編號：G 510 / 508　系所：醫學檢驗生物技術學系甲組 乙組　科目：生命科學

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）

一、選擇題：(9%)

1. Allele T (long tongue) exhibits incomplete dominance over the recessive allele t (short tongue). A heterozygote for the tongue gene would have: (1%)

A) a long tongue.
B) a short tongue.
C) a tongue that changes length.
D) a tongue of intermediate length.

2. A, B, and C are linked genes. Recombination between A and B is 3%; between A and C is 6%; and between B and C is 9%. What is the order of these genes on the chromosome? (2%)

A) A-B-C　B) A-C-B　C) B-C-A　D) B-A-C

3. In genomic imprinting, the expression of a genetic disorder depends on: (2%)

A) the age of the mother when she became pregnant.
B) the sex of the child.
C) whether the trait is X-linked or autosomal.
D) which parent transmits the disease-causing allele.

4. A man and a woman are both carriers for two autosomal recessive disorders, PKU (chromosome 12) and cystic fibrosis (chromosome 7). If they have a daughter, what is the probability that she will have PKU but not CF? (2%)

A) 3/4　B) 9/16　C) 3/16　D) 1/2

5. In a pedigree, autosomal recessive traits tend to: (2%)

A) occur in every generation.
B) affect only males.
C) be passed on only by females.
D) skip generations.

二、選擇題：(9%)

1. A man with mental retardation was found to have deletions at the short arm of chromosome 4 by light microscope. What is the minimal size of genome loss in this man?

(A) 5×10^7 base pairs
(B) 10^4 base pairs
(C) 10^2 base pairs
(D) 1 base pair
(E) None of the above

2. A boy with birth defect and immune deficiency was found to have a normal male karyotype. Fluorescence in situ hybridization (FISH) was performed using a probe specific to a region at chromosome 22. The probe was labeled with a red fluorescence dye. He was found to have deletion of chromosome 22 by the probe. What is the

(背面仍有題目,請繼續作答)

minimal size of genome deleted in this man?
(A) 5×10^7 base pairs
(B) 10^4 base pairs
(C) 10^2 base pairs
(D) 1 base pair
(E) None of the above

3. For chromosome analysis, the cell cycle should be arrested at which stage?
(A) G1
(B) S
(C) G2
(D) M
(E) None of the above

4. For diagnosis of a single base pair change in the hemoglobin gene, which of the following methods is the most appropriate?
(A) Chromosome analysis
(B) Fluorescence in situ hybridization
(C) Sequence analysis
(D) Comparative genomic hybridization
(E) cDNA microarray

5. The size of human genome and estimated number of coding genes in the human genome are
(A) 3×10^9 and 30,000, respectively
(B) 3×10^8 and 30,000, respectively
(C) 3×10^9 and 100,000, respectively
(D) 3×10^{10} and 80,000, respectively
(E) None of the above, respectively

6. What is the appropriate method for diagnosis of gene deletions (about 20 kilobases in size)
(A) Junctional PCR (PCR across the deletion junction)
(B) Southern blot analysis
(C) Pulse field gel electrophoresis
(D) Polyarylamide gel electrophoresis
(E) A and B

7. What is the appropriate method to detect deletion or duplication of genome of approximately 1 megabases
(A) Chromosome-based comparative genomic hybridization
(B) Array-based comparative genomic hybridization
(C) Fluorescence in situ hybridization
(D) Southern blot analysis
(E) B and C

8. What is the most appropriate method to detect changes of gene copy number in interphase cells
(A) Cytogenetic analysis
(B) Fluorescence in situ hybridization
(C) Methylation-specific PCR
(D) RT-PCR
(E) Comparative genomic hybridization

9. Which of the following is the mechanism of autosomal dominant inheritance
(A) Dominant negative effect
(B) Haploinsufficiency
(C) Gain of function
(D) All of the above
(E) None of the above

三、In a recent report, it said "Wealthy Asian people are being warned by doctors to note a growing number of hepatitis diseases, as nearly one in every 10 Chinese is a hepatitis B virus carrier. The high incidence of hepatitis is attributed by transmission routes and life styles with an increase in intake of alcohol and animal fat in diet". Please describe the strategies on how to prevent, control and treat hepatitis B virus infection. (9%)

四、What is the definition of stem cells? What is cancer stem cell? Why is the study of cancer stem cell important in cancer biology? （9%）

五、You are working in a pharmaceutical laboratory producing new antibiotics for human and veterinary use. One compound with potential value functions by inhibiting the action of prokaryotic ribosomes. The compound, however, was

（背面仍有題目,請繼續作答）

shown to inhibit the growth of animal cells in culture. What is (are) the possible explanation for its effect on animal cells? (9%)

六、 Define "operon", and describe the negative control mechanism of the lactose operon in bacteria. (9%)

七、The outcome of Human Genome Project reveals that there are approximately 20,000-25,000 genes in human DNA. However, it is estimated that more than 25,000 types of protein are required for maintaining a normal and functional physical condition in human. Please describe **four** mechanisms by which more than one biological function(s) can be accomplished by the products of a single gene. (9%)

八、Clinical and epidemiologic studies have suggested an association between infectious agents and chronic inflammatory disorders, e.g. atherosclerosis, arthritis and cancer. Better understanding of microbial pattern-recognition receptors and innate immune signaling pathways of the host is helping to elucidate the connection between microbial infection and chronic disease.
(1) Please give two pathogens (one bacteria and one virus) which are associated with tumor formation. (2%) (2) Please describe two kinds of cells involved in innate immunity. (3%) (3) Please explain **the rationale and the interaction** of innate immunity, infection and chronic disorders. (4%)

九、Influenza A (H5N1) virus causes severe disease in humans and poses a pandemic threat. Describe the molecular basis for this high pathogenicity of the virus. (9%)

十、What are the applications of metabolomics in the life sciences? Describe the main platforms used in the metabolomics? (10%)

十一、Please describe the pathogenesis of pulmonary tuberculosis briefly.(9%)