國立成功大學

110學年度碩士班招生考試試題

編　號：314

系　所：醫學檢驗生物技術學系

科　目：分生與細胞生物

日　期：0203

節　次：第 1 節

備　註：不可使用計算機

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※ 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. Considering enzyme kinetics, please illustrate the differences between (1) competitive, (2) uncompetitive inhibition with Lineweaver-Burk plots (double reciprocal plot) and specify the impacts of the inhibitors to the Km and Vmax of an enzyme under the assumption of steady-state kinetics. (8 %)

2. Please choose the most appropriate answer for each question from the list from (1) to (10) in the panel below (6%)

a. _____a water soluble vitamin and strong antioxidant; deficiency is associated with Scurvy

b. _____a fat-soluble vitamin involved in the post-translational modification of certain proteins requiring γ–carboxylation for complete activity, such as coagulation factor II, VII, IX and X; deficiency often leads to bleeding diathesis

c. _____a fat-soluble secosteroids responsible for enhancing intestinal absorption of calcium, iron, magnesium, phosphate, and zinc; deficiency results in impaired bone mineralization and bone damage which leads to bone-softening diseases, such as Rickets and Osteomalacia

(1) Vitamin A (retinol)
(2) Vitamin B1 (thiamine)
(3) Vitamin B2 (riboflavin)
(4) Vitamin B6 (pyridoxine)
(5) Vitamin B9 (folic acid)
(6) Vitamin B12 (cyanocobalamin)
(7) Vitamin C
(8) Vitamin D
(9) Vitamin E
(10) Vitamin K

3. The genes encoding enzymes involved in tricarboxylic acid cycle (TCA cycle) are often called "house-keeping genes".

a. Please define "house-keeping gene". (2%)

b. Why are those enzymes involved in TCA cycle considered "house-keeping genes"? Please be as specific as you can. (2%)

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4. Please explain the following concepts in the field of Molecular Biology. (4%)
a. Central dogma of molecular biology
b. Operon (Please use an example to illustrate your answer)

5. Please compare between gene-knockout and gene-knockdown. (Please write down your answers by illustrating their characteristics, tools used, advantages and disadvantages with a table for comparison.) (8%)

6. List at least three types of non-coding RNAs (6%), and describe their biogenesis pathways (6%) and functions (6%).

7. What is the first mRNA vaccine approved by FDA? (4%)

8. Please describe the clinical application(s) of genetic/genomic testing (8%).

9. Please describe the "cytokine strom"' which might be the disease severity in COVID-19 (10%).

10. Please describe the structures, functions and classifications of "LIPIDS" (10%).

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11. Please read this abstract and answer the following questions:

"Adoptive T cell therapy (ACT) using ex vivo–expanded autologous tumor-infiltrating lymphocytes (TILs) can mediate complete regression of certain human cancers. The impact of TIL phenotypes on clinical success of TIL-ACT is currently unclear. Using high-dimensional analysis of human ACT products, we identified a memory-progenitor CD39-negative stem-like phenotype (CD39−CD69−) associated with complete cancer regression and TIL persistence and a terminally differentiated CD39-positive state (CD39+CD69+) associated with poor TIL persistence. Most antitumor neoantigen-reactive TILs were found in the differentiated CD39+ state. However, ACT responders retained a pool of CD39− stem-like neoantigen-specific TILs that was lacking in ACT nonresponders. Tumor-reactive stem-like TILs were capable of self-renewal, expansion, persistence, and superior antitumor response in vivo. These data suggest that TIL subsets mediating ACT response are distinct from TIL subsets enriched for antitumor reactivity." (Science 370:1328, 2020)

(A) Explain how tumor-infiltrating lymphocytes contribute to tumor regression. (5%)
(B) Describe the experiments that the authors might have performed to complete this study. (10%)
(C) Describe the impact of this study on the current knowledge. (2%)
(D) According to this abstract, please describe the potential applications in therapeutic treatment of patients with cancers. (3%)