

PEDIGREE WORKSHEET - ANSWER KEY

1. The following pedigrees show the inheritance of a trait known as ACHOO syndrome (or photic sneeze reflex), a condition whereby people break into a sneezing fit upon sudden exposure to bright light.

- a) For the left pedigree assign genotypes (using A and a) assuming the trait is autosomal dominant.
For the right pedigree assign genotypes assuming the trait is autosomal recessive.

Dominant	Recessive
Aa + aa	aa + Aa
aa; aa; Aa	aA; aA; aa

- b) What are the possible modes of inheritance of photic sneeze reflex? Now try to assign alleles assuming the trait is sex-linked (on the X chromosome) for both dominant and recessive inheritance.

X-linked Dominant	X-linked Recessive
XA/Xa + Xa/Y	Xa/Xa + XA/Y
Xa/Xa; Xa/Xa; XA/Y	Xa/XA; Xa/XA; Xa/Y

- c) What are the possible modes of inheritance of photic sneeze reflex?

All modes of inheritance, are possible in this case:

- ACHOO could also be autosomal dominant, the affected woman would be Aa, her husband aa, the daughters inherited a from the mother and a from the father, while the son inherited A from the mother and a from the father.
- ACHOO could be autosomal recessive, with the affected woman aa, her husband Aa, the daughters aA and the son aa.
- ACHOO could be X-linked dominant, so the affected woman would be X^AX^a, her husband would be X^aY, the two daughters would have inherited the X chromosome with the a allele from their mother and the X with the a allele from their father (the only X chromosome he has), while the son would have inherited the X chromosome with the A allele from the mother and the Y chromosome from the father.
- ACHOO could be X-linked recessive as well; the affected woman would be X^aX^a, so her son automatically would inherit an X with the a allele from her (and a Y from his father); the unaffected man (the father) would be X^AY, thus automatically passing the X chromosome with the A allele to all his daughters, who would be X^aX^A as they would also inherited an X with the a allele from their mother.

- d) Assuming the mode of inheritance for this trait is autosomal dominant, what is the probability that, if these two parents had a 4th child, that child would be an affected boy? 25% (0.5 x 0.5)

Probability of a boy = 50%

	<u>X</u>	<u>X</u>
X	XX	XX
Y	XY	XY

Probability of being affected = 50%

	<u>A</u>	<u>a</u>
a	Aa	aa
a	Aa	aa

2.

Pedigree	Possible	Not Possible
I	Autosomal dominant Autosomal recessive X-linked recessive	X-linked dominant
II	Autosomal Recessive	Autosomal Dominant X-linked Dominant X-linked Recessive
III	Autosomal dominant Autosomal recessive	X-linked Dominant X-linked Recessive
IV	Autosomal recessive X-linked recessive	Autosomal dominant X-linked dominant.

Pedigree I:

X-linked dominant is ruled out. If the trait were X-linked dominant, all the daughters of affected men should be affected, as they would be inheriting their fathers' only X chromosome, which would have the dominant affected allele.

Pedigree II:

The only possible mode of inheritance is autosomal recessive (Be able to explain why).

Pedigree III:

The trait can be autosomal dominant: all affected individuals in the pedigree have at least one affected parent, so they could all be heterozygotes who inherited their "affected" allele from their affected parent, while the unaffected people inherited "unaffected" alleles from both parents.

The trait could be autosomal recessive, with all unaffected parents of affected people being heterozygous.

The trait cannot be X-linked dominant: affected man in generation I has one unaffected daughter; if the trait were X-linked dominant this man would be passing on an X with the dominant affected allele to all his daughters, so they should all be affected, but one of them is not.

The trait cannot be X-linked recessive: if it were X-linked recessive, all sons of the affected woman in generation II should be affected, since she would be homozygous for the "affected" allele and would be passing one of her two X chromosomes with the "affected" allele to each of her sons, so her sons should all be affected, while two of them are not.

Pedigree IV:

The trait could be X-linked recessive or autosomal recessive. (Be able to explain why).