

一、對應題—將下列名詞的最適名詞解釋，自下方(A-T)的選項選出填入答案卷(20分)

1. ___ Adaptive radiation
2. ___ Peripatric speciation
3. ___ Clade
4. ___ Disruptive selection
5. ___ Parallel evolution
6. ___ Heterochrony
7. ___ Reinforcement (in evolution)
8. ___ Symbiosis
9. ___ K/T boundary
10. ___ Gene pool
11. ___ Reticulate evolution
12. ___ Paedomorphosis
13. ___ Key adaptation
14. ___ Sympatric speciation
15. ___ Synonymous substitution
16. ___ Pre-mating reproductive isolation
17. ___ Post-zygotic reproductive isolation
18. ___ Horizontal gene transfer
19. ___ Gene transposition
20. ___ Vicariance

- A) The combined status of the genes of a given sexual population
- B) A gene moves or is copied from one organism to the other organism's genome
- C) Rapid diversification into different adaptive forms
- D) Two or more phenotypes are selected against the intermediate
- E) A juvenilized morphology of the reproductive adults
- F) An intimate association between two organisms
- G) A set of species descended from the same ancestor
- H) The period between Cretaceous and Tertiary
- I) Speciation by reproductive isolation in peripatric populations
- J) Evolutionary changes caused by an alteration of timing of developmental events
- K) Speciation events happening in the same geographic region
- L) An adaptation that enables organisms to occupy a new ecological niche
- M) Fixation of a base pair change that does not alter the amino acid in the protein product of a gene
- N) Separation of a continuously distributed ancestral population into separated ones due to a geographic barrier
- O) Selection for greater reproductive isolation between populations
- P) A gene moves from one location to the other location in the same genome
- Q) Reproductive isolation due to that the hybrid is unable to survive in either parental environment
- R) Mix of lineages due to hybridization
- S) Evolution of similar features among different lineages
- T) Reproductive isolation due to that two species are unable to mate

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二、選擇題(每題 2 分，共 18 分) ※ 注意：請於試卷內之「選擇題作答區」依序作答。

1. Which of the following was the most recent event?

- (A) The origin of tetrapod vertebrates
- (B) The Cambrian explosion
- (C) The divergence of birds and T-Rex
- (D) The K/T mass extinction
- (E) The origin of hominid primates

2. If the cladogram of taxa matches the geological history of an area, this suggests:

- (A) Vacariance
- (B) Mutation
- (C) Natural selection
- (D) Dispersal
- (E) None of the above

3. The classification of taxa by similarity of their appearance is called:

- (A) Cladistics
- (B) Evolutionary taxonomy
- (C) Phenetics
- (D) Divergence
- (E) Parallel evolution

4. What is the effect of directional natural selection on genetic variation? Directional selection _____ genetic variation.

- (A) increases
- (B) decreases
- (C) maintains
- (D) has no effect on

5. Linkage disequilibrium between two loci can be caused by:

- (A) Natural selection
- (B) Nonrandom mating
- (C) Physical linkage
- (D) All of the above
- (E) None of the above

6. Which of the following is considered the evidence of allopatric speciation?

- (A) Sister species tend to live in the same location
- (B) In birds, the clade that mates promiscuously tend to have more species than the clade that forms a pair bond
- (C) The degree of reproductive isolation is stronger when the geographic distance between lineages is larger
- (D) A and B
- (E) B and C

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7. Which of the following is the advantage of sex?
- (A) Recombination brings together adaptive alleles in multiple loci
 - (B) Maintaining beneficial combinations of adaptive alleles in multiple loci
 - (C) Sexual organisms produce more offspring per generation than asexual organisms
 - (D) A and B
 - (E) All of the above

8. The correlation between two traits can NOT be caused by:
- (A) Linkage disequilibrium
 - (B) Strong recombination
 - (C) Correlated environment
 - (D) Correlated evolution
 - (E) Pleiotropy

9. Which of the following descriptions of genome evolution is true?
- (A) In general, functional genomic regions tend to have slower evolution rate than non-functional genomic regions
 - (B) In general, functional genomic regions tend to have lower mutation rate than non-functional genomic regions
 - (C) There are multiple synonymous codons coding for the same amino acid, and they are used in unequal frequencies in the genome
 - (D) A and C
 - (E) A and B

三、簡答題組(共 62 分)

1. A population has mean body weight of 100 kg. After natural selection, the survivors have mean body weight of 150 kg. The heritability of body weight is 0.2

1a. What is heritability? (4 分)

1b. the selection differential? (3 分)

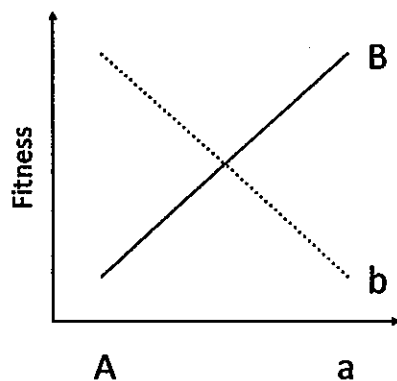
1c. What is the mean body weight of the next generation? (3 分)

2. Explain the Dobzhansky-Muller model of hybrid incompatibility (6 分)

3. Explain the biological species concept (6 分)

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4. The graph below is a “reaction norm”.



4a. If “A” and “a” are two different environments and “B” and “b” are two different genotypes, this reaction norm represents: (2 分)

- (A) Environmental variance
- (B) Environmental correlation
- (C) Epistasis
- (D) Epigenetics
- (E) Genotype-by-environment interaction

4b. Following 4a, genotype “B” has different trait values in different environments. This is: (2 分)

- (A) Plasticity
- (B) Evolution
- (C) Genetic drift
- (D) Ontogeny
- (E) Neo-functionalization

4c. If “A” and “a” are two genotypes of one gene and “B” and “b” are two genotypes of the other gene, this reaction norm represents: (2 分)

- (A) Environmental variance
- (B) Environmental correlation
- (C) Epistasis
- (D) Epigenetics
- (E) Genotype-by-environment interaction

4d. What is trade-off? Does this graph show trade-off? (4 分)

5. Why gene duplications are important in the evolution of functional genes? Explain the consequences of genes after duplication. (10 分)

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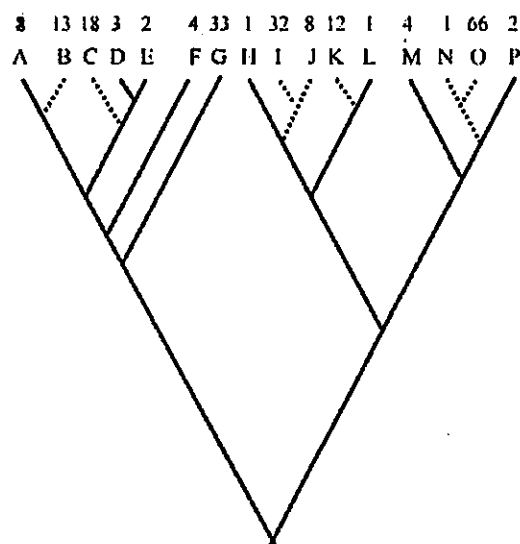
6. The phylogeny on the right shows the numbers of species in each clade/lineage. **Dashed branches show a putative key adaptation** (a trait). Perform a sister-group comparison to test the hypothesis whether these traits are key adaptations, using the following formula.

$$P(R \geq S) = \frac{2r}{s+r-1}$$

The formula denotes the probability for the two clades (R & S) are significantly different, given the species diversities of r and s within, respectively ($r > s$).

6a. Which of the taxa with the adaptive trait, i.e. B, C, I, J, K, N, and O, or other possible combination ($\{I, J\}$, etc.), show significant level of adaptation, at the $p < 0.05$ level? Explain your results. (10分)

6b. In the group $\{M, N, O, P\}$, where will be the key adaptation occurred? Explain your results. (10分)



試題隨卷繳回