

題號： 346  
科目： 演化生物學  
節次： 4

國立臺灣大學 114 學年度碩士班招生考試試題

題號：346  
共 3 頁之第 1 頁

一、配合題 (30%, 2% each)

A. Sympatric	B. Synonymous	C. Symbiosis
D. Chimeric gene	E. Homologous gene	F. Genetic drift
G. Phylogeography	H. Bottleneck	I. Gene flow
J. Trade-off	K. Phenotypic plasticity	L. Niche differentiation
M. Adaptive radiation	N. Paraphyletic	O. Monophyletic

- \_\_\_ 1. In the protein coding region, a DNA mutation that does not affect the translated amino acid
- \_\_\_ 2. A group of organisms that have a common ancestor but are not all descendants of that common ancestor
- \_\_\_ 3. A close and long-term relationship between two different species
- \_\_\_ 4. Random change of allele frequency in a population over time
- \_\_\_ 5. A gene created by the fusion of two or more gene segments
- \_\_\_ 6. Two populations or species inhabiting the same location
- \_\_\_ 7. Competing species use different environments or resources to coexist
- \_\_\_ 8. Genes that share a common ancestral origin
- \_\_\_ 9. The existence of both a fitness benefit and cost of a mutation or a character state, relative to another
- \_\_\_ 10. Transfer of genetic material between populations through migration or interbreeding
- \_\_\_ 11. The ability of one genotype to generate distinct character states under different environments
- \_\_\_ 12. A sharp reduction of population size resulting in the loss of genetic variation
- \_\_\_ 13. Rapid diversification into different adaptive forms
- \_\_\_ 14. The study of how genetic lineages are distributed across space and the causes
- \_\_\_ 15. A group of organisms that have a common ancestor and are all descendants of that common ancestor

二、選擇題 (45%, 3% each)      ※ 本大題請於試卷內之「選擇題作答區」依序作答。

- \_\_\_ 1. Birds and bats evolved wings for flying. This is called:  
(A) Paralogy  
(B) Homoplasy  
(C) Monophyletic  
(D) Homologs
- \_\_\_ 2. There is an animal population with mean body weight of 100 kg. The breeders first performed a selection and only let the individuals heavier than 120 kg to reproduce. For the mean body weight of the next generation, which value is less likely?  
(A) 100 kg  
(B) 110 kg  
(C) 120 kg  
(D) 130 kg
- \_\_\_ 3. For the case mentioned above, the trait can be controlled by these factors:  
(I) One gene with low heritability,      (II) Many genes with low heritability  
(III) One gene with high heritability,      (IV) Many genes with high heritability  
Under which "genetic architecture" do you think selection would be most effective?  
(A) I and II  
(B) III and IV  
(C) I and III  
(D) II and IV

見背面

題號： 346

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科目： 演化生物學

題號： 346

節次： 4

共 3 頁之第 2 頁

\_\_\_\_ 4. Which of the following is correct about human evolution?

- (A) There are multiple out-of-Africa human migration events
- (B) Anatomically modern humans, Neanderthals, and Denisovans evolved from different ape species
- (C) Anatomically modern humans, Neanderthals, and Denisovans are different species, so they cannot interbreed
- (D) Lactose tolerance evolved once

\_\_\_\_ 5. In some bee or ant colonies, only a few individuals could reproduce, and most of their siblings are infertile workers. This is a case of:

- (A) Sexual selection
- (B) Kin selection
- (C) Reproductive isolation
- (D) Mutualism

\_\_\_\_ 6. In the domestication of plants with a single domestication origin, people often assume populations near the origin of domestication would have highest genetic variation. With cultivar range expansion, the populations near the expansion front have low genetic variation. This is due to:

- (A) Founder effects
- (B) Balancing selection
- (C) Disruptive selection
- (D) Inbreeding depression

\_\_\_\_ 7. In a population, the relative fitness of the three genotypes in a gene is:  $AA = 1$ ,  $Aa = 0.8$ ,  $aa = 1$ . This is a case of:

- (A) Directional selection
- (B) Heterosis
- (C) Overdominance
- (D) Underdominance

\_\_\_\_ 8. In the case above, the fitness difference between  $AA$  and  $Aa$ , 0.2, is:

- (A) Selection differential
- (B) Selection coefficient
- (C) Selection signature
- (D) Selection direction

\_\_\_\_ 9. In a bird species, males with brighter red colors also have children with higher survival. This fits which idea below?

- (A) Handicap hypothesis
- (B) Red king hypothesis
- (C) Runaway sexual selection
- (D) Honest signal

\_\_\_\_ 10. What type of species concept is most suitable for fossil records?

- (A) Ecological species concept
- (B) Biological species concept
- (C) Morphological species concept
- (D) Phylogenetic species concept

接次頁

題號： 346

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題號： 346

節次： 4

共 3 頁之第 3 頁

\_\_\_\_ 11. Polyploidization is a mechanism of instant speciation in sympatry. Which of the following ploidy combinations could be considered different species, whose hybrids are not fertile?

- (A)  $2x$  and  $2x$
- (B)  $2x$  and  $6x$
- (C)  $2x$  and  $4x$
- (D)  $4x$  and  $8x$

\_\_\_\_ 12. Which of the following forces maintains genetic variation?

- (A) Genetic drift
- (B) Directional selection
- (C) Balancing selection
- (D) Bottleneck

\_\_\_\_ 13. Which of the following is NOT the possible fate of newly duplicated genes?

- (A) Neo-functionalization
- (B) Dup-functionalization
- (C) Sub-functionalization
- (D) Non-functionalization

\_\_\_\_ 14. Which of the following is NOT considered a component of fitness?

- (A) Body size
- (B) Survival
- (C) Mating success
- (D) Fecundity

\_\_\_\_ 15. Which of the following description about inbreeding is correct?

- (A) Inbreeding decreases heterozygosity
- (B) An inbred population has more pure genetic background, facilitating adaptation
- (C) Inbreeding decreases mutation rate and reduces genetic variation
- (D) Inbreeding increases the effect of a dominant allele

三、問答題 (25%, 可用中文回答)

1. (12%) For animals and plants separately, give one example for each of the pre-mating and post-mating reproductive barriers (4 answers to give).
2. (6%) In an animal population, there are 100 females and 100 males. For the locus A, in each sex, there are 50 AA and 50 aa individuals.
  - (1) What is the genotype frequency?
  - (2) What is the allele frequency?
  - (3) After one generation of random mating, what is the genotype frequency?
3. (7%) Explain "common garden experiment" and describe how this experiment helps you distinguish whether the phenotypic differences between two wild plant populations are due to genetic or environmental effects.

試題隨卷繳回