

注意事項：不必抄題，但須依題號依序作答。

Answer all the following questions:

- (1)
 - a) Describe the structure of a lysosome and peroxisome? What are their roles in eukaryotic cells? (8%)
 - b) How are large molecules transported across the cell membrane? (5%)
 - c) Describe two classes of proteins known to be involved in regulation of the cell cycle. (4%)

- (2)
 - a) What is the transposon, and who first proposed their existence? (5%)
 - b) How many different kinds of gametes can be produced by a individual with the genotype AABbCCddEeFf? (3%)
 - c) What are the sources of genetic variation? (4%)
 - d) What is meant by "one gene is epistatic to another"? (4%)

- (3)
 - a) Using sickle-cell anemia as an example, how can a lethal recessive gene be maintained in a population? (5%)
 - b) In your own words, what is the neutral theory of molecular evolution? (5%)
 - c) What is relative fitness? What role does it play in adaptive evolution? (4%)

- (4)
 - a) What type of experiments did Beadle and Tatum perform with *Neurospora*? How did they demonstrate the relationship between genes and enzymes? (6%)
 - b) What determines the primary structure of a protein? How must a polypeptide chain be modified before it can be a fully functional protein? (6%)
 - c) Describe the methodology used in site-directed mutagenesis. (5%)

- (5)
 - a) What are possible patterns of viral genome replication? What are the functions of RNA replicase and reverse transcriptase? (6%)
 - b) What is the difference between generalized transduction and specialized transduction? (6%)

(背面如有題目,請繼續作答)

- (6) a) Suppose you wanted to produce human insulin (a peptide hormone) by cloning. Assume that this could be done by inserting the human insulin gene into a bacterial host, where, given the appropriate conditions, the human genes would be transcribed then translated into human insulin. Which do you think it would be best to use as your source of the gene, human genomic insulin DNA or a cDNA copy of this gene? Explain your choice. (4%)
- b) A cloned DNA sequence was used to probe a Southern blot. There were two DNA samples on the blot, one from white blood cells and the other from a liver biopsy of the same individual. Both samples had been digested with *Hpa* II. The probe bound to a single 2.2 kb band in the white blood cell DNA, but bound to two bands (1.5 and 0.7 kb) in the liver DNA. Is this difference likely to be due to a somatic mutation in a *Hpa* II site? Explain. (3%)
- How would it affect your answer if you knew that white blood cell and liver DNA from this individual both showed the 2 band pattern when digested with *Msp* I? (3%)
- (7) How is antisense technology used to fight viral infection? (4%)
- (8) Describe the following terms in biology: (10%)
- a) Lyon hypothesis
 - b) Chaperone
 - c) Transient expression
 - d) Polysomes
 - e) Arabidopsis