

Genetics Problem Set

AP Biology

1. In the Japanese morning glory (*Pharbitis nil*), purple flower color can be produced by dominant alleles of either of two separate gene pairs ($A-bb$ or $aaB-$), $A-B-$ produces blue petals, and $aabb$ produces scarlet petals. For each of the following cross results, deduce the genotypes of parents and progeny: (Suzuki 4th, 89)

Cross	Parents	Progeny
1	blue x scarlet	$\frac{1}{4}$ blue : $\frac{1}{2}$ purple : $\frac{1}{4}$ scarlet
2	purple x purple	$\frac{1}{4}$ blue : $\frac{1}{2}$ purple : $\frac{1}{4}$ scarlet
3	purple x scarlet	$\frac{1}{2}$ purple : $\frac{1}{2}$ scarlet
4	blue x purple	$\frac{3}{8}$ blue : $\frac{1}{2}$ purple : $\frac{1}{8}$ scarlet

2. If Mexican Hairless dogs are interbred, the puppies show a ratio of $\frac{3}{8}$ hairless to $\frac{1}{8}$ normal; in addition, some deformed dead puppies are also born. Propose an explanation for this outcome, and outline how you would test your idea. (Suzuki 4th, 87)
3. If a man of blood group AB marries a woman of blood group A whose father was of blood group O, what different blood groups can this man and woman expect their children to belong to? (Suzuki 4th, 87)
4. A condition known as *ichthyosis hystrix gravior* appeared in a boy in the early eighteenth century. His skin became very thick and developed loose spines that were sloughed off at intervals. When he grew up, this "porcupine" man married and had six sons, all of whom had this condition, and several daughters, all of whom are normal. For four generations, this condition passed from father to son. From this evidence, what can you postulate about the location of the genes? (Suzuki 4th, 67)
5. Mother and father both find the taste of a chemical called phenylthiourea very bitter. However, two of their four children find the chemical tasteless. Assuming the inability to taste this chemical to be a monogenic trait, is it dominant or recessive? (Suzuki 4th, 35)

6. In dogs dark coat color (C) is dominant over albino (c) and short hair (S) is dominant over long hair (s). If these effects are caused by two independently assorting genes, write the genotypes of the parents in each of the crosses below: (Suzuki 4th, 37)

<i>Parental phenotypes</i>	<i>Number of Progeny</i>			
	Dark, short	Dark, long	Albino, short	Albino, Long
Dark, short x dark, short	89	31	29	11
Dark, short x dark long	30	31	9	11
Albino, short x albino, short	0	0	28	9
Dark, short x dark, short	46	16	0	0

7. Holstein cattle normally are black and white. A superb black and white bull, Charlie, was purchased by a farmer for \$100 000. The progeny sired by Charlie were all normal in appearance. However, certain pairs of his progeny, when interbred, produced red and white progeny at a frequency of about 25%. Charlie was soon removed from the stud lists of the Holstein breeders. Explain precisely why, using symbols. (Suzuki 4th, 34)