編號： 70

國立成功大學 105 學年度碩士班招生考試試題

系　　所：生物科學與科技學院-生科聯招

考試科目：生物化學

考試日期：0228，節次：1

※ 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。

簡答題 (共七題，100 分)

1. Enzymes are biological polymers that catalyze the chemical reactions to produce various cellular functions. Please clarify the function of following enzymes: (10%)
   (a) isomerases; (b) hydrolases; (c) transferases; (d) ligases; (e) nucleases

2. Enzyme-catalyzed oxidation of organic molecules by molecular oxygen (O_2) plays important role in numerous biological functions. Please answer the following questions: (15%)
   (a) Where is the major source of reactive oxygen species (ROS) in mammalian cells?
   (b) How to examine ROS levels in cells?
   (c) What are effects of ROS on cellular functions?
   (d) What are vitamins as ROS scavengers (antioxidants)?
   (e) What's the environmental factor that induces ROS production and may also cause DNA mutation?

3. Deregulation of metabolizes of fatty acids, cholesterol and eicosanoids are highly correlated with cardiovascular diseases. Please answer the following questions: (15%)
   (a) What are the immediate substrate, the end product and the most important enzyme that involved in the pathway for synthesis of fatty acids (lipogenesis)?
   (b) What enzyme controls the rate of cholesterol synthesis?
   (c) What's effect of VLDL, LDL and HDL on cardiovascular system?
   (d) High levels of plasma free fatty acids may excite chronic inflammation by inducing production of cytokines. How to examine the expression of cytokines in plasma?
   (e) Following question (d), induction of cyclooxygenase (COX) results in enhancing inflammation response. What metabolizes of COX mediate inflammatory response? What approaches could be used to examine the expression of COX mRNA and protein?

4. Pollutants come from drinking water or air that promote the risk of chronic diseases. Therefore, the toxics (xenobiotics) should be removed from living body. Please answer the following questions: (15%)
   (a) Where xenobiotics are metabolized in the body and what enzymes take the detoxification response?
   (b) Derivatives of xenobiotics are conjugated with molecules, and they are eventually excreted in the urine or bile. What ways (types) are involved in the process of conjugation as described?
   (c) The AhR/ARNT (transcriptional factors) complex regulates the expression of detoxification enzymes. However, additional molecules should be involved in the regulation of enzymes caused by differential pollutants. How could you identify the molecules that may also regulate gene expression?
   (d) Following question (c), how to study the molecules interact with AhR/ARNT complex?
   (e) The therapeutic efficacy of drugs is determined by the function of detoxification enzymes. How to examine the function of gene that is normal or abnormal?

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5. The fasting blood glucose is the index for diabetes. Please answer the following questions: (15%)
   (a) During fasting and diabetes, the activity of following enzymes is increase or decrease? (1) pyruvate carboxylase; (2) pyruvate dehydrogenase; (3) glucokinase; (4) glucose 6-phosphatase
   (b) Diabetes accompany with insulin resistance. How blood glucose level regulates the release of insulin?
   (c) What proteins regulate the uptake of glucose into the liver?
   (d) Deregulation of enzymes such as hexokinase and pyruvate kinase has been found in many cancers. How to examine specific enzyme proteins that express in tumor tissues?
   (e) Following question (d), induction of cancer cell apoptosis or inhibition of cell proliferation is the major approach in cancer therapy. How to examine cell apoptosis and proliferation?

6. Metabolic disorders of proteins and amino acids are associated with many types of disease. Please answer the following questions: (15%)
   (a) According to the requirement of ATP consumption, where protein degradation takes place in cells?
   (b) What is the major end product of nitrogen catabolism in humans?
   (c) Which amino acids are converted to oxaloacetate, ketoglutarate and dopamine, respectively?
   (d) What types of amino acids could be phosphorylated, resulting in changing protein functions?
   (e) What enzymes could regulate the status of protein phosphorylation?

7. Chromosome structure is correlated with genes expression. Please answer the following questions: (15%)
   (a) What kind of histone modification improves chromosome relaxation?
   (b) How to deplete genes in cells?
   (c) What the enzyme relieves torsional strain that results from helicase-induced unwinding?
   (d) What nucleotides are involved in DNA synthesis? And how to examine DNA synthesis in cells?
   (e) How to repair DNA damage induced by UV-light?