

※ 注意：請於試卷內之「非選擇題作答區」作答，並應註明作答之題號。

一、名詞解釋 (30%, 3% each)

1. Microevolution
2. Homoplasy
3. Neoteny
4. Phylogeography
5. Allele
6. Genetic drift
7. Panmictic
8. Quantitative trait
9. Founder effect
10. Meiotic drive

二、題組 (20%)

1. What NOT to expect of natural selection and adaptation? (Circle all correct answers)(5%)

- (A) The necessity of adaptation
- (B) Perfection
- (C) Cooperative behavior
- (D) Progress
- (E) Harmony and balance of nature
- (F) Morality and ethics

2. Why effective population size is usually smaller than the actual census size? (Circle all correct answers)(5%)

- (A) Migration between populations.
- (B) Variation in the number of progenies produced by females, males, or both.
- (C) Unequal number of males and females that produce offspring.
- (D) Natural selection increases variation in progeny number.
- (E) Fluctuations in population size.
- (F) Mutations.

見背面

3. There are 3 alleles at locus A in a population with their frequencies of 0.4, 0.4, and 0.2.

A. What is the expected heterozygosity of locus A in this population? (5%)

B. The observed heterozygosity of locus A is 0.5. Please give possible explanations on why observed heterozygosity is different from expected heterozygosity? (5%)

三、配合題 (20%, 2% each)

- A. QTL mapping
- B. Sexual selection
- C. Hybrid zone
- D. Allopatric speciation
- E. Sympatric speciation
- F. Horizontal transmission
- G. Gene duplication
- H. Heritability
- I. Genotype x environment interaction
- J. Antagonistic pleiotropy

___ 1. Speciation by genetic divergence of populations in the same location.

___ 2. Differential reproduction as a result of variation in the ability to obtain mates.

___ 3. Phenotypic variation arising from the difference in the effect of the environment on the expression of different genotypes.

___ 4. New genes arise as copies of pre-existing gene sequences.

___ 5. Determining the chromosomal position containing at least one gene that contributes to variation in a quantitative trait.

___ 6. The proportion of the variance in a trait among individuals that is attributable to differences in genotype.

___ 7. Speciation by genetic divergence of populations in distinct locations.

___ 8. Contrasting effects of a gene on different characters or on the same character in different environments.

___ 9. A region in which genetically distinct populations come into contact and produce some offspring of mixed ancestry.

___ 10. Movement of genes or symbionts between individual organisms other than by parent-offspring transmission.

接次頁

四、單選題 (15%, 3% each)

____ 1. The frequency of multiple synonymous codons coding for the same amino acid is not equal in the genome. This is called:

- (A) Post-translational modification
- (B) Codon swapping
- (C) Codon bias
- (D) Four-fold degenerate sites

____ 2. Although sometime pollination could successfully happen between different plant species, pollen-pistil incompatibility happens (the pollen from species A could not successfully germinate on the pistil of species B). This is a type of:

- (A) Premating barrier
- (B) Postmating prezygotic barrier
- (C) Postzygotic barrier
- (D) Hybrid incompatibility

____ 3. Which of the following is a potential benefit for the evolution of sexual reproduction?

- (A) Facilitating the co-operation between parents
- (B) In theory, sexual reproduction produces twice the amount of progeny than asexual reproduction
- (C) Promoting male-male competition, facilitating the evolution of male traits
- (D) Combining alleles to generate new genotypes that might be adaptive to new environments

____ 4. Which of the following about "secondary contact" in the model of speciation is true?

- (A) Results from vicariance
- (B) Results in allopatric speciation
- (C) Is caused by Dobzhansky-Muller incompatibility
- (D) Allele frequency cline is usually observed

見背面

____ 5. In the famous example of the evolution of freshwater three-spined stickleback fish, the candidate gene *Pitx1* does not express in the pelvic region, leading to the lack of development of pelvic spine. This is likely due to the mutation in which region of the *Pitx1* gene?

- (A) The enhancer or promoter region
- (B) The protein-coding region
- (C) The region under balancing selection in the lake

五、問答題 (15%, 5% each)

1. A scientist studied a species of plant and found that individuals in high elevation are generally shorter than individuals growing in low elevation. (1) Can he conclude there is genetic difference causing the height difference? Why or why not? (2) What experiment should he do to demonstrate there is a genetic cause for such height difference?

2. Please explain (1) sub-functionalization and (2) neo-functionalization after gene duplication

3. Please give an example and explain how sympatric speciation could happen in (1) animals and (2) plants

試題隨卷繳回