

一、配合題 (20%, 2% each)

(A) Phenotypic plasticity	(B) Adaptive landscape	(C) Linkage disequilibrium
(D) Reproductive isolation	(E) Parthenogenesis	(F) Altruism
(G) Mutualism	(H) Refugia	(I) Vicariance
(J) Transposable element		

- \_\_\_ 1. A DNA sequence, copies of which become inserted into various sites in the genome
- \_\_\_ 2. Conferral of a benefit on other individuals at an apparent cost to the donor
- \_\_\_ 3. The ability of one genotype to generate distinct character states under different environments
- \_\_\_ 4. Locations in which species have persisted while becoming extinct elsewhere
- \_\_\_ 5. A type of asexual reproduction that requires no male contribution
- \_\_\_ 6. Separation of a continuously distributed ancestral population or species into separate populations because of the development of a geographic or ecological barrier
- \_\_\_ 7. The association of two alleles at two or more loci more frequently than predicted by their individual frequencies
- \_\_\_ 8. The relationship or mathematical function between mean fitness of a population and the allele frequencies at a locus
- \_\_\_ 9. A symbiotic relationship in which each of two species benefits by their interaction
- \_\_\_ 10. Reduction of gene exchange between populations by any possible factors

二、單選題 (30%, 2% each) ※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

- \_\_\_ 1. What does the breeder's equation,  $R = h^2s$ , tell us about evolutionary biology?
  - (A) Evolutionary response to selection depends on genetic variation of the trait
  - (B) Phenotypic plasticity is important in evolutionary response to environment change
  - (C) The stronger the selection force, the higher the correlation is between parent and offspring mean traits
  - (D) Genetic covariance among traits constrains the direction of evolution

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\_\_\_ 2. A contact zone exists between two species locally adaptive to distinct habitats. In the short term, allele frequency cline of a locally adaptive gene is NOT affected by:

- (A) Strength of selection
- (B) Dispersal distance of individuals
- (C) Rate of self-fertilization
- (D) Mutation rate

\_\_\_ 3. When post-zygotic isolation evolved first, it is advantageous to develop pre-mating or pre-zygotic isolation. This is called:

- (A) Red-queen hypothesis
- (B) Sympatric speciation
- (C) Reinforcement
- (D) Haldane's rule

\_\_\_ 4. Which of the following is NOT directly related with Muller's ratchet?

- (A) Recombination rate
- (B) Sexual reproduction
- (C) Dispersal distance
- (D) Natural selection

\_\_\_ 5. Which of the following is NOT a fitness component of an individual or a genotype?

- (A) Survival
- (B) Ability to find mates
- (C) Fecundity
- (D) Body size

\_\_\_ 6. "Selfish DNA" is:

- (A) A DNA sequence that makes an individual altruistic
- (B) A DNA sequence that replicates but with no immediate function for the organism
- (C) A DNA sequence that maximizes the fitness of the individual
- (D) A DNA sequence facilitating the cooperation among kins

\_\_\_ 7. Which of the following is not the fate of a new gene after gene duplication?

- (A) Muta-functionalization
- (B) Neo-functionalization
- (C) Sub-functionalization
- (D) Pseudo-functionalization

\_\_\_ 8. Which of the following is correct about human evolution?

- (A) The out-of-Africa event happened only once
- (B) Neanderthals diverged from Europeans after anatomical modern human migrated into Europe
- (C) Linkage disequilibrium decays faster in Africans than in Native Americans
- (D) Infant birth weight is a good example of diversifying selection

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

- (A) This is the line of least resistance through which evolution is facilitated
- (B) This is a boundary line separating biogeographical realms
- (C) This line is used to defined the boundary between species in a contact zone
- (D) This is a line on the map where gene flow is facilitated

\_\_\_ 10. Which of the following is correct about sympatric speciation?

- (A) Polyploidization is a way to achieve sympatric speciation
- (B) It is the most common form of speciation
- (C) After sympatric speciation, the two species expanded to different locations, called parapatric speciation
- (D) Domestication is a type of sympatric speciation

\_\_\_ 11. A woman and her husband both show the normal phenotype for skin pigmentation. However, both had one parent who was an albino. Albinism is an autosomal recessive trait. What is the probability that their first child will have normal skin pigmentation?

- (A) 0%
- (B) 25%
- (C) 50%
- (D) 75%
- (E) 100%

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\_\_\_ 12. Same as above. If their first two children have normal pigmentation, what is the chance that their third child will have albinism?

- (A) 0%
- (B) 25%
- (C) 50%
- (D) 75%
- (E) 100%

\_\_\_ 13. In familial hypercholesterolemia (presence of high plasma cholesterol levels), individuals homozygous for the allele causing the disorder completely lack receptors on liver cells that take up cholesterol from the blood stream. Heterozygotes have one-half the number of receptors while individuals homozygous for the normal allele are phenotypically normal. This is an example of

- (A) Complete dominance
- (B) Co-dominance
- (C) Incomplete dominance
- (D) Epistasis

\_\_\_ 14. Sex-linked genetically inherited traits:

- (A) Can appear in both males and females
- (B) Are only found in males
- (C) Are only found in females
- (D) Are only inherited from mother

\_\_\_ 15. Developmental similarities observed in most vertebrates are probably due to

- (A) chance.
- (B) the similar environments in which they live.
- (C) homeobox genes.
- (D) their phylogenetic histories.
- (E) homeobox genes and their phylogenetic histories.

三、名詞解釋 (30%, 3% each)

1. Balancing selection
2. Adaptation

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3. Phylogeny
4. Speciation
5. Orthology
6. Molecular clock
7. Fitness
8. Selective sweep
9. Monophyletic group
10. Homoplasy

四、問答題 (20%)

1. (5%) In a diploid organism, genes A and B affect fitness. Gene A has alleles A and a, and gene B has alleles B and b. In both genes, the lower-case alleles (a and b) are recessive to the upper-case alleles (A and B), and homozygous recessives (aa and bb) have lower fitness. Please use this to explain hybrid vigor from the cross of two inbred genotypes.
2. (5%) For a trait, the phenotypic variance ( $V_p$ ) is about 100, and genetic variance ( $V_G$ ) is about 80. (1) What is the heritability? (2) A population's mean trait value is 10. After directional selection, the survivors' mean trait value is 20. Will the next-generation progenies' mean trait values of those survivors be lower, equal, or higher than 20? Why?
3. (10%) Among native Americans, two types of earwax(cerumen) are seen, dry and sticky. A geneticist studied the inheritance of this trait by observing the types of offspring produced by different kinds of matings. He observed the following numbers:

Parents	Number of mating pairs	Offspring	
		Sticky	Dry
sticky x sticky	10	32	6
sticky x dry	8	21	9
dry x dry	2	0	6

- (1) How is earwax type inherited? (recessive, dominance, or codominance)
- (2) Why are there no 3:1 or 1:1 ratios in the data shown in the chart?

試題隨卷繳回