Inheritance Investigators

Predict traits when simple dominance does not tell the whole story

BIO.3B.3 "Investigate traits that follow non-Mendelian inheritance patterns (e.g., incomplete dominance, codominance, multiple alleles in human blood types, and sex-linkage)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the allele rules for each trait, then circle the parent genotypes in all four cases so you can use them to predict offspring.

Four Families, Four Predictions

1. At a school greenhouse, a student crosses two snapdragons, each with genotype RW. In these flowers, R is a red-flower allele and W is a white-flower allele. Neither allele completely masks the other: a plant with RW has pink flowers. This pattern is incomplete dominance. Down the road, a cattle breeder mates a roan shorthorn cow (C^RC^W) with a white shorthorn bull (C^WC^W). C^R produces red hairs, and C^W produces white hairs. A roan animal has both red and white hairs, rather than hairs of a blended color. This pattern is codominance.

2. A volunteer at a blood drive has genotype I^Ai; their partner has genotype I^Bi. They want to predict the blood types their children could have. The ABO blood group has three common alleles in the population: I^A, I^B, and i. Each person inherits only two, one from each parent. I^A and I^B are codominant when inherited together, while either one masks i. Blood type A has I^AI^A or I^Ai; type B has I^BI^B or I^Bi. Type AB has I^AI^B, and type O has ii. Multiple alleles exist in the population, not in one person.

3. At a clinic, a counselor studies a family with an X-linked recessive condition. The mother has X^NX^n, and the father has X^NY. Here, X^N carries the typical version of the gene, and X^n carries a recessive condition-causing version. A child with two X chromosomes must inherit two X^n copies to have the condition; one X^N masks one X^n. A child with an X and a Y has no second copy of this gene on the Y, so one X^n causes the condition. Fathers pass their X to daughters and their Y to sons. Each child receives one of the mother's X chromosomes.

2 ANSWER WITH EVIDENCE

Use the passage

1. For the snapdragon cross, what fraction of offspring will have red, pink, and white flowers? Show how the parents' alleles lead to those fractions.

2. What fraction of the calves will be roan? Explain why a roan coat is not an example of incomplete dominance.

3. Which blood types could the volunteer and their partner have in their children, and what fraction would have each type?

4. In the clinic family, what fraction of sons could have the condition? Could any daughters have it? Explain using the X chromosomes they inherit.

3 YOUR TURN

Your own words

Choose two inheritance patterns from the passage. For each, invent a parent pair not used in the passage, predict the offspring genotypes and traits, and explain how the alleles produce those traits in 4 to 6 sentences.

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PART 1 · READ AND MARK

Underline the allele rules for each trait, then circle the parent genotypes in all four cases so you can use them to predict offspring. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	For the snapdragon cross, what fraction of offspring will have red, pink, and white flowers? Show how the parents' alleles lead to those fractions.	**Each RW parent can pass on R or W. The offspring genotypes are one-quarter RR (red), one-half RW (pink), and one-quarter WW (white).**
2	What fraction of the calves will be roan? Explain why a roan coat is not an example of incomplete dominance.	**Half will inherit C^RC^W and be roan; half will be C^WC^W and white. Roan coats show separate red and white hairs, not a blended hair color.**
3	Which blood types could the volunteer and their partner have in their children, and what fraction would have each type?	**The possible genotypes are I^Ai, I^Bi, I^AI^B, and ii. Types A, B, AB, and O each have a one-quarter chance.**
4	In the clinic family, what fraction of sons could have the condition? Could any daughters have it? Explain using the X chromosomes they inherit.	**Half the sons could inherit X^n from their mother and have the condition. No daughters could have it because every daughter inherits the father's X^N.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

For incomplete dominance, I cross an RR red snapdragon with a WW white snapdragon. Every offspring is RW and pink because neither allele completely masks the other. For ABO blood types, I pair an I^AI^B parent with an ii parent. Half the children would have type A (I^Ai), and half would have type B (I^Bi), because each child inherits i and one of the other parent's alleles.

Accept other valid parent pairs that differ from those in the passage. Check that each prediction matches the stated genotypes and inheritance pattern.