Genetics: Dihybrid Cross

Using Punnett Squares to Predict the Outcome

Gregor Mendel, the father of modern genetics, discovered that in pea plants the gene for round seeds (R) is dominant to the gene for wrinkled seeds (r). He also discovered that yellow seed color (Y) is dominant to green seed color (y). He then made the following cross:

P RRYY x rryy

Notice that the first parent would always give the alleles for round and yellow seeds. And that the second parent would always give the alleles for wrinkled and green seeds.

1. What would be the **genotype** for all the F_1 offspring?_____
2. What would be the **phenotype** for all the F_1 offspring? _____

Mendel then decided to take the F_1 offspring and cross them together.

3. Show Mendel's F1 cross below. (See the answer to question #1)

F_1 _____ x _____

4. Based on independent assortment, what are the four possible gametes from these plants?

_____ _____ _____ _____

To determine the outcome of a cross with two traits, we use the **dihybrid Punnett square**. Put the four possible gametes from the parents along the top and side of the square and then fill in the sixteen boxes to show all possible offspring genotypes.

5. Complete the dihybrid Punnett square for Mendel's F1 cross.

6. What are the chances of having offspring with round, yellow seeds?_____
7. What are the chances of having offspring with round, green seeds?_____
8. What are the chances of having offspring with yellow seeds? _____
9. What are the chances of having offspring with green seeds?_____
10. What are the chances of having offspring with pure round, pure yellow seeds (homozygous dominant for both traits? _____

In humans free earlobes (E) is dominant to attached to attached earlobes (e), and tongue rolling (R) is dominant to non-rolling (r).

11. What are all the possible genotypes of a person with free earlobes who can roll his tongue?

_____

12. What is the genotype of a girl with attached earlobes but she cannot roll her tongue? _____

13. What are all the possible genotypes of a person with free earlobes who cannot roll her tongue?

_____

In cats, the gene for black fur (B) is dominant to the gene for brown (b), and the gene for short hair (S) is dominant to the gene for long hair (s).

14. Complete the Punnett square for the following cross: BBSs x Bbss
15. What are the genotype and phenotype ratios from this cross?

In tomato plants the gene for purple stems (A) is dominant to the gene for green stems (a). The gene for red fruit (R) is dominant to the gene for yellow fruit (r). If two tomato plants heterozygous (AaRr) for both traits are crossed, state what proportion of the offspring are expected to have:

16. red fruit _____ 17. green stems & red fruit _____ 18. purple stems & red fruit _____

If 640 seeds resulting from the above tomato plant cross are collected and planted, how many would be expected to grow into plants with:

19. purple stems & yellow fruit _____ 20. green stems & yellow fruit _____
21. green stems & red fruit _____

You are a geneticist working for a large seed company. One of your colleagues quit before she could finish some experiments and left them to you. All you know is that she was working with a rare type of flower that comes in two colors, red and blue, and that the plant has either a short stem or a long stem. You don't know which traits are dominant or recessive; however, you do have a bunch of these plants that have red flowers and long stems that you can cross. After many months of work you finally get the results of your crosses.

	red/long	red/short	blue/long	blue/short
Trial 1	2140	713	714	240
Trial 2	1006	336	335	110
Trial 3	874	292	291	100
Trial 4	866	289	289	100
Trial 5	739	248	244	80

20. Which traits are probably dominant and recessive and why? _____

_____

21. Do you think that the original plants that you were given were heterozygous for both traits and why? _____