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**Extension**

# Genetics of cat sensitivity to catnip

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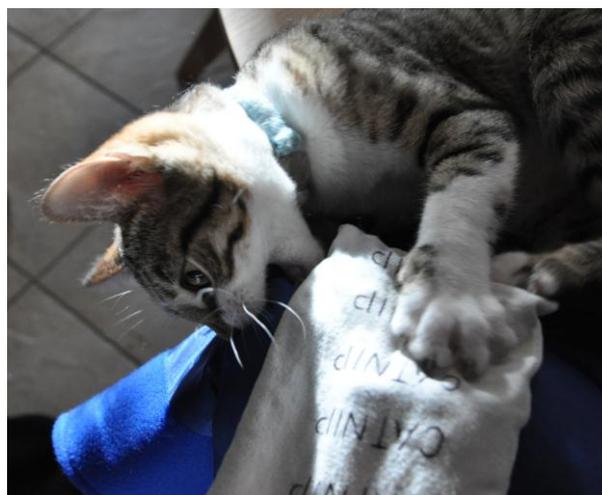


Photo by Miranda Jack

How can we tell whether a gene is dominant or recessive, sex-linked or autosomal? Consider this example using the catnip response.

Catnip does not affect all cats. Figure 1 shows the results of a study carried out over several years on a population of cats. The square symbols are the males, the circular symbols are females; dotted lines indicate uncertain parentage. Solid symbols represent cats that reacted to catnip, open symbols represent cats that were unaffected by the plant, a question mark (?) denotes animals not tested for catnip sensitivity. First, see if you can find the evidence that the allele for catnip sensitivity is dominant, then decide if the gene is situated on a sex chromosome or not, by studying the results. Then read on to see if you are correct.

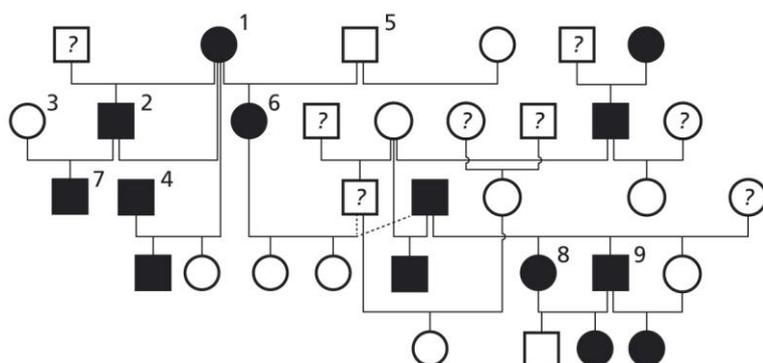


Figure 1 A pedigree of catnip response

(redrawn from Todd, N. B. (1962) 'Inheritance of the catnip response in domestic cats', *Journal of Heredity* Vol. 53, pp. 54–56)

To distinguish between dominant and recessive alleles, the significant crosses are 1 × 4 and 8 × 9. In both these crosses, two catnip-affected individuals produced an offspring that is not affected. If the allele for catnip sensitivity were recessive, the only possible genotype of all the parents would be homozygous for that allele. All their gametes would therefore contain the allele, and they could not pass on insensitivity to catnip.

To illustrate what must have happened in the crosses, let's call the allele for catnip sensitivity 'C', and the allele for insensitivity 'c'. Since some of the offspring were unaffected, the parents in both these crosses must have been heterozygotes — Cc, producing equal numbers of gametes with C or c. The crosses would be expected to generate equal numbers of offspring with the following genotypes: CC, Cc, cC and cc. All offspring with C would be sensitive to catnip (on average three out of four progeny); the unaffected female from cross 1 × 4 and the unaffected male from cross 8 × 9 must be cc. The allele must therefore be dominant.

To decide whether the gene is sex linked — i.e. a gene carried on a sex chromosome — look at the cross 1 × 5 in which a catnip-affected female crossed with an insensitive male. The offspring was a female that was affected by catnip. As the father (XY) was not affected, we know that the gene cannot be linked to the Y chromosome, because the offspring was female (XX). The cross between 2 and 3 shows that the gene cannot be linked to the X chromosome, because the male offspring was affected but can only have got his X chromosome from his mother, who was unaffected. This shows that the gene must be carried on an autosomal chromosome.

Now you know that the catnip sensitivity allele is dominant you can make predictions about the phenotype of offspring of crosses. If you can test the parents of some kittens for catnip sensitivity you will need to wait until the kittens are about 3 months old to see if your predictions are right. The vomeronasal organ is not fully formed at birth, so young cats are unaffected by the plant even if they have the allele for sensitivity.