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科目：遺傳學(A)
節次： 7

國立臺灣大學 102 學年度碩士班招生考試試題

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※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

I. Chose <u>ONE</u> best answer from the choices (4 points each)

1. If the parents are heterozygotes for a mutant *CFTR* gene, the chance that any future child will be a heterozygote is
   A. 1
   B. 1/2
   C. 1/3
   D. 1/4
   E. 0

2. Thalidomide was a common treatment for morning sickness in the 1950s. Children born to mothers given this drug showed the phenotypes of a genetic disease known as phocomelia, which involves shortened limbs. This may represent
   A. incomplete dominance.
   B. genetic heterogeneity.
   C. penetrance.
   D. phenocopy.
   E. maternal effect

3. Which of the following is not a type of loss-of-function mutation?
   A. conditional
   B. hypomorphic
   C. null
   D. dominant-negative
   E. ectopic

4. Imagine you've isolated a yeast mutant that contains histones resistant to acetylation. What phenotype do you predict for this mutant?
   A. The mutant will grow rapidly.
   B. The mutant will require galactose for growth.
   C. The mutant will show low levels of gene expression.
   D. The mutant will show high levels of gene expression.
   E. The mutant will not reproduce normally.

5. In Kerr and Wright's experiment with 96 fruit-fly populations, only 4 males and 4 females bred in each generation. After 16 generations, 73% of their populations had only one allele present for the bristle morphology gene. Which of the following would you expect to occur if they allowed 10 males and 10 females to breed in each generation?
   A. About 73% of the populations would have only one allele for the bristle morphology gene.
   B. More than 73% of the populations would have only one allele present.
   C. Less than 73% of the populations would have only one allele present.
   D. All of the populations would have only one allele present.
   E. None of above

6. Cystic fibrosis is a genetic disorder in homozygous recessives that causes death during the teenage years. If 9 in 10,000 newborn babies have the disease, what are the expected frequencies of the dominant (A_1) and recessive (A_2) alleles according to the Hardy-Weinberg model?
   A. $f(A_1) = 0.9997$, $f(A_2) = 0.0003$
   B. $f(A_1) = 0.9800$, $f(A_2) = 0.0200$
   C. $f(A_1) = 0.9700$, $f(A_2) = 0.0300$
   D. $f(A_1) = 0.9604$, $f(A_2) = 0.0392$
   E. $f(A_1) = 0.9600$, $f(A_2) = 0.0400$

見背面

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7. A man and woman living in a tropical area where malaria is prevalent and health care is not accessible have seven children. The genotypes of these children are ss, Ss, SS, ss, Ss, Ss, and SS. What must the genotype of both parents be?
   A. SS, Ss
   B. SS, ss
   C. Ss, ss
   D. Ss
   E. ss

8. What are the chances that a non-color blind male from a family with color-blindness (an X-linked recessive allele) will pass on the color blind trait to his children?
   A. 50%
   B. 100%
   C. 0%
   D. 75%
   E. not enough information is given to determine the answer

9. The frequency of crossing-over between linked genes A and B is 35%; between B and C is 10%; between C and D is 15%; between C and A is 25%; between D and B is 25%. The sequence of the genes on the chromosome is:
   A. ACDB
   B. ACBD
   C. ABDC
   D. ABCD
   E. ADCB

10. In guinea pigs, smooth coat (S) is dominant over rough coat (s) and black coat (B) is dominant over white coat (b). In the cross SsBb X SsBb, how many of the offspring will have a smooth, black coat?
    A. 9 out of 16
    B. 1 out of 16
    C. 6 out of 16
    D. all offspring will have this phenotype
    E. not enough information is given to determine the answer

11. The "genetic code" is the list of code words ("codons") in RNA which specify particular amino acids in proteins. Which of the following statements about the genetic code is correct?
    A. The genetic code is degenerate
    B. Codons are groups of three nucleotides
    C. Groups of codons specifying the same amino acid differ in the third position
    D. Three of the codons specify peptide termination
    E. All of the above

12. The result of experiments performed in the late 1950s indicated that the replication of DNA was "semi-conservative". What does this mean?
    A. Only part of each DNA strand is replicated
    B. The two double-stranded molecules generated by replication both contain one new and one old strand
    C. One of the two double-stranded molecules generated by replication is entirely new
    D. One strand of each DNA molecule is destroyed during replication, and one is retained
    E. After some replication events the original DNA molecule remains unchanged

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II. Short answer questions

1. In the cross Aa X aa, what genotypes can occur in the offspring? What is the probability that a given offspring will be Aa? If the first offspring is aa, what is the chance that the next will also be aa? What is the probability that the third one will be AA? (12 points)

2. A plant with orange-spotted flowers was grown in the greenhouse from a seed collected in the wild. The plant was self-pollinated and gave rise to the following progeny: 88 orange with spots, 34 yellow with spots, 32 orange with no spots, and 8 yellow with no spots. What can you conclude about the dominance relationships? (10 points)

3. Explain epigenetic inheritance and describe a known example of epigenetic inheritance? (5 points)

4. Explain Hardy-Weinberg principle. (5 points) What are the **five** assumptions for Hardy-Weinberg principle? (10 points)

5. What are the differences between meiosis and mitosis? (10 points)

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