Beyond Simple Dominance

Use trait evidence to identify inheritance patterns.

GEN.4.3 "Investigate traits that follow non-Mendelian inheritance patterns (e.g., incomplete dominance, codominance, multiple alleles, autosomal linkage, sexlinkage, polygenic, and epistasis)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the observed trait of each organism or person with two different alleles. Circle the evidence that a gene has more than two alleles in a population.

Three Clues from the Biology Club

1. A biology club studies three traits that do not fit a simple dominant-recessive pattern. In incomplete dominance, an organism with two different alleles has a trait between the traits of organisms with two matching alleles. In codominance, both allele effects are visible together rather than blended. Multiple alleles means a gene has more than two versions in a population, though each individual still carries only two. The club begins with snapdragons. Plants with two red-flower alleles have red petals, and plants with two white-flower alleles have white petals. Their offspring, each with one red and one white allele, have pink petals. Two pink plants can produce red, pink, or white offspring.

2. Next, the club visits a cattle breeder. A calf inherits one allele for red hair from a red-haired parent and one allele for white hair from a white-haired parent. The calf's coat is roan: individual red hairs and white hairs grow side by side. No single hair is pink, and the coat is not a uniform blend of the two colors. If two roan cattle have a calf, that calf could inherit two red alleles, two white alleles, or one of each. Those combinations would produce red, white, or roan coats, respectively. A photograph from a distance might hide the separate hairs, so close observation matters.

3. Finally, a local blood bank describes the ABO blood group gene. Three alleles are common in the population: I^A, I^B, and i. The I^A allele produces A markers on red blood cells, while I^B produces B markers; i produces neither marker. Someone with I^A and I^B has type AB blood, with both A and B markers on the cells. Someone with I^A and i has type A. If a parent with $I^A i$ and a parent with $I^B i$ have a child, the child could have type A, B, AB, or O blood. The club uses these observations to test which inheritance patterns explain each trait.

2 ANSWER WITH EVIDENCE

Use the passage

1. Which inheritance pattern explains the snapdragon offspring? Use their petal colors as evidence.

2. Why does the roan calf show codominance rather than incomplete dominance?

3. How does the ABO blood group show both multiple alleles and codominance? Give one piece of evidence for each pattern.

4. How could the two parents described in the last paragraph have a child with type O blood?

3 YOUR TURN

Your own words

Invent a trait for an imaginary animal with two alleles. In four sentences, give both matching-allele traits, predict the offspring's trait when those parents are crossed, and explain whether the offspring show incomplete dominance or codominance.

Beyond Simple Dominance

PART 1 · READ AND MARK

Underline the observed trait of each organism or person with two different alleles. Circle the evidence that a gene has more than two alleles in a population. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Which inheritance pattern explains the snapdragon offspring? Use their petal colors as evidence.	**Incomplete dominance. Offspring with one red and one white allele have pink petals, a color between red and white.**
2	Why does the roan calf show codominance rather than incomplete dominance?	**Its red and white hairs remain separate and visible together; they do not blend into pink hairs.**
3	How does the ABO blood group show both multiple alleles and codominance? Give one piece of evidence for each pattern.	**The gene has three alleles in the population: I^A, I^B, and i. A person with I^A and I^B has both A and B markers.**
4	How could the two parents described in the last paragraph have a child with type O blood?	**Each parent could pass on i. A child with two i alleles has neither A nor B markers and has type O blood.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

A beetle with two G alleles (GG) has a green shell, while one with two Y alleles (YY) has a yellow shell. Crossing a GG beetle with a YY beetle gives offspring with one G and one Y allele. Each offspring has separate green and yellow stripes. This is codominance because both colors remain distinct instead of blending.

Accept invented traits with consistent parent alleles and offspring traits. For incomplete dominance, the offspring trait must be intermediate; for codominance, both effects must remain distinct.