

Pedigree Analysis for Inheritance Patterns

Given and Introduction:

In genetics, a pedigree chart is used to study the inheritance pattern of traits across generations. In the provided pedigree:

- Circles represent females.
- Squares represent males.
- Filled symbols indicate individuals with the trait in question.
- Empty symbols represent individuals without the trait.

Step 1: Determine the Possible Inheritance Pattern

Examine the distribution of the trait across the pedigree to hypothesize whether the trait is inherited in an autosomal dominant, autosomal recessive, X-linked dominant, or X-linked recessive manner.

Step 2: Characteristics of Inheritance Patterns

Autosomal Dominant:

- Trait typically appears in every generation.
- Affected individuals have at least one affected parent.
- Both males and females are equally likely to be affected.

Autosomal Recessive:

- Trait can skip generations.
- Affected individuals may have unaffected parents who are carriers.
- Both males and females are equally likely to be affected.

X-linked Dominant:

- Trait does not skip generations.
- Affected males pass the trait to all of their daughters but none of their sons.
- Affected females (if heterozygous) have a 50% chance of passing the trait to each child, regardless of gender.

X-linked Recessive:

- More males are affected.
- Affected males may have carrier mothers.
- Trait can skip generations, and affected females are rare.

Step 3: Analysis of the Pedigree

1. Examining Generations:

The trait appears in I-1, II-2, II-6, and III-3. Both males and females are affected.

2. Parents and Offspring:

Look at I-1: Affected individual with two unaffected offspring who are her sons (II-4, II-5), suggesting they carry the recessive allele without expressing it. II-2 and II-6, siblings, show the trait skipping directly to the next generation (III-3).

3. Sex Distribution:

Both females and males are affected, and there is no evidence suggesting a gender-specific pattern.

Supporting Statement:

Considering the trait skips generations and affects both genders equally without preferential transmission, this matches the pattern of autosomal recessive inheritance. Both affected individuals arise from parents who are likely carriers of the trait.

Step 4: Confirm Hypothesis

Finalize that the observed inheritance pattern fits an autosomal recessive trait where:

- Individuals II-2 and II-6 are siblings who received the recessive allele from carrier parents.
- Individual III-3 inherited the recessive trait from parental carriers.

Explanation:

The trait's manifestation only in homozygous recessive individuals (aa) with carrier parents (Aa) confirms autosomal recessive inheritance.

Final Solution:

The provided pedigree represents an autosomal recessive inheritance pattern.

Conclusion:

The trait in the given pedigree follows the pattern of autosomal recessive inheritance, affecting males and females equally, often skipping generations, and arising when both parents are carriers of the recessive allele.

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