

Practice with Monohybrid and Dihybrid Crosses!

A. Monohybrid Crosses

1. Brown eyes are dominant to blue. Two heterozygous brown-eyed individuals mate. Describe the genotypes and phenotypes of their children.
2. In humans the gene for free earlobes (F) is dominant to the gene for attached ear lobes (f). Show the possible genotypes and phenotypes of the offspring if one parent is heterozygous for free lobes and the other has attached lobes.
3. In humans the gene for being near-sighted is dominant to the gene for normal vision. What percentage of the children will have normal vision if one parent has normal vision and the other is heterozygous near-sighted?
4. The disease “sickle cell anemia” is due to a recessive gene. How could parents who are seemingly healthy with normal blood have a child with sickle cell anemia?
5. A man with no freckles marries a woman heterozygous for freckles. If having freckles is a dominant trait, describe the genotypic and phenotypic ratios for their future offspring.
6. In peas, the allele for tall plants (T) is dominant to the allele for short plants (t). A tall pea plant of unknown genotype is crossed with a short pea plant. About half of the F1 generation is short. What was the genotype of the tall plant?
7. Brown eyes are dominant to blue. A blue-eyed woman and a brown-eyed man have a blue-eyed child. What are their genotypes? What is the probability that their next child will have brown eyes?
8. In pea plants, yellow peas are dominant over green peas. Predict the phenotypic and genotypic outcome of a cross between two plants heterozygous for yellow peas.
9. In guinea pigs, the allele for a smooth coat (S) is dominant over the allele for a rough coat (s). Explain how you could find out whether a guinea pig with a smooth coat is a hybrid or a purebred.
10. In horses, the allele for a black coat (B) is dominant over the allele for a brown coat (b). A cross between a black horse and a brown horse produces a brown foal. Is the black horse a hybrid or a purebred? Explain.
11. In pea plants, yellow seeds (Y) are dominant and green seeds (y) are recessive. A pea plant with yellow seeds is crossed with a pea plant with green seeds. The resulting offspring have about equal numbers of yellow and green seeded plants. What are the genotypes of the parents?
12. In another cross, a yellow seeded plant was crossed with another yellow seeded plant and it produced offspring of which about 25% were green seeded plants. What are the genotypes of both parents?

13. Let's say you decide to make your living as a mink farmer. In mink, black fur is dominant over white fur. Since the market for black mink coats is higher than white mink, you (being the entrepreneur that you are) decide to only raise black mink. Everything is going well but the guy you bought your mink from seemed a little crooked! You want to make sure they are pure breeds so you run a test-cross.
- Give the genotype of the mink you will use to test-cross the "unknown" mink. (Use "B" and "b")
 - In your first test-cross, 30 out of 60 offspring are black and the rest are white! No wonder you got such a good deal! What is the genotype of the "unknown" mink in this case?
 - Was the black-furred mink you chose for your test-cross a pure breed or a hybrid?
 - Since you have many mink and there may only be one bad one in the bunch, you decide to do a second test-cross on a different mink. This time, out of 55 offspring, every last one is black! What is the genotype of the "unknown" mink in this test-cross?

B. Dihybrid Crosses

14. In pea plants, the round seed allele is dominant over the wrinkled seed allele, and the yellow seed allele is dominant over the green seed allele. The genes for seed texture and those for seed color are on different chromosomes. A plant heterozygous for seed texture and seed color is crossed with a plant that is wrinkled and heterozygous for seed color. *R = round, r = wrinkled, Y= yellow, y = green
- Construct a Punnett square for this cross.
 - What is the expected phenotypic ratio for the offspring?
15. In humans there is a disease called *phenylketonuria* (PKU) which is caused by a recessive allele. People with this allele have a defective enzyme and cannot break down the amino acid phenylalanine. This disease can result in severe developmental delays or death. Let "E" represent the normal enzyme. Also in humans is a condition called galactose intolerance or *galactosemia*, which is also caused by a recessive allele. Let "G" represent the normal allele for galactose digestion. In both diseases, normal dominates over recessive. If two adults were heterozygous for both traits (EeGg), what is the probability of having a child:
- that is completely normal?
 - that has just PKU?
 - that has just galactosemia?
 - that has both diseases?
16. A female guinea pig is heterozygous for both fur color and coat texture is crossed with a male that has light fur color and is heterozygous for coat texture. What possible offspring can they produce? Dark fur color is dominant (D) and light fur (d) is recessive. Rough coat texture (R) is dominant, while smooth coat (r) is recessive.
17. In humans, dark hair (D) is dominant over blonde hair (d), and curly hair (C) is dominant over straight hair (c).
- A woman with heterozygous curly, homozygous blonde hair marries a man with heterozygous curly, heterozygous dark hair. What is the probability that they will have a child with straight, blonde hair?
 - What would the phenotypes look like for the F1 generation of a cross between a person who has straight hair and who is homozygous dark, with an individual who has blonde hair and is heterozygous curly?
18. In humans, a widow's peak hairline (W) is dominant over a straight hairline (w), and brown eyes (B) are dominant over blue eyes (b). A man that is heterozygous for both widow's peak and brown eyes marries a woman who is also heterozygous for both traits. Using a Punnett square, what is the probability of them producing a child with brown eyes and a straight hairline?