

題號： 399

國立臺灣大學 112 學年度碩士班招生考試試題

科目： 演化生物學

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一、配合題 (20%, 2% each)

- A. Vicariance
- B. Altruism
- C. Linkage disequilibrium
- D. Parthenogenesis
- E. Genetic assimilation
- F. Orthologs
- G. Paralogs
- H. Refugia
- I. Phylogenetic niche conservatism
- J. Introgression

\_\_\_ 1. Slow evolution of the ecological requirements of a group of organisms, resulting in long-continued dependence of related species on similar environmental conditions

\_\_\_ 2. Locations in which species have persisted while becoming extinct elsewhere

\_\_\_ 3. Separation of a continuously distributed ancestral species due to geographic barrier

\_\_\_ 4. A process by which a phenotype whose development is triggered by an environmental stimulus evolves to be constitutively expressed

\_\_\_ 5. Members of a gene family originated from speciation

\_\_\_ 6. The association of two alleles at two or more loci more frequently than predicted by their individual frequencies

\_\_\_ 7. Movement of genes from one species or population into another by hybridization

\_\_\_ 8. Development of an egg into an embryo without paternal contribution of genes

\_\_\_ 9. Members of a gene family originated from gene duplication

\_\_\_ 10. Benefitting other individuals at an apparent cost to the donor

二、選擇題 (20%, 2% each)

\_\_\_ 1. The Isthmus of Panama (巴拿馬地峽) separates the Atlantic and Pacific ocean. For marine species living in the two sides of the isthmus, this is NOT a case of:

- (A) Geographic barrier
- (B) Vicariance
- (C) Temporal isolation
- (D) Allopatric speciation

\_\_\_ 2. A pseudogene is:

- (A) A gene that has lost its function
- (B) A gene that has acquired the new function through mutation
- (C) A gene that is exchanged between species through gene flow
- (D) A genomic fragment originated from horizontal gene transfer

\_\_\_ 3. Sometimes negative genetic correlation exists between important traits. For example, a tree can either produce many small fruits or fewer large fruits. This is called:

- (A) Fitness component
- (B) Inversion
- (C) Phenotypic plasticity
- (D) Tradeoff

見背面

\_\_\_ 4. Which of the following is correct about sexual selection?

- (A) Sexual selection works on males
- (B) Male peacocks' tails increase their survival in the field and is therefore favored
- (C) Sometimes the direction of sexual selection is antagonistic with natural selection
- (D) Male-male competition is not a form of sexual selection

\_\_\_ 5. Which of the following is correct about recombination?

- (A) No recombination event could happen within the region of a chromosomal inversion
- (B) Muller's ratchet describes what may happen if there is no or little recombination
- (C) A self-fertilizing plant species does not have recombination
- (D) Geographic barrier facilitates recombination between species

\_\_\_ 6. Which of the following is NOT post-mating pre-zygotic barrier between species?

- (A) Failure of mechanical fit of reproductive structures
- (B) Plant species have different pollinators
- (C) Sperm competition between males of difference species
- (D) Sperm fails to fertilize the egg

\_\_\_ 7. In which of the following situation is "reinforcement of speciation" likely to occur?

- (A) Secondary contact of allopatric species
- (B) Sympatric speciation
- (C) Allopatric species that do not contact
- (D) Species pairs that already have pre-mating barrier

\_\_\_ 8. What is isolation by distance?

- (A) The longer the migration distance of a species, the stronger the population differentiation
- (B) Allopatric species tend to show stronger hybrid inviability than sympatric species
- (C) The higher the geographic distance, the more different the environment is, and therefore stronger divergent selection
- (D) Populations that are geographically closer are genetically closer

\_\_\_ 9. Which of the following is correct about heritability?

- (A) Heritability is the regression slope of mean offspring on mean parent trait values
- (B) A high-heritability trait is controlled by very few genes
- (C) A high-heritability trait is controlled by many genes
- (D) For a high-heritability trait, a mutation in a gene controlling that trait results in large phenotypic changes

\_\_\_ 10. Which of the following is a trait possibly under stabilizing selection?

- (A) Human selection on crop yield
- (B) Body color in cichlid fishes
- (C) Body color in peppered moth
- (D) Human birth weight

## 三、問答題 (10%)

1. (5 %) With the genome sequences of Neanderthals becoming available, scientists have found anatomically modern humans had gene flow with Neanderthals. Interestingly, traces of Neanderthal genomic fragments were found in modern Europeans and Asians but not in Africans. Please draw a phylogenetic tree with these 5 groups (African, Asian, Chimpanzee, European, Neanderthal) and indicate where on the tree this gene flow might have happened.
2. (5 %) In a plant species, individuals living in low elevation are tall, and those living in high elevation are short. How would you design an experiment to investigate whether plant height in this species is caused by environmental influences or genetic differences among populations?

## 四、名詞解釋 (30%, 3% each)

1. Microevolution
2. Synonymous mutation
3. Haplotype
4. Disruptive selection
5. Sexual selection
6. Founder effect
7. Phylogeography
8. Adaptation
9. Selection coefficient
10. Sibling species

## 五、題組 (20%)

1. How many unique gametes could be produced through independent assortment by an individual with the genotype AaBbCCDdEE? (5%)  
(A) 4  
(B) 16  
(C) 8  
(D) 64
2. What are we NOT to expect from natural selection and adaptation? (Choose 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  
(G) Segregation distortion
3. There are two alleles at locus A in a population with their frequencies of 0.4 and 0.6. (10%)  
(1) What is the expected heterozygosity of locus A in this population? (4%)  
(2) The observed heterozygosity of locus A is 0.2. Please give possible explanations on why observed heterozygosity is different from expected heterozygosity? (6%)