※ 注意：請於試卷內之「非選擇題作答區」作答，並應註明作答之題號。

1. Please discuss how potassium channels permeate potassium more than sodium ions? (10%)
2. Please describe what reactive oxygen species are and how they are produced. (7%)
3. Please describe autophagy and its functions. (8%)
4. Compare the microfilament and microtubule with five differences. (10%)
5. Briefly describe clatherin-mediated endocytosis. (7%)
6. Define the regulation of Rho family of small GTPases by GEF, GAP, and GDI. (8%)
7. RNA knockdown has become a powerful tool in the arsenal of methods to deregulate gene expression. Briefly describe how gene expression can be knocked down. (4 %)
8. Translation of an improperly processed mRNA could lead to production of an abnormal protein that interferes with the gene's normal functions. Several mechanisms collectively termed mRNA surveillance help cells avoid the translation of improperly processed mRNA molecules. Please briefly describe such surveillance mechanisms both in nucleus and in cytoplasm (nonsense-mediated decay)? (6%)
9. mRNA decay is critical to control gene expression levels. Please describe the pathways for eukaryotic mRNA degradation. (6%)
10. Covalent modifications on nucleosomal histones are essential in chromatin regulation and gene expression. Histone acetylation and methylation have emerged as key players in the repression or activation of genes. In addition, DNA methylation in CpG dinucleotides has been frequently associated with gene silencing. Please describe how to analyze (1) histone methylation and acetylation and (2) DNA methylation patterns at specific sites in the genome? (9%)
11. A silent mutation is a mutation that changes DNA but not the amino acid incorporated. For example, if the DNA coding strand has a TTC, it encodes for phenylalanine. If a mutation in the DNA changes the sequence to TTT, then the DNA has undergone a silent mutation because both TTT and TTC code for the same amino acid. However, it is now known that more than 50 human diseases are caused by silent mutations. Suggest three possible causes that could lead to the observed "silent mutations are not always silent" (15%).
12. (a) Explain how acetylation or phosphorylation in histones could change the binding affinity between DNA and histones (4%). (b) What are replication licensing factors (3%)? and How did they get their name (3%)?

試題隨卷繳回