

1. The whole DNA base pair of human genome was sequenced and analyzed completely in 2003. It was surprising that only 20000-25000 genes could be identified. Hence, the roles of posttranslational modifications in protein biosynthesis, regulation, and function have become very important. Please describe five kinds of posttranslational modification and explain the function of these modifications briefly. (25 points)
2. Describe the "Tumor marker", and its applications in cancer diagnosis (10 points)
3. Design experiments to find novel tumor markers (15 points)
4. What is "dyslipidemia"? Describe the etiology, diagnostic criteria and treatment of two types of dyslipidemia. (10 points)
5. Assume that mitochondria are cylinders 1.5 μm in length and 0.6 μm in diameter. (5 points)
 - (a) What is the volume of a single mitochondrion?
 - (b) Succinyl-CoA is an intermediate in the citric acid cycle, an important metabolic pathway localized in the mitochondria of eukaryotic cells. The concentration of succinyl-CoA in mitochondria is about 0.05 μM . How many molecules of succinyl-CoA are in a single mitochondrion?
6. What is "one-gene, one-enzyme hypothesis"? Based on your current knowledge, please correctly restate that hypothesis and provide the rationale for your answer in detail. (5 points)
7. Please answer the following questions based on your understanding in Krebs cycle in carbohydrates metabolism. (7 points)
 - a. Complete the following reaction and name the enzyme complex that catalyzes it.
$$\text{Pyruvate} + \text{CoA} + \underline{\hspace{1cm}} \rightarrow \underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \text{CO}_2$$
 - b. This enzyme complex (in your answer above) uses five coenzymes. Name the coenzymes.
 - c. The Krebs cycle is also known as TCA (tricarboxylic acid) cycle. Identify the tricarboxylic acids in the cycle.

(背面仍有題目,請繼續作答)

8. A physician prescribed 5 mg standard dose of oral anticoagulant: warfarin to two patients. However, one patient developed severe hemorrhage and died in one week. Explain it and give your suggestion for improvement. (5 point)
9. During your PCR reactions, you got
- (1) many longer un-specific products found, what can you do to improve it;
 - (2) many shorter un-specific products found, what can you do to improve it;
 - (3) the PCR product was weak, is there a way to increase the yield?
- (please choose 2 questions to answer; 5 points)
10. Match the columns based on your knowledge on DNA replication. (8 points)
- | | |
|-------------------------------|---|
| a. DNA gyrase | 1. Joins 3' hydroxyl to 5' phospho |
| b. Helicase | 2. ATP-dependent dsDNA unwinder |
| c. Leading strand | 3. RNA polymerase |
| d. Lagging strand | 4. Okazaki fragments |
| e. Primase | 5. Attaches holoenzyme to template |
| f. beta-subunit of DNA polIII | 6. 3' end toward replication fork |
| g. DNA ligase | 7. Type II topoisomerase |
| h. SSB | 8. Blocks DNA secondary structure formation |