Greenhouse Color Clues

Model flower-color inheritance with allele pairings and probabilities

FB.4.3 "Use models (e.g., Punnett squares) and mathematical reasoning to describe and predict patterns of inheritance of single genetic traits from parents to offspring (e.g., dominant, and recessive traits, incomplete dominance, codominance…"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the alleles each pink parent can pass on, circle the four offspring genotypes in the cross, and number the predicted red, pink, and white plants in the group of 80. Use your marks to trace how allele pairings lead to predicted colors.

Predicting Snapdragon Colors

1. At a school greenhouse, a class grows snapdragons with red, white, and pink flowers. For this single trait, call the red-color allele R and the white-color allele W. A plant with RR has red flowers, and a plant with WW has white flowers. A plant with RW has pink flowers because neither allele completely hides the other. This pattern is called incomplete dominance. Flower color does not tell you whether a seed will sprout, but it can help you predict the colors of plants that grow from a particular cross. Each parent passes just one of its two alleles to each offspring.

2. Two pink snapdragons, each with RW, are crossed. Each parent can contribute R or W, with a one-half chance for either allele. To model this cross, pair every possible allele from one parent with every possible allele from the other. The four equally likely pairings are R with R, R with W, W with R, and W with W. These pairings produce RR, RW, RW, and WW. Thus, among many offspring, the predicted color pattern is one red for every two pink and one white. A Punnett square organizes these four pairings into boxes, but each box represents a probability, not a guaranteed plant.

3. Suppose the greenhouse staff plants 80 seeds from this pink-by-pink cross. If every seed grows and the predicted proportions hold exactly, 20 plants would have red flowers, 40 would have pink flowers, and 20 would have white flowers. Real groups may differ from these numbers because the alleles passed to one seed do not control the alleles passed to the next. Even if several pink-flowered plants appear in a row, the next offspring still has a one-half chance of pink flowers. The model predicts a pattern across many offspring, not the exact color of any one offspring.

2 ANSWER WITH EVIDENCE

Use the passage

1. In the pink-by-pink cross, which two allele pairings produce pink offspring? What fraction of the four pairings is that?

2. What is the probability that an offspring from two pink parents has white flowers? Use the allele pairings to explain.

3. If 120 seeds from the pink-by-pink cross all grow, how many red-flowered plants does the model predict? Show your calculation.

4. After four pink-flowered offspring appear, a student says the next one must have white flowers. Does the model support that claim? Explain.

3 YOUR TURN

Your own words

A red-flowered plant (RR) crosses with a pink-flowered plant (RW). Complete the table to model all four equally likely allele pairings, then write one sentence predicting the probability of each flower color.

RED PARENT'S ALLELE	PINK PARENT'S ALLELE	OFFSPRING GENOTYPE	FLOWER COLOR

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PART 1 · READ AND MARK

Underline the alleles each pink parent can pass on, circle the four offspring genotypes in the cross, and number the predicted red, pink, and white plants in the group of 80. Use your marks to trace how allele pairings lead to predicted colors. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	In the pink-by-pink cross, which two allele pairings produce pink offspring? What fraction of the four pairings is that?	**R with W and W with R produce pink offspring. They make up 2/4, or 1/2, of the pairings.**
2	What is the probability that an offspring from two pink parents has white flowers? Use the allele pairings to explain.	**The probability is 1/4. Only W with W produces WW, the white-flower genotype.**
3	If 120 seeds from the pink-by-pink cross all grow, how many red-flowered plants does the model predict? Show your calculation.	**The model predicts 30 red-flowered plants because 1/4 of 120 is 30.**
4	After four pink-flowered offspring appear, a student says the next one must have white flowers. Does the model support that claim? Explain.	**No. Earlier offspring do not change the next offspring's allele pairings. The next offspring still has a 1/4 chance of white flowers.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

R | R | RR | red
R | W | RW | pink
R | R | RR | red
R | W | RW | pink
An offspring has a 1/2 chance of red flowers and a 1/2 chance of pink flowers.

Accept the four table rows in any order, with each red-parent R paired once with each pink-parent allele for each of the red parent's two allele positions. Probabilities describe expected patterns, not guaranteed counts.