

Solve Pedigree Problems in 60 Seconds

NEET Biology · Principles of Inheritance and Variation · 4 patterns · 4 steps · 8 practice questions

Symbols:

□ Normal male

○ Normal female

■ Affected male

● Affected female

◉ Carrier female

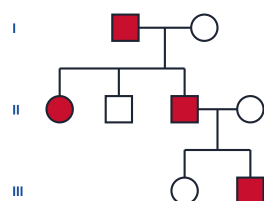
◇ Sex unspecified

□—○ Mating

□=○ Consanguineous mating

Autosomal Dominant

Vertical pedigree

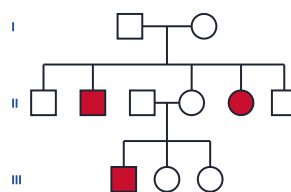


- Trait passes from both father and mother.
- Males and females almost equally affected.
- **Vertical:** present in every generation. An affected child always has at least one affected parent; the trait never skips a generation.

Examples: Myotonic dystrophy, dimpled cheek, widow's peak, brachydactyly, syndactyly, polydactyly, PTC taster

Autosomal Recessive

Skips generations

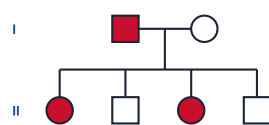


- Passes from both parents; males and females almost equally affected.
- Not vertical: normal (carrier) parents produce affected children; the trait skips generations.
- Consanguinity (marriage between cousins) brings it out in the offspring.

Examples: Albinism, sickle-cell anaemia, thalassemia, PKU, alkaptonuria (AKU), cystic fibrosis, Tay-Sachs disease

X-linked Dominant

Father → all daughters

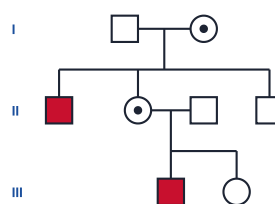


- Usually very rare in the population.
- An affected father passes it to **all his daughters** and none of his sons.
- So sometimes more females than males are affected.

Examples: Vitamin D-resistant (hypophosphataemic) rickets

X-linked Recessive

Mostly males



- Females show it only when homozygous; males show it when hemizygous, so **more males are affected** and it is rare in females.
- Affected mother → 100% of sons affected. Carrier mother → 50% of sons.
- Unaffected father → all daughters unaffected. Never passes father → son.

Examples: Red-green colour blindness, haemophilia

4-step method to identify any pedigree

1. **Two normal parents, affected child?** → **Recessive**. If that child is an affected *daughter* of a normal father → autosomal recessive (X-linked recessive is ruled out).
2. **Two affected parents, normal child?** → **Dominant**. If that child is a normal *daughter* of an affected father → autosomal dominant (X-linked dominant is ruled out).
3. **Look at the sexes.** Mostly males, coming through unaffected mothers → X-linked recessive. Affected father → all daughters affected, no sons → X-linked dominant.
4. **Father → son transmission seen?** → It cannot be X-linked (a son gets only Y from his father).



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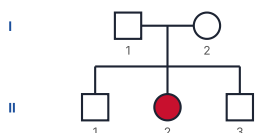
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Practice Pedigrees

Identify the pattern first, then work out genotypes and probabilities.

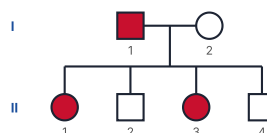
Practice questions

Q1.



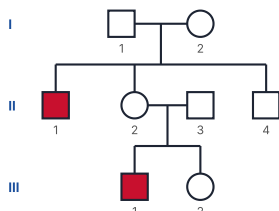
(a) Identify the mode of inheritance. (b) Write the genotypes of I-1 and I-2. (c) What is the probability that II-3 is a carrier?

Q2.



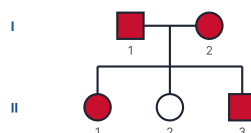
Which mode of inheritance is most likely? Give the reason.

Q3.



(a) Which mode of inheritance is most likely? (b) What is the genotype of II-2? (c) What is the chance that her next son is affected?

Q4.



(a) Identify the mode of inheritance. Which type is ruled out by II-2? (b) What is the chance that the next child is affected?

- Two normal first cousins marry and have an albino child. (a) Mode of inheritance? (b) Genotypes of the parents? (c) Probability that the next child is albino? (d) Why does consanguinity increase the risk?
- A woman who carries haemophilia marries a normal man. What percentage of (a) sons (b) daughters will be haemophilic?
- A trait appears in every generation and an affected father has an affected son. Which modes are ruled out, and which is most likely?
- Which is not autosomal recessive? (a) Albinism (b) Phenylketonuria (c) Myotonic dystrophy (d) Cystic fibrosis

Answers

- (a) Autosomal recessive: normal parents have an affected daughter, so it is recessive, and a normal father rules out X-linked. (b) Both Aa. (c) 2/3 (II-3 is normal, so he is AA or Aa in the ratio 1 : 2).
- X-linked dominant: the affected father passes it to both daughters and neither son.
- (a) X-linked recessive: only males are affected, and they come through normal mothers. (b) Carrier, $X^A X^a$. (c) 1/2 (50%) of her sons.
- (a) Autosomal dominant: affected parents have a normal child. II-2 is a normal daughter of an affected father, which rules out X-linked dominant. (b) 3/4 ($Aa \times Aa$).
- (a) Autosomal recessive (b) Both Aa (carriers) (c) 1/4 (d) Relatives are more likely to carry the same recessive allele from a common ancestor.
- (a) 50% (b) 0%; 50% of daughters are carriers.
- Father $\rightarrow$ son transmission rules out both X-linked types. Appearing in every generation suggests autosomal dominant.
- (c) Myotonic dystrophy. It is autosomal dominant.

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