



Punnett Squares – PowerPoint

Introduction

Students learn about Dominant and Recessive traits by looking at rabbits and corn. Students then count the ratio of purple to yellow corn kernels on an F2 ear of corn to determine if the ratio is what would be expected based on the genetic information.

Concepts for biotechnology:

1. Students learn the relationship between genotype and phenotype.
2. Students learn that genes are inheritable units.

Hawaii Standards

1. SC.BS.5.4 Explain how Mendel's laws of heredity can be used to determine possible offspring.

Instructions

Materials

Obtain colored corn with 3:1 ratio of purple to yellow from biological supplier.

Students work in pairs to count the corn colors. One student calls off the color and the other student records the colors (x for purple, blank for yellow). Students then count up the number of each color and divide the number of purple by the number of yellow.

Next add up all of the corn for each color in the classroom. Determine if the ratio is closer to the expected outcome. Discuss the importance of large populations when looking at genetics. Relate the results back to what Gregor Mendel observed.

Punnett Squares

Slide 2

Almost all mammals and many plants have a pair of chromosomes, one from the male parent and one from the female parent. Each chromosome carries the same genes. The genes are always found at the same location on the chromosome. However, the genes may not be exactly alike.

Different forms of the same gene are called alleles. For instance, a gene for rabbit hair color would be found at a certain place on a chromosome from the male parent and at the same place on the paired chromosome from the female parent.

Slide 3

Let's assume that the male rabbit comes from a long line of black rabbits. His parents only passed on the allele, or form of the gene, for black fur. Both of his genes are the same, he is homozygous. We'll call the allele for black fur, big F.

Let's also assume that the female rabbit comes from a long line of white rabbits. Her parents only passed on the allele, or form of the gene, for white fur. Both of her genes are the same, she is homozygous. We'll call the allele for white fur, little f.

Slide 4

What happens when we cross these two rabbits?

We use a Punnett square to visualize the possible outcomes.

The father rabbit has two copies of the gene for fur, so we place one of them in each of the boxes at the top of the square. Likewise, the mother has two copies of the gene for fur and we place those on the side.

We can then see what each parent would give to their possible children. The father will give the allele for black fur to each of his offspring and the mother will give the allele for white fur to each of her offspring. We now know what genes the baby rabbits got. This is their genome for fur. The term genome is the DNA that an organism has.

But how do the baby rabbits look? What are their physical traits or phenotype?

They are all black. That tells us that black is the dominant trait. A dominant trait is one that shows if the gene for that trait is present. White is the recessive trait. A recessive trait only shows when there are two copies of the gene.

Punnett Squares

Slide 5

So the next generation has all black rabbits. What will happen if two of these rabbits mate?

Slide 6

We know what their genome is because we saw what they inherited from the parents.

We can place a big F and a little f in the boxes for each rabbit. Then we cross them to find out the possible combinations of the next generation.

(Students predict the color of the rabbits before you click.)

Slide 7

(recap depending on student's understanding.)

Slide 8

Most organisms have many genes that determine color. Corn color is determined by the color of the kernel and the color of the coating on the kernel.

Slides 9 -15

These slides repeat the use of Punnett squares and can be skipped if students are clear on their use.

Slide 16 -17

Quiz for genotype and phenotype

Slide 18

A coating around the kernel can be colored.

Slide 19

If the coating is purple, it masks the yellow color.

If the coating is clear, the yellow color shows through.

Punnett Squares

Slide 20

All of our ears have yellow kernels. We are only looking at two forms of a gene that makes the coat purple or clear.

Slide 21

On a piece of paper, make a Punnett square and fill it in.

Slide 22

All of the offspring are heterozygous, but they are all purple.

Is clear or purple the dominant trait?

Slide 23

We can label them with big P for the dominant purple and little p for the recessive clear.

Slide 24

What will happen if we cross the heterozygous corn?

Slide 25

Make a Punnett square of your results.

Slide 26

Check your Punnett square.

Slide 27

By looking at the Punnett square, what is the ratio of purple to yellow (clear coat) corn in this generation.

Look at the corn that is being passed out to see if your ear of corn has that ratio. Each kernel is a separate outcome.

Punnett Squares

Corn Colors

Work as pairs. One person calls the color of each kernel for 5 consecutive rows. The partner records the colors with an X for purple and a blank for yellow.

Record the number of each color and calculate the ratio.

Add all of the results for your class. Does this change the ratio?

