

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Please briefly describe the following terms.

- (1) RNAi (3%)
- (2) Alternative splicing (3%)
- (3) iPS cells (3%)
- (4) Gene therapy (3%)
- (5) Optogenetics (3%)

2. Please briefly describe the following methods.

- (1) Two dimensional gel electrophoresis (3%)
- (2) Reverse transcription (3%)
- (3) Southern blot (3%)
- (4) Next generation sequencing (3%)
- (5) knockout mice (3%)

3. What is microRNA? (3%)

How do microRNAs regulate gene expression? (7%)

4. What is SNP? (3%)

Please describe its importance and application in medicine. (7%)

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5. What are post-translational modifications? Give three examples and explain how they are regulated? (8%)
6. What is "Nuclear receptor"? What are the protein domain characteristics for the nuclear receptor? What is the action mechanism for nuclear receptor? (8%)
7. What are transrepression and transactivation? Briefly describe how these two actions work? (8%)
8. Draw a mitochondrion. Explain how ATP is generated. In addition to ATP generation, what other pathways are done in the mitochondria? How is mitochondrial DNA replicated and transcribed? Why reactive oxygen species (ROS) are frequently generated in mitochondria? (14%)
9. Please describe the differences between reverse transcription-PCR (RT-PCR) and standard PCR? For what purpose would you use RT-PCR? (6%)
10. Eukaryotic genomic DNA containing the AMPK gene can be cloned into plasmid that replicates in *E. coli*, but the AMPK protein is not expressed from this plasmid in *E. coli*. Briefly explain the possibilities? How can the expression of eukaryotic genes in bacteria be accomplished? (6%)