1. Please 1) define the central dogma of molecular biology, 2) list the major protein machinery and its components involving each process of this dogma, and 3) name two exceptions to this dogma and discuss their biological functions. (15 %)
2. Please 1) list two types of animal cell death and 2) describe at most five of their characteristics for each type of cell death, and 3) discuss their differences and biological functions in the aspect of animal development. (10 %)
3. Protein –DNA interactions or Protein-RNA interactions are common molecular events in regulating cellular gene expression. Please describe at least three different methods that can detect those molecular interactions and state the principles behind them. Moreover, how the identity of the protein involved is revealed. Using examples to illustrate your points is encouraged. (10 %)
4. One graduate student is studying the molecular pathogenetic mechanism of a disease. From genetic linkage mapping, microsatellite analysis and studies of other molecular genetic markers, he has narrowed down the region that may harbor the disease gene. Within this region, he has identified several candidate genes that may associate or may be involved in the pathogenesis of disease. Please describe what sorts of experiments that he need to do before confirming that indeed the disease allele is associated with the disease, including the phenotype and pathogenetic mechanism. (10 %)
5. Please explain the detail of any bacterial toxin in molecular mechanism and cell biology level? (10%)
6. Please explain the detail of secretion systems in pathogenic bacteria? (10 %)
7. How many cell types are there in the central nervous system? Please explain the function of each cell type. (10 %)
8. Please describe the anatomical vulnerability and the pathogenesis of Alzheimer's disease. (10 %)
9. There is only one choice for each of the following questions. (15 %)

   (1) Which one of the statements about the application of gene cloning is false? (5%)

   A. Large amounts of recombinant protein can be produced by gene cloning.
   B. DNA fingerprinting is used to detect bound to DNA
   C. Cloned genes can be used to detect carriers of disease-causing genes
   D. Gene therapy attempts to correct disorder by deriving a good copy of a gene to a patient
   E. Genetically modified organisms have been used to produce clinically important proteins

   (2) Which one of the following statement about the gene mapping techniques is true? (5%)

   A. S1 nuclease mapping determines the nontranscribed regions of a gene.

(背面仍有題目,請繼續作答)

B. Primer extension determines the 3`-end of a transcript.

C. Gel retardation can show whether DNA can bind to and retard the migration of a protein fragment through an agarose gel.

D. DNase I footprinting determines where, on a DNA fragment, a protein binds

E. The function of DNA sequences in the promoter of a gene can be determined if they are ligated downstream of a reporter gene and then assayed for expression.

(3) Which one of the following statements about PCR is false? (5%)

A. The PCR cycle involves denaturation of the template, annealing of the primers and polymerization of nucleotides

B. PCR use thermostable DNA polymerases.

C. Ideally, PCR primers should be of similar length and G-C content.

D. PCR optimization usually includes varying the magnesium concentration and the polymerization temperature.

E. If PCR was 100 % efficient, one target molecules would amplify to 2^0 after n cycles.