

本試題是否可以使用計算機: 可使用, 不可使用 (請命題老師勾選)

Part I 單選題共 15 分:

1. A mutation that causes the replacement of one amino acid by another in the mutated gene product is called? (2.5 points)
 - A. Non-sense mutation
 - B. Frameshift mutation
 - C. Amber mutation
 - D. Silent mutation
 - E. Missense mutation
2. Which of the following immunoglobulins is the first antibody produced in reaction to an antigen during an immune response? (2.5 points)
 - A. IgM
 - B. IgG
 - C. IgA
 - D. IgE
 - E. IgD
3. Plasma proteins exist in blood and are important to many physiological functions. Which of the following is NOT what the plasma proteins involve to? (2.5 points)
 - A. Buffering capacity of the blood
 - B. Blood clotting
 - C. Binding and transportation of certain hormones in the blood
 - D. Retention of fluid in the blood vessels
 - E. Transportation of O₂ in the blood
4. Which of the following is NOT what saliva does? (2.5 points)
 - A. Facilitates speech
 - B. Carries out antibacterial effects
 - C. Contributes to oral hygiene
 - D. Facilitates absorption of glucose across the oral mucosa
 - E. Involved in digestion of carbohydrate
5. Which virus is RNA virus? (2.5 points)
 - A. Parvovirus
 - B. Adenovirus
 - C. Human immunodeficient virus
 - D. Poxviru
 - E. Herpesvirus

(背面仍有題目,請繼續作答)

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6. Which is the most likely pathogen able to infect stomach to cause ulcers? (2.5 points)

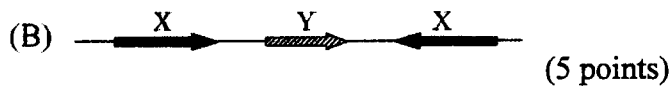
- A. *E. coli*
- B. *Helicobacter pylori*
- C. *Vibrio Cholerae*
- D. *Mycobacterium tuberculosis*
- E. *Salmonella typhi*

Part II: 問答題共 85 分

1. Please explain briefly the following terms:
(A) Oncofetal gene; (B) Oncofetal protein; (C) Oncofetal antigen. (10 points)
2. Funk Biotechnology Institute cloned a gene named JMBN. Its gene product was found to be a transmembrane protein with N-terminal extracellular and C-terminal cytoplasmic domains. Immunohistochemistry shows that JMBN was overexpressed in 10 of 30 lung cancer samples. A549 cells (a lung cancer cell line) also overexpress JMBN mRNA and protein. Knocking down the expression of JMBN in A549 cells by RNAi approach resulted in increased cell proliferation rate ($p=0.008$).
(A) Please state 2 hypotheses that may explain the above findings.
(B) Please describe the experiments you may want to perform to test your hypotheses. (Assuming everything you need is there). (10 points)
3. Draw the general formula of the amino acid and draw the structure of a tripeptide made of three residues of alanine (5 points). Describe general and specific ways by which polypeptides are degraded within cells (5 points).
4. Describe the roles of RNA in the biological world (10 points).
5. Shortening of telomeres during rounds of replication causes dividing arrest of normal mammalian cells in culture. Describe the structure and function of a telomere of eukaryotic chromosomes (10 points) and the reasons cause shortening of telomeres during DNA replication when culturing normal cells (5 points).
6. Please describe what are the primary, secondary, tertiary, and quaternary structures of proteins (10 points)?

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7. Genome reorganization happens usually through homologous recombination. In the following case (A), two copies of X gene and one Y gene are located in a genomic fragment. The two X genes are orientated in the same direction. In another case (B), a genomic fragment also contains two X genes and one Y gene, but the X genes are orientated in opposite directions. Please draw pictures to describe the gene organization in the genomic fragments after one homologous recombination happens in each case. (The arrows indicate the genes and their orientation in the genome)



8. The following sequence is the coding strand of a bacterial genomic DNA fragment that encodes the 5' end of an open reading frame (ORF) and its upstream sequence. The Shine-Dalgarno sequence of the ORF is 5'-AGGAGG-3'. The first amino acid at the N-terminal end of the protein encoded in the ORF is Met (methionine).

1 10 20 30 40 50
 5'-ACTTACCATG AGGAGGATTA CCCCATGACC ATAATTACGG ATTCACTGGC-3'

Please show (A) The sequence of the first five 5'-end nucleotides of the mRNA transcribed from the DNA fragment (5 points), (B) the sequence of the first five N-terminal amino acids of the protein encoded by the ORF (5 points).

RNA codon table

Ala	GCU, GCC, GCA, GCG	Leu	UUA, UUG, CUU, CUC, CUA, CUG
Arg	CGU, CGC, CGA, CGG, AGA, AGG	Lys	AAA, AAG
Asn	AAU, AAC	Met	AUG
Asp	GAU, GAC	Phe	UUU, UUC
Cys	UGU, UGC	Pro	CCU, CCC, CCA, CCG
Gln	CAA, CAG	Ser	UCU, UCC, UCA, UCG, AGU, AGC
Glu	GAA, GAG	Thr	ACU, ACC, ACA, ACG
Gly	GGU, GGC, GGA, GGG	Trp	UGG
His	CAU, CAC	Tyr	UAU, UAC
Ile	AUU, AUC, AUA	Val	GUU, GUC, GUA, GUG
Stop codon	UAG, UGA, UAA		