

Overlapping genomic regions underlie canine fearfulness and human mental disorders

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Researchers in the Hannes Lohi research group in the University of Helsinki focused on two forms of canine fearfulness: noise sensitivity and general fearfulness. The latter encompasses the fear of unfamiliar humans and new situations. Among Finnish dogs, noise sensitivity has been observed in as much as 40 percent of the population, while, according to estimates, one in four dogs suffers from fearfulness.

Prior studies have suggested that canine fearfulness corresponds with human anxiety disorders, potentially could potentially serve as a disease model for human disorders.

"Fear is an innate and vital reaction. However, when it becomes excessive and an overriding feature in a dog's life, it turns into a behavioural problem," says Riika Sarviaho, a doctoral student.

Canine behavioural disorders include separation anxiety, generalised anxiety disorder and various phobias. Fear can be expressed as aggression, which may, at its worst, lead to attacks against other dogs or humans.

More than 300 owners of German Shepherds filled out a behavioural survey for the study, which had already been validated as a reliable tool on the basis of behavioural tests. Based on the responses, a score depicting the intensity of fearfulness was given to each dog.

"Interpreting and measuring behaviour is a challenging but important stage of successful research. Extremely fearful dogs are excluded from the population, leaving their numbers often very low. To expand the dataset and power of the study, less extreme cases were also included in the study," Professor Hannes Lohi adds.

Nearly identical genomic regions

On the basis of genetic research, generalised anxiety in dogs was associated with a region of canine chromosome 7 that corresponds with a certain region in human chromosome 18.

"This is an extremely fascinating finding, since chromosomal region 18p11 has been linked with several neuropsychiatric diseases, such as schizophrenia and bipolar affective disorder already in the 1990s. Fear is an integral part of many mental disorders. Schizophrenia has even been described as chronic fear. The results indicate that canine fearfulness and human psychotic disorders may have similar underlying factors," Sarviaho notes.

In further studies, the significance of the chromosomal region should be verified and the gene variants associated with fearfulness identified. With the help of genetic findings, it will be easier to understand the pathogenetic mechanisms of canine fearfulness in neurons and to compare them with corresponding human diseases.

Noise sensitivity seen also in humans

Dogs' sensitivity to [noise](#) is apparent when they express fear, for example during a thunderstorm or fireworks. In veterinary medicine, noise sensitivity is considered a diagnostic condition of its own, and [dogs](#) that are sensitive to noise are not necessarily otherwise fearful.

Sensitivity to sound also occurs among humans; for example, in human misophonia and hyperacusis, certain sounds cause feelings of discomfort, fear or even rage. However, the genetic background of these diseases remains poorly known in both human and [veterinary medicine](#).

"The genomic region associated with [noise sensitivity](#) in the German Shepherd breed is interesting. It includes several genes that have been associated with human mental [disorders](#). Among others, it includes a

gene that codes a receptor for the neurotransmitter glutamate and has been linked with both anxiety and hearing. Another gene of interest is the oxytocin receptor gene OXTR, which has been associated with anxiety, stress and social behaviour. Further analyses of this region will be carried out as well," Professor Lohi explains.

The findings indicate that canine fearfulness is hereditary. To verify the role of the newly discovered genomic regions and to identify other new regions and actual risk [genes](#) requires further research with an even larger dataset.

Gene discoveries have so far been rare in canine behavioural studies, and the recently published study is the first one to be carried out within a single breed, resulting in the identification of a significant link between canine fearfulness and genomic regions.

More information: R. Sarviaho et al. Two novel genomic regions associated with fearfulness in dogs overlap human neuropsychiatric loci, *Translational Psychiatry* (2019). [DOI: 10.1038/s41398-018-0361-x](https://doi.org/10.1038/s41398-018-0361-x)

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