Flowers by Chance

Trace a gene's effect and predict inherited flower colors.

FB.4 "Students will demonstrate an understanding of how genetic information is transferred from parent to offspring. Compare and contrast the basic structure and function of nucleic acids (e.g., DNA, RNA)..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the steps connecting a gene to flower color, circle each two-letter genotype, and number the two allele choices a pink parent can pass on.

The Greenhouse Color Puzzle

1. At a school greenhouse, snapdragon flowers can be red, white, or pink. Each plant inherits one version, or allele, of a pigment gene from each parent. A gene is a stretch of DNA on a chromosome, a packaged DNA molecule. DNA stores instructions in a sequence of bases. Cells copy a gene's instructions into RNA, which carries the message used to build a protein. Unlike DNA, RNA is usually single stranded and uses uracil instead of thymine. The protein made from this gene helps produce red pigment. Thus, a small difference in DNA can change a flower's color.

2. In these snapdragons, call the working pigment allele R and the nonworking allele W. An RR plant makes enough pigment for red flowers, while a WW plant makes no red pigment and has white flowers. An RW plant makes less pigment than an RR plant and has pink flowers. This pattern is called incomplete dominance: neither allele completely masks the other in a plant with two different alleles. When two pink plants produce seeds, each parent passes along either R or W. Each parent's two possible alleles are equally likely to enter an egg or pollen cell.

3. To predict the offspring of a pink-by-pink cross, pair each possible allele from one parent with each possible allele from the other. There are four equally likely pairings because each parent has two equally likely choices. These predictions describe chances across many offspring, not a promise about any four seeds. Suppose a mutation changes one base in an R allele so it can no longer direct production of a working pigment protein. For this model, treat that changed allele like W. A plant's flower color may then change because its protein activity has changed, even though its chromosomes still carry the same number of genes.

2 ANSWER WITH EVIDENCE

Use the passage

1. Trace how an inherited allele can affect flower color. Include DNA, RNA, and protein in your explanation.

2. Two pink plants produce seeds. List the four equally likely allele pairings and predict the percentage of red, pink, and white offspring.

3. If one pink parent passes W, what flower colors could its offspring have with another pink parent? Explain using allele pairs.

4. A mutation stops the R allele in an RW plant from directing production of a working pigment protein. What color would the flowers be under this model, and why?

3 YOUR TURN

Your own words

Cross a red RR snapdragon with a pink RW snapdragon. List four equally likely allele pairings, predict the percentage of each flower color, and explain how the inherited gene versions cause those colors.

Flowers by Chance

PART 1 · READ AND MARK

Underline the steps connecting a gene to flower color, circle each two-letter genotype, and number the two allele choices a pink parent can pass on. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Trace how an inherited allele can affect flower color. Include DNA, RNA, and protein in your explanation.	**An allele is a version of a DNA gene. Its instructions are copied into RNA and used to build a protein that helps produce red pigment.**
2	Two pink plants produce seeds. List the four equally likely allele pairings and predict the percentage of red, pink, and white offspring.	**The pairings are RR, RW, RW, and WW. The predicted offspring are 25% red, 50% pink, and 25% white.**
3	If one pink parent passes W, what flower colors could its offspring have with another pink parent? Explain using allele pairs.	**The other parent could pass R, making a pink RW plant, or W, making a white WW plant.**
4	A mutation stops the R allele in an RW plant from directing production of a working pigment protein. What color would the flowers be under this model, and why?	**They would be white. The changed R allele acts like W, so neither allele directs production of working pigment protein.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The red parent can pass only R, while the pink parent can pass R or W. The four equally likely pairings are RR, RW, RR, and RW. RR makes enough pigment for red flowers, and RW makes less pigment for pink flowers. The predicted offspring are 50% red, 50% pink, and 0% white.

Accept equivalent allele-pair orderings. Percentages are predictions across many offspring, not guarantees for a small number of seeds.