

一、選擇題：單選題，1-10 題，每題 1.5 分。11-15 題，每題 2 分。請於選擇題作答區作答。

(單選題，1-10 題，每題 1.5 分)

1. What is the major difference in immunoglobulin gene between liver cells and B cells?
(A) Composed of deoxyribonucleic acid
(B) DNA forms double helix
(C) Its replication is semiconservative
(D) DNA rearrangement is occurred in B cells
(E) Point mutation, deletion and insertion change the sequence of DNA.
2. Which method is not applied to detect the level of gene expression?
(A) Northern blot
(B) RT-PCR
(C) Western blot
(D) Gene array (gene-chip) assay
(E) DNA sequencing.
3. The genetic code is triplet. Which of the following is incorrect?
(A) UCC is STOP
(B) AUG is Met
(C) UAA is STOP
(D) UGA is STOP
(E) UAG is STOP.
4. Three different types of RNA are involved in the synthesis of protein. Which of the following description is incorrect?
(A) They are mRNA, tRNA and rRNA.
(B) tRNA contains an anticodon.
(C) tRNA contains T ψ C arm, E arm and extra arm.
(D) Eukaryotic mRNA is capped at the 5' end.
(E) mRNA is polyadenylated by poly(A)-polymerase at the 3' end.
5. Which of the following description is incorrect for the stages of bacterial protein synthesis?
(A) Initiation step involves the 30S and 50S ribosome subunits that bind to the mRNA.
(B) Initiation complex contains the first aminoacyl-tRNA.
(C) Protein chain extends by transferring from aminoacyl-tRNA to peptidyl-tRNA during elongation step.
(D) Termination step is to release the polypeptide chain from tRNA and dissociate ribosome from mRNA.
(E) Energy is provided by the hydrolysis of GTP during protein synthesis.

接背面

6. Cytosolic proteins are degraded by proteasomes. Which of the following description is incorrect?
- (A) Ubiquitin is first linked to E1.
 - (B) Ubiquitin is then transferred from E1 to E2.
 - (C) E2 or E3 select protein substrate to be degraded.
 - (D) Ubiquitin is link to the target protein by hydrogen bond.
 - (E) Formation of polyubiquitin is a signal for the proteasome to degrade the target protein.
7. Which of the following feature of bacterial promoter is not true?
- (A) The startpoint is usually a purine.
 - (B) -10 sequence is a consensus hexamer TATAAT.
 - (C) -35 sequence is a consensus nonamer TTGACACAC.
 - (D) The distance separating the -35 and -10 sites is mostly 16-18 bp.
 - (E) Mutations in the promoters affect the level of gene expression.
8. Which of the following statement is not true about lactose and tryptophan pathways?
- (A) The lactose pathway operates by induction.
 - (B) Inducer β -galactoside activates the repressor to bind to the promoter.
 - (C) The tryptophan pathway operates by repression.
 - (D) Tryptophan activates the repressor to bind to the promoter.
 - (E) None of above.
9. Which of the following description about phage is incorrect?
- (A) The lytic pathway of phage involves the production of phage particles, lysis of the host cell and release of the viruses.
 - (B) The phage genome is integrated into the host chromosome in the lysogenic pathway.
 - (C) Lysogeny vs. lysis is a delicate balance.
 - (D) Antiterminator Q is required for the lysogenic pathway of lambda.
 - (E) Lysogeny is maintained by an autogenous circuit.
10. Which of the following feature of retroviruses is incorrect?
- (A) Retroviruses have genomes of single-stranded RNA.
 - (B) The genome of retroviruses contains the *gag*, *pol* and *env* genes.
 - (C) The Gag and Env components are involved in packing RNA and generating the virion.
 - (D) The Pol components are involved in nucleic acid synthesis.
 - (E) Reverse transcriptase is generated from *gag* gene.

(單選題，11-15 題，每題 2 分。)

11. Which enzyme can modify histone by addition of acetyl groups, and may be associated with activation of transcription?
- (A) HAT
 - (B) HDAC
 - (C) Helicase
 - (D) Gyrase
 - (E) Exonuclease.

12. Which enzyme(s) mediate(s) the rearrangement of V, D, J gene segments?
- (A) Protein tyrosine kinase
 - (B) RAG1 and RAG2
 - (C) RecA
 - (D) NF κ B
 - (E) NFAT.
13. Which of the following is not involved in protein trafficking?
- (A) ER and Golgi
 - (B) Cdc2 and Cdc13
 - (C) Cargo
 - (D) Endosomes and lysosomes
 - (E) COP-I and COP-II.
14. Which of the following description about p53 is incorrect?
- (A) Wild-type p53 is required to restrain cell growth.
 - (B) Cell growth is unrestrained in the absence of p53.
 - (C) Mutant p53 can lead to unrestrained cell growth.
 - (D) Damage to DNA triggers activation of p53.
 - (E) The p53 can prevent apoptosis.
15. Which of the following is not an antigen-mediated receptor pathway in immune system?
- (A) IFN γ receptor pathway
 - (B) Toll-like receptor pathway
 - (C) NK cell receptor pathway
 - (D) T cell receptor pathway
 - (E) B cell receptor pathway.

二、解釋名詞、問答題：請作答於非選擇題作答區。

1. 解釋名詞：(10 分)

- A. Heterochromatin
- B. NF- κ B
- C. Si RNP
- D. Homologous recombination
- E. Ubiquitin

2. 請說明當細胞表面上之 death receptor, Fas, 受到其 ligand, FasL 刺激因而造成細胞凋亡(apoptosis)時, 這些經由 FasL 造成細胞凋亡的訊息是如何經由 Fas 而傳遞至細胞內? 以及它是如何受到調控? (9 分)

3. 請說明當一個蛋白質經由細胞內合成後到表現在細胞表面上時所需經過的醣化(glycosylation)過程。(6 分)

接背面

4. 請舉出在 eukaryotic cells 兩種 transposal elements (mobile DNA elements) 並說明其移動方式。(7 分)
5. 簡述 nuclear pore complex 的結構，並說明蛋白如何經由 nuclear pore complex 進入核中。(7 分)
6. 在 eukaryotic cells 中被 RNA polymerase I, II, III 所 transcribe 的基因有何不同？(5 分)
7. 解釋 yeast 2-hybrid system 的原理。(6 分)
8. Please write down the correct sequences (one point each)

If the coding strand of genomic sequence is 5'-AATTGGCC-3'

The mRNA sequence is 5'-_____①_____3'

The antisense sequence is 5'-_____②_____3'

The PCR Primer sequence to amplify this region is 5'-_____③_____3'

The SiRNA sequence to silence this region is 5'-_____④_____3'

The cDNA sequence is 5'-_____⑤_____3'

9. Cytokine are important effector molecules in modulating immune response. Upon cytokine stimulation, JAK-STAT signaling pathway is activated which leads to the transactivation of downstream genes, resulting in cell growth, proliferation or differentiation. In this pathway, STATs are transcriptional factors which will eventually trigger the expression of downstream genes. To study the role of STAT2, a member of STATs, in interferon (IFN)-mediated response, cells were transfected with wild type or mutant STAT2 lacking C-terminus (STAT2-811-814A) in combination with a reporter gene and then treated with IFN. The reporter gene is under the control of the promoter of ISG54, an IFN-responsible gene. The effect of wild type or mutant STAT2 on the induction of the reporter gene is shown in the following figure.

- A. Please describe how JAK-STAT pathway is activated by the binding of cytokine to its receptors. (4 points)
- B. Please describe, at the molecular level, how a transcriptional factor like an activated STAT induces transcription of a gene such as ISG54, after IFN treatment. (8 points)
- C. Please interpret the results of the following figure (5 points) and make conclusions (3 points).

