

10.5 PROJECT

AMERICA'S THIRD FAVORITE PET: CAN WE PREDICT THEIR FUR COLOR?

According to the Humane Society of the United States, rabbits are the third most popular type of mammal owned as pets, with cats and dogs ranking higher. In this activity, you will calculate the probability of seeing a particular fur color when breeding rabbits.

Suppose that a particular breed of rabbit can be one of two colors: gray or white. The color of this breed of rabbit is determined by whether it has at least one dominant allele G in its genotype or whether it has only the recessive allele g . Out of the three possible genotypes (GG , Gg , and gg), rabbits with genotypes GG and Gg exhibit gray fur while rabbits with genotype gg exhibit white fur. Assume that each parent passes on one of its two color alleles to each offspring with equal probability.

If we breed two gray rabbits of genotype Gg , the possibilities for the fur color of the offspring are given in the following table.

 	G	g
G	GG 	Gg 
g	Gg 	gg 

1. Use the table to determine the probability of a rabbit being gray (GG or Gg alleles) and determine the probability of the rabbit being white (gg alleles) as decimal values.
2. Construct a table for the breeding of a white rabbit (gg) and a gray rabbit (Gg).
3. Use your table from part 3 to determine the offspring coloring probability for the breeding of a white rabbit (gg) and a gray rabbit (Gg).
 - a. What is the probability that an offspring will be white (gg)?
 - b. What is the probability that an offspring will be gray with genotype Gg ?
 - c. What is the probability that an offspring will be gray with genotype GG ?
4. Use the binomial distribution to determine the probability that a litter of 10 offspring from a white rabbit (gg) and a gray rabbit (Gg) will contain exactly 6 white rabbits.
5. Use the binomial distribution to determine the probability that a litter of 10 offspring from a white rabbit (gg) and a gray rabbit (Gg) will contain at least 1 gray rabbit.
6. Without doing any computations, explain what the color of the parents must be to guarantee 100% of white rabbits as offspring.
7. Explain what the color of the parents must be to guarantee 100% of gray rabbits as offspring.