Family Risk Clues

Use family data to investigate inheritance and disease risk

BIO.3B.4 "Analyze and interpret data (e.g., pedigrees, family, and population studies) regarding Mendelian and complex genetic traits (e.g., sickle-cell anemia, cystic fibrosis, muscular dystrophy, color-blindness..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each statement that helps you predict a child's genotype. Circle the genotypes in the family table, then number the allele pairs that two carrier parents could produce.

A Family Asks About Cystic Fibrosis

1. A genetic counselor studies how a trait moves through families. For a simplified cystic fibrosis model, C is a working CFTR allele and c is a disease-causing allele. A person with cc has cystic fibrosis; a person with Cc is an unaffected carrier. Each parent passes one allele to each child.

2. At a school health fair, a family asks whether a diagnosis in one child changes another child's chances. Tests identify the CFTR allele pairs shown below. Both parents were tested, as were their two children. The table records current health status, not the age at diagnosis. Any child can inherit either parent's allele.

CFTR TEST RESULTS FOR ONE FAMILY

Family member	Allele pair	Health status
Marisol, parent	Cc	Unaffected
Teo, parent	Cc	Unaffected
Elena, child	cc	Has cystic fibrosis
Ivo, child	CC	Unaffected

3. One sibling's genotype cannot change the alleles passed in a later pregnancy. To predict risk, pair the alleles each parent could pass and count the resulting genotypes. If a child is known to be unaffected, exclude any genotype that causes the condition before comparing the remaining possibilities. Testing a future partner can also change a family's risk estimate.

2 ANSWER WITH EVIDENCE

Use the passage

1. What inheritance pattern is supported by the parents' and Elena's results? Use their allele pairs as evidence.

2. What is the probability that Marisol and Teo's next child will have cystic fibrosis? Show the possible allele pairs.

3. If Marisol and Teo's next child is unaffected, what is the probability that the child is a carrier? Explain your count.

4. Could Ivo pass the disease-causing allele to a child? Use his test result to explain.

3 YOUR TURN

Your own words

Suppose Elena has children with a partner whose test result is Cc. In three or four sentences, give each possible child genotype and its probability, then explain the children's chances of having cystic fibrosis or being an unaffected carrier.

ANSWER KEY

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HIGH SCHOOL · BIO.3B.4

PART 1 · READ AND MARK

Underline each statement that helps you predict a child's genotype. Circle the genotypes in the family table, then number the allele pairs that two carrier parents could produce. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What inheritance pattern is supported by the parents' and Elena's results? Use their allele pairs as evidence.	**Autosomal recessive inheritance: both unaffected parents are Cc carriers, and Elena has cystic fibrosis with cc.**
2	What is the probability that Marisol and Teo's next child will have cystic fibrosis? Show the possible allele pairs.	**The possible pairings are CC, Cc, cC, and cc. One of four is cc, so the probability is 25%.**
3	If Marisol and Teo's next child is unaffected, what is the probability that the child is a carrier? Explain your count.	**Two of the three unaffected pairings, CC, Cc, and cC, are carriers. The probability is 2/3.**
4	Could Ivo pass the disease-causing allele to a child? Use his test result to explain.	**No. Ivo is CC, so he has no c allele to pass on.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Elena can pass only c, while her partner can pass C or c. Each child has a 50% chance of being Cc and a 50% chance of being cc. A Cc child would be an unaffected carrier, and a cc child would have cystic fibrosis.

Accept cC as equivalent to Cc when students list allele pairings. Probabilities apply to each pregnancy independently.