一、配合題 (20%, 2% each)

A. Selection differential
B. Trade-off
C. Vertical transmission
D. Sister species
E. Biological species
F. Competitive exclusion
G. Chimeric gene
H. Gene family
I. Macroevolution
J. Microevolution

____ 1. Two or more loci with similar nucleotide sequences that have been derived from a common ancestral sequence
____ 2. The difference between the mean character value in a population before selection, and in the subset of individuals that survive and reproduce
____ 3. Extinction of a population due to competition with another species
____ 4. Two species that are derived from an immediate common ancestor, and are one another's closest relatives
____ 5. Slight, short-term evolutionary changes within species
____ 6. The evolution of substantial phenotypic changes, usually great enough to place the changed lineage and its descendants in a distinct genus or higher taxon
____ 7. A group of populations within which genes are actually exchanged by inter-breeding, and which are reproductively isolated from other such groups
____ 8. The existence of both a fitness benefit and a fitness cost of a mutation or character state, relative to another
____ 9. A gene that consists of parts of two or more different ancestral genes
____ 10. Movement of genes of symbionts by transmission from parents to their offspring

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二、單選題 (15%, 3% each)

____ 1. In a quantitative trait with no correlation with other traits, the response to selection in one generation is proportional to:

(A) Mutation rate

(B) Genetic variance of the trait

(C) Environmental variance of the trait

(D) Mean trait value of the population

____ 2. Which of the following may have the fastest evolution rate?

(A) Amino acids

(B) Non-synonymous sites

(C) Synonymous sites

____ 3. In a type of sexual selection, a male display character and female preference for the character strengthen each other so that both evolve to be more extreme. This is called:

(A) Paradox of sexual selection

(B) Cost of sexual selection

(C) Runaway sexual selection

(D) Muller's Ratchet

____ 4. A gene has function A and B. After gene duplication and mutation, its copy I retains function A and copy II retains function B. This is called:

(A) Sub-functionalization

(B) Neo-functionalization

(C) Gene conversion

(D) Chimeric genes

____ 5. Which of the following is NOT a trade-off?

(A) Higher fecundity is associated with lower survival

(B) Strong correlation exists between parental and progeny height

(C) A mutation that is beneficial in one trait but bad in another trait

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三、名詞解釋 (30%, 3% each)

1. Meiotic drive
2. Pleiotropic effect
3. Phenotypic plasticity
4. Inbreeding depression
5. Heritability
6. Kin selection
7. Adaptation
8. Polymorphism
9. Maternal effect
10. Locus

四、問答題 (35%)

1. Explain the Dobzhansky-Muller model of hybrid incompatibility (5%)

2. Premating barrier of gene flow: please give one example in **animals** and one example in **plants**. (5%)

3. Using human as an example, please explain the terms **haploid**, **diploid**, and **polyploid** and how many chromosomes exist in a cell in each case. (5%)

4.

	A_1A_1	A_1A_2	A_2A_2
Observed	187	114	19

The genotype frequencies of a locus within a population are listed above.

A. What are the allele frequencies of A1 and A2? (5%)
B. What are the frequencies of three expected genotypes under Hardy-Weinberg equilibrium? (5%)

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5. Suppose there are three genotypes at a locus with two alleles differ in relative fitness due to differences in survival

	A_1A_1	A_1A_2	A_2A_2
Frequency at birth	p^2	$2pq$	q^2
Relative fitness	w_{11}	w_{12}	w_{22}

Please write down the model of selection for the following cases. (hint: consider Directional selection, overdominance selection, and underdominance selection)

(1) $w_{11} = w_{12} > w_{22}$ (4%)
(2) $w_{11} > w_{12} > w_{22}$ (2%)
(3) $w_{11} < w_{12} > w_{22}$ (2%)
(4) $w_{11} > w_{12} < w_{22}$ (2%)

試題隨卷繳回