國立臺灣大學95學年度碩士班招生考試試題

I. 解釋名詞 (30%)：

(1) Chromosome interference (2) Linkage disequilibrium (3) Epigenetic
(4) Wobble hypothesis (5) Gene conversion (6) SOS response
(7) Overdominance (8) Loss of heterozygosity (9) Pair-rule gene
(10) Exon shuffling

II. 單選題 (60%)： **※ 注意：請於試卷上「選擇題作答區」依序作答。**

1. Linkage is an exception to the Mendelian law of :
   A. segregation
   B. dominance and recessiveness
   C. independent assortment
   D. unit factor inheritance

2. A rare dominant trait, when exhibited in men, is transmitted to half their sons and to half their daughters. The gene for this trait is carried on :
   A. the X chromosome
   B. an autosome
   C. the Y chromosome
   D. a cytoplasmic factor

3. In a family, two phenotypically normal parents have a son who suffers from the X-linked for of hemophila. What is the probability that both of their next two children will also have hemophilia?
   A. 1/4
   B. 1/8
   C. 1/16
   D. extremely low likelihood of having two such children in a row

4. A family history of Down syndrome is reason to suspect :
   A. nondisjunction
   B. highly mutable genes
   C. chemical or drug sensitivity
   D. inherited translocation

5. An amphidiploid allopolyploid is produced from diploid species A ($n = 6$) and diploid species B ($n = 8$). This allopolyploid will have how many bivalents formed during prophase I of meiosis?
   A. 7
   B. 14
   C. 28
   D. none of the above

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6. Assume that a certain gene affects gonadal development so that it results in a 20% loss of fertility. Selection against this gene will be least effective if it is :
   A. an autosomal dominant with 100% penetrance
   B. an autosomal dominant with 80% penetrance
   C. a sex-linked recessive
   D. an autosomal recessive
   E. a sex-linked dominant with 80% penetrance

7. Crossover map distances determined by two-pointed crosses are P—C = 7, S—M = 10, C—M = 8, S—C = 2, and P—S = 5. The relative positions of these four linked loci are :
   A. P S C M
   B. S C P M
   C. S C M P
   D. P C S M
   E. C S P M

8. A true-breeding (homozygous) mouse strain with black hair is crossed to a true-breeding strain with white hair. The F_1 are all black. When the F1 mice are crossed to each other, they give rise to an F_2 consisting of about 9 black: 3 brown: 4 white mice. This is an example of :
   A. recessive epistasis
   B. dominant epistasis
   C. pleiotropy
   D. duplicate genes

9. DNA palindromic sequences renature at :
   A. zero-time
   B. low C_0t values
   C. intermediate C_0t values
   D. high C_0t values
   E. very high C_0t values

10. Forty units of enzyme A are needed to produce wild-type phenotype. The wild-type allele produces 20 units and a new mutation produces only five units. The mutation would be :
   A. dominant
   B. recessive
   C. incompletely dominant
   D. codominant
   E. overdominant

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11. The mouse autosomal genes B and S are linked and 38 map units apart. Genotypes *BS/BS* and *bs/bs* are intercrosses and the F_1 is testcrossed to *bs/bs*. The proportion of *B-S-* progeny will be:
    A. 0.38
    B. 0.76
    C. 0.50
    D. 0.31
    E. 0.19

12. In the haploid fungus *Neurospora*, a strain with the mutant phenotype *poky* (mitochondrial) is crossed as paternal parent. What proportion of progeny will be *poky*?
    A. 0
    B. 0.25
    C. 0.50
    D. 0.75
    E. 1.0

13. A mutant allele of corn leads to absence of red anthocyanin pigment in the kernel (absence of anthocyanin results in a yellow color). The allele, however, is unstable, reverting quite late, yet often, in development. The expected phenotype of kernels homozygous for this mutation is:
    A. fully red
    B. fully yellow
    C. yellow with many large red spots
    D. yellow with few large red spots
    E. yellow with many small red spots

14. Which of the following processes will increase variation between populations?
    A. Earthquakes
    B. Mutation
    C. Migration
    D. Balancing selection
    E. Inbreeding

15. In *Drosophila* the recessive alleles for brown and scarlet eyes (of two independent genes) interact so that *bw/bw*; *st/st* is white. If a pure-breeding brown is crossed to a pure-breeding scarlet, what proportion of the F_2 will be white?
    A. 1/16
    B. 1/4
    C. 7/16
    D. 3/4
    E. 13/16

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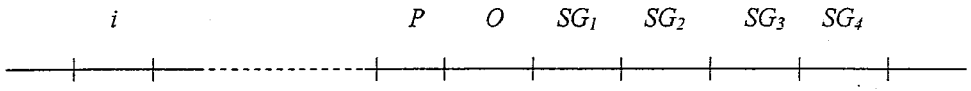
16. Curly (*Cy*), a wing mutant in *Drosophila*, is dominant to the allele for normal (straight) wings and is lethal when homozygous. If two curly flies are mated, the proportion of wild-type flies among the progeny would be :
    A. 1/4
    B. 1/2
    C. 3/4
    D. 1/3
    E. 1/6

17. A cloned yeast gene of unknown function was subjected *in vitro* mutagenesis in which a serine codon was replaced by arginine at amino acid position 10 in the open reading frame. This gene was used to replace the resident wild-type gene. The resulting cell still showed a wild-type phenotype. A possible reason is :
    A. The amino acids have equivalent function at that position.
    B. There is another copy of the wild-type gene present in the genome
    C. The mutant gene did not replace wild-type but inserted ectopically
    D. The gene has no function; it is an inactive pseudogene
    E. All of the above

18. What proportion of all six-child families in which one parent is a heterozygote showing polydactyly (a dominant trait) and the other is a normal individual will be expected to produce at least one child with polydactyly?
    A. 5/6
    B. 1/64
    C. 1/6
    D. 1/2
    E. 63/64

19. The following diagram shows an operon and its regulatory gene (*i*), where *P* is the promoter, *O* is the operator, and SG_1 to SG_4 are four structural genes. The operon is repressible. A mutation that causes the operon to function as a constitutive operon could be localized in :
    A. *i* or *P* or *O*
    B. *P* or *O* but not *i*
    C. *i* but not *P* or *O*
    D. *i* or *O* but not *P*
    E. none of the above



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20. A plant-breeding institute establishes four new strains of winter grain (G_1, G_2, G_3, and G_4). The genetic variation in each of these for resistance to an infectious fungus (rust) is measured by comparing the F_1 and F_2 phenotypic variances after crosses of each to a standard grain strain (G):

Strain	F_1 variance	F_2 variance
G_1	0.41	0.57
G_2	0.40	0.62
G_3	0.43	0.55
G_4	0.46	0.66

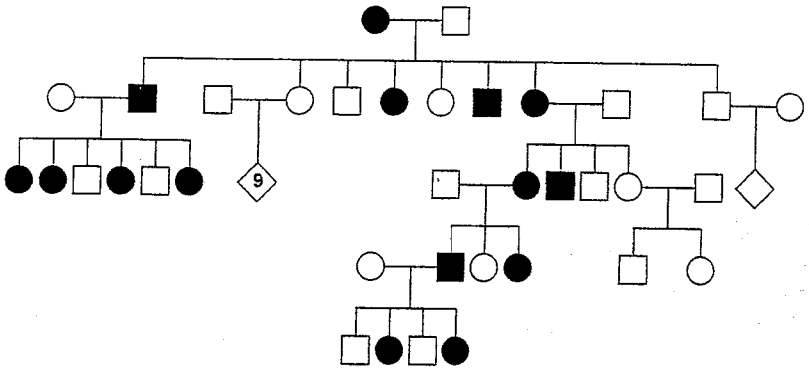
Which one of these four strains would be expected to respond most readily to artificial selection for rust resistance?

A. G_1
B. G_2
C. G_3
D. G_4

III. 問答題 (10%):

1. In *Drosophila*, there are strains that have the two X chromosomes attached. These attached-X females also carry a Y chromosome. These strains have many experimental uses, but one of the most powerful is the measurement of the mutation rate for sex-linked visible effects.
   (a) What kinds of offspring would you expect by crossing an attached-X female to a normal male? (3%)
   (b) How could such a cross used to measure the mutation rate for sex-linked genes? (2%)

2. Consider the following pedigree:



   (a) What pattern of transmission is most consistent with this pedigree? Explain why. (4%)
   (1) autosomal recessive; (2) autosomal dominant; (3) X-linked recessive; (4) X-linked dominant
   (b) On the third line, what does the diamond with a *9* in the middle mean? (1%)

試題隨卷繳回