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1. Please describe several methods that can detect single nucleotide polymorphism (SNP) in an organism. (10%)

2. Please describe several methods that can identify a specific microorganism. (10%)

3. Define post-translational modification (PTM). List 3 types of PTM. (5%)

4. Define real-time reverse-transcription PCR. (5%)

5. Assume X genetic disease is caused by loss of function in the X factor. Several molecular mechanisms have been reported to cause X disease. These mechanisms are **chromosomal translocation**, **microdeletion**, **point mutation**, **promoter inactivation**, and **defect in nuclear transportation**. Now you are assigned to find out the molecular cause of the X disease in a patient, how would you do it? (That is, what experiments should you perform to clarify the molecular cause of this disease?) (10%)

6. Please describe "oxidative stress" and its related diseases. (10%)

7. What's 3'-UTR? Please describe a possible regulator of 3'-UTR and its modes of action. (10%)

8. Protocols for ethanol precipitation of very small quantities of DNA often include the addition of glycogen to act as a carrier. Typically, the ethanol precipitation is carried out by adding two volumes of 95% ethanol to a solution of salty DNA at 4 °C.
   (1) Explain why glycogen will precipitate under these conditions. (2%)
   (2) What properties of the two polymers, DNA and glycogen, make them behave in a similar manner under these conditions and why is salt needed? (4%)

（背面仍有題目，請繼續作答）

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9. How a single nucleotide mutation in a protein-encoding gene might affect this protein? Please list at least four possibilities that you can think of and briefly explain the underlying mechanisms. (8%)

10. Regarding lipid biosynthesis:
    (1) What are the immediate source of carbons for fatty acid biosynthesis? (2%)
    (2) What is the role of the citrate-malate-pyruvate shuttle? (2%)
    (3) Why do mammals require certain essential fatty acids in their diet? (2%)

11. There is an "A" gene, which suspects to recognize pathogenic *E. coli* on macrophage. Please describe how to clone this gene and express it in mammalian cells (10%), including what kind of cloning vector you will use. And further design experiments to demonstrate the biological function by using the construct you cloned above (10%).

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