

國立中央大學九十學年度碩士班研究生入學試題卷

所別: 生命科學系 不分組 科目: 細胞遺傳 共 1 頁 第 1 頁

I. 問答題(請詳細回答下列問題;如有計算須列出計算式子或計算過程)

1. What is the cell cycle? What is the mitosis-promoting factor? The cell cycle of fat cells is stimulated by insulin-like growth factor I (IGF-I), but is inhibited by UV light. According to the signal transduction and the control of the cell cycle, (1) explain how IGF-I regulates the passes of the G1 checkpoint, G2 checkpoint and spindle assembly checkpoint and (2) explain how fat cells defense their DNA damage and the formation of apoptosis caused by UV light.(20%)
2. Give an example to describe the ways of how animal cells communicate with each other?(10%)
3. Luteinizing hormone and testosterone are the glycoprotein and steroid hormones, respectively. Describe how they are synthesized, processed and secreted inside and outside of the animal cells based on the endomembrane system. Also, describe the mechanisms of how both hormones action on their target cells.(20%)
4. Two theoretical genetic strains of a virus ($a^+b^+c^+$ and $a^+b^+c^-$) are used to simultaneously infect a culture of host bacteria. Of 10,000 plaques scored. The following genotypes were observed.

$a^+b^+c^+$	4100	$a^+b^+c^-$	160
$a^+b^-c^+$	3990	$a^+b^-c^-$	140
$a^+b^+c^+$	740	$a^+b^-c^+$	90
$a^+b^+c^+$	670	$a^+b^+c^-$	110

Determine the genetic map of these three genes on the viral chromosome. Determine whether interference was positive or negatives. (10%)
5. A husband and wife have normal vision, although both of their fathers are red-green- color-blind, which is inherited as an X-linked recessive condition. What is the probability that their first child will be (a) a normal son ? (b) a normal daughter ? (c) a color-blind son ? (d) a color-blind daughter ? (10%)
6. In a plant, a tall variety was crossed with a dwarf variety. All F1 plants were tall. When F1X F1 plants were interbred, 9/16 of the F2 were tall and 7/16 were dwarf. (10%)
 - (a) Explain the inheritance of height by indicating the number of gene pairs involved and by designating which genotypes yield tall and which yield dwarf (use dashes where appropriate).
 - (b) Of the F2 plants, what proportion of them will be true-breeding if self-fertilized ? List these genotypes.

II. 簡要回答下問題 (2 points/answer)

1. Name two cellular organelles, each having genetic material, which are involved in either photosynthesis or respiration ?
2. How many different kinds of gametes can be produced by a individual with the genotype AABbCCddEeFf ?
3. Albinism, lack of pigmentation in man, results from an autosomal recessive gene (a). Two parents with normal pigmentation have an albino child.
 - (a) What is the probability that their next child will be an albino girl ?
 - (b) What is the probability that their next three children will be albino ?
4. provide a simple definition for segregation and independent assortment.
5. What distinguishes sex-limited from sex-influenced inheritance ?
6. In mice, there is a set of multiple alleles of a gene for coat color. Four of those alleles are listed below. C^+ =full color (wild); c^{ch} =chinchilla; c^d =dilution; c =albino.

Give that the gene locus is not sex-linked and each allele is dominant to those lower in the list, diagram the crosses indicated below and give the phenotypic ratios expected from each

 - (a) wild (heterozygous for dilution) X chinchilla (heterozygous for albino)
 - (b) chinchilla (heterozygous for albino) X albino
7. Many of the color varieties of summer squash are determined by several interacting loci: AA or Aa give white, aaBB or aaBb give yellow, and aabb produces green. Assume that two fully heterozygous plants are crossed. Give the phenotypes (with frequencies) of the offspring.
8. What is the relationship between the degree of crossing over and the distance between two genes?

