (4%)
- (2) On the lagging strand, by what kind of enzyme can Okazaki fragments join together? Answer in English. (4%)
- (3) Formation of a phosphodiester bridge is critical to the elongation of a DNA strand. Does the direction of elongation follow 5' to 3' or 3' to 5'? Provide an illustration to support your answer. (6%)
- (4) Describe the role of telomerase in a DNA replication. (4%)
- (5) Make a comparison between "base excision repair" and "nucleotide excision repair". (包括發生原因與修補機制比較；8%)
- (6) Make a comparison between "enhancer" and "repressor". (4%)
- (7) In prokaryotes, how is a transcription terminated? (4%)
- (8) Does splicing take place after the completion of transcribing an mRNA? No matter what your answer is, please provide explanation. (4%)
- (9) Why a splice site is usually recognized by more than one spliceosome? (4%)

三、Translation and gene regulation (20 分；除非要求以英文回答，皆可用中文或英文簡答；若覺有需要，可佐以簡圖回答之)

- (1) Explain what the Shine-Dalgarno sequence is and does for translation. (4%)
- (2) In eukaryotes, why are the UTR sequences involved in the regulation of translation? (4%)
- (3) Define "operon" and explain why synthesis of tryptophan in bacteria becomes slow by the elevation of the tryptophan concentration. (6%)
- (4) In gene regulation, is "translational control" usually associated with or independent from "transcriptional control"? No matter what your answer is, please provide explanation. (6%)

四、Does RNA interference (RNAi) lead to gene knock down or knock out? Why? During RNAi, how is the double-stranded RNA (dsRNA) processed and how does it lead to the silence of gene expression? (10%)

五、CRISPR-Cas9 has become a powerful tool for gene editing. Therefore, does CRISPR-Cas9 lead to gene knock down or knock out? Why? Application of CRISPR/Cas9 may become a viable solution for the control of crop insect pests. Please provide your explanation. (10%)