

※ 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. When the CAU anticodon of a tRNA^{Met} was modified to UAC, the anticodon for tRNA^{Val}, valine aminoacyl-tRNA synthetase recognized the altered tRNA^{Met} and added valine rather than methionine to it. When the converse modification was made, the altered tRNA^{Val} containing a CAU anticodon (rather than UAC) was recognized and activated by methionine aminoacyl-tRNA synthetase. What do these data suggest about the mechanism by which aminoacyl-tRNA synthetases recognize their cognate tRNAs? (5%)
2. Why is the elongation factor EF-Tu so important in *E.coli*? (5%)
3. Describe the mechanism by which the bacterial chaperonin GroEL promotes protein folding. (5%)
4. Describe how eukaryotic DNA replication is tied to cell division. (Hint: Think about the proteins involved) (5%)
5. What are the functions possessed by all DNA polymerases and required for replication in prokaryotic cells? (5%)
6. Transcription factor-based cellular reprogramming has opened the way to converting somatic cells to a pluripotent state, but has limitations resulting from the requirement for transcription factors and the relative inefficiency of the process. Some of studies show that miRNA and HDAC (histone deacetylase)-mediated pathways can cooperate in a power way to reprogram somatic cells to pluripotency. (9%)
 - a. Based on the nature of miRNA biology, please discuss the possible mechanism underlying the increased efficiency of miRNA-mediated reprogramming.
 - b. Why does the HDAC inhibitor enhance cell reprogramming?
 - c. During cell reprogramming, the promoters of pluripotency-associated genes would be demethylated for activation. Methylation is typically the transfer of a methyl group to a cytosine molecule in a CpG site. Please draw this methyl-cytosine.

見背面

7. Recombinant Protein expression systems are very widely used in the research of life sciences, biotechnology and medicine. Several natural inducible expression systems are directly used or modified and used for artificial expression systems. For examples, protein is expressed in E.coli by IPTG induction, and in mammalian cells by tetracycline-controlled transcription activation (Tet-off). Please describe the mechanism of these two systems. (8%)
8. Describe the methods used to identify the DNA-binding domain and activation domain in a transcriptional activator. (8%)
9. The appropriate subcellular localizations of proteins are crucial for cell survival and mislocalization of proteins may result in human diseases. List five possibilities that result in protein mislocalization. (5%)
10. Ubiquitin marks proteins for degradation in proteasomes. Describe two events that polyubiquitination regulates the cell cycle progression. (5%)
11. Organismal lifespan can be extended by genetic and pharmacological manipulations of cellular processes. Explain why caloric restriction is correlated with longevity. (5%)
12. What are the characteristics of cancer stem cells? (5%)
13. Describe an endocytic pathway for low-density lipoprotein (LDL). (5%)
14. How can you demonstrate that epidermal growth factor receptor is an integral protein? (8%)
15. Please fill in the blank with correct answers. (8%)

Types of molecule transport across plasma membrane

Transport Type	Simple diffusion	Facilitated transport	Active transport	Cotransport
Substrate/mediator	Oxygen/lipid bilayer	(a)/(b)	Na ⁺ , K ⁺ /Na ⁺ -K ⁺ pump	(c)/(d)

- (a)
- (b)
- (c)
- (d)

16. Glucose transporter 1 is expressed at highest levels in erythrocytes with a Km of 1.5 mM and glucose transporter 2 is expressed in liver and the insulin-secreting β cells with a Km of 20 mM. Blood glucose rises from its basal level of 5 mM to more than 10 mM after a meal. Please associate the property of glucose transporter 2 with the function of liver and β cells in energy metabolism. (9%)