考生注意事項：所有考題務必在答案卷上依序作答，在問題卷上作答者不計分。

1. Describe the regulation of cell cycle G2/M transition in eucaryotic cell. (10%)

2. Describe the types of post-translational modification in protein of eucaryotes, and give one example to explain its importance. (10%)

3. Describe the major pathways of protein degradation pathways in eucaryotes, and give one example to explain its importance. (10%)

4. Describe the effects of protein localization on its function in eucaryotic cell, and give one example to explain its importance. (10%)

5. Tom Jones, who has been free of gout symptoms since starting the xanthine oxidase inhibitor allopurinol, picked mushrooms in a wooded area near his home. A few hours after eating one small mushroom, he experienced mild nausea and diarrhea. He went to the hospital emergency room, where a poison expert identified the mushrooms as *Amanita phalloides* (the "death cap"). This kind of mushrooms contains a toxin, which initially causes gastrointestinal disturbances, then electrolyte imbalance and fever, followed by liver and kidney dysfunction. Between 40% to 90% of the individuals who ingest the toxin die within a few days. Tom weighs about 90 kg. An average-size mushroom weighs about 50 g and contains about 7 mg of the toxin. The LD_{50} (the oral dose that kills 50% of those who ingest the toxin) is 0.1 mg/kg body weight).

   (a). What is the toxin called? (4%)

   (b). What is the mode of action of this toxin? (3%)

   (c). Is Tom Jones likely to survive his mushroom poisoning? (3%)

6. Susan Gray, a 28-year-old computer programmer, notes increasing fatigue, pleuritic chest pain, and a nonproductive cough. In addition, she complains of joint pains, especially in her hands. A maculopapular erythematous rash on both cheeks and the bridge of her nose ("butterfly rash") has been present for the last 6 months. Initial laboratory studies reveal a subnormal white blood cell count, a mild reduction in hemoglobin, and proteinuria with a slight increase in serum creatinine. Tests were performed on Susan's blood to determine if antibodies to a number of nuclear and cytoplasmic antigens were present. The tests were strongly positive and, in conjunction with her symptoms, lead to a diagnosis of systemic lupus erythematosus (SLE).

(背面仍有題目,請繼續作答)

(a). In this disorder, the body makes antibodies against many of its own components. What are the targets of these antibodies? (5%)

(b). Among these targets, which are related to the maturation of mRNA? Describe their functions and structures as a complex. (5%)

7. Annie Davidson is a 4-year-old girl of Mediterranean ancestry whose height and body weight are below the 20th percentile for girls of her age. She is spiritless, tires easily, and complains of anorexia (dislike of eating) and shortness of breath on exertion (using bodily or mental power). A dull pain has been present in her right upper quadrant for the last 3 months. Her skin color is bluish-gray, and she appears pale. Initial laboratory studies reveal a severe anemia with a hemoglobin of 6.2 g/dl (normal range 12-16 g/dl). A battery of additional hematological tests reveal that Annie has thalassemia, intermediate type.

   (a). What is the disease of thalassemia, the single most common gene disorders in the world? (5%)

   (b). What kinds of the mutations affecting the synthesis of hemoglobin may be the cause of Annie's disease? (5%)

8. Please describe the structure and property of DNA double helix, and its biological implications. (10%)

9. Please describe the differences between prokaryotic and eukaryotic DNA replication, and the biological function of proteins required for prokaryotic and eukaryotic DNA synthesis. (10%)

10. Please describe the DNA lesions and their causes that require repair, and the repairing system that is used for repair of a T residue arising when 5-methylcytosine (^{me}C) in a CpG sequence is deaminated. (10%)