

國立嘉義大學 99 學年度
生化科技學系碩士班招生考試試題

科目：分子生物學

1. Define the following terms: (25%)

- (1) Holliday junction
- (2) Klenow fragment
- (3) Okazaki fragment
- (4) Kozak's rules
- (5) Shine-Dalgarno Sequence

2. Match each term on the left with a statement on the right (25%)

<i>Term</i>	<i>Statement</i>
(1) Gene	a. Has no effect on phenotype in a heterozygote
(2) Allele	b. A variant for a character
(3) Character	c. A cross between individuals heterozygous for a single character
(4) Trait	d. An alternative version of a gene
(5) Recessive allele	e. Having two different alleles for a gene
(6) Genotype	f. A heritable feature that varies among individuals
(7) Phenotype	g. An organism's appearance or observable traits
(8) Heterozygous	h. A cross between an individual with an unknown genotype and a homozygous recessive individual
(9) Testcross	i. The genetic makeup of an individual
(10) Monohybrid cross	j. A heritable unit that determines a character; can exist in different forms

3. (1) On chromosome 22 (4.8×10^7 base pairs), there are about 700 genes. If the average size of the genes is 19,000 base pairs, each gene on average contains 5.4 exons, and the average size of the exons is 266 base pairs. (i) Calculate the fraction of nucleotides in a gene that will be present in mRNA? (ii) What the fraction of the chromosome that is occupied by genes? (iii) Propose a simple procedure that would help us to establish the intron/exon structure of a gene. (9%)
- (2) How many different DNA fragments would you expect to obtain if you completely digest a bacterial genomic DNA (4×10^6 nucleotide pairs) with *Hae*III (4-base recognition site)? or with *Eco*R I (6-base recognition site)? (6%)
- (3) Which of the following statements are correct? For the incorrect statements, correct them specifically (hint: the correction should not be simply from “can” to “cannot”, or from “is” to “isn't”). (10%)
 - (i) Restriction endonucleases cut DNA at specific sites that always located between genes.
 - (ii) DNA migrates toward the positive electrode during electrophoresis.
 - (iii) DNA ligase can join two DNA fragments with protruding end on one fragment and blunt end on the other.
 - (iv) In situ hybridization can be used to locate nucleic acid sequences in cells or on chromosomes.
 - (v) DNA microarray is an application of restriction nuclease cleavage of DNA.
4. Anti-cancer Drug A could decrease protein X expression in breast cancer cells lines. Our hypothesis is the protein X could be regulated by Drug A in the transcriptional levels and post-translational levels.
 - (1) Please describe experiments to verify the hypothesis. (10%)
 - (2) We assume protein X is an oncogene. Protein X is overexpressed in breast cancer. Give an example for oncogene activation. (10%)
 - (3) Describe the techniques to knockdown Protein X expression. (5%)