

TOWARDS HEALTHIER BREEDS – GENETIC STUDIES FOR DOGS

Rapid development of biomedical research in the past decade has revolutionized the research of genetic diseases. Thousands of disease genes have been discovered in various inherited disorders and that has resulted in the early diagnostics and prevention as well as better treatment of the diseases. This development was greatly boosted by the international Human Genome Project, which has facilitated the identification of the risk alleles and disease genes in many conditions.

Recently, the dog's genome has also been sequenced providing us an equally great opportunity for many new gene discoveries. The dog is a geneticist's dream because each pure breed represents a group of genetically similar animals that descended from only a few ancestors. The presence of hundreds of breeds of dog, each in an isolated breeding population, allows us to simplify a complicated genetic problem. Most breeds have been artificially created by man and this selective breeding has resulted in amazing variation between breeds with respect to weight, size, head shapes, coat, ear shape, behaviours and diseases. Since any traits associated with a given breed must result from a shared set of genetic determinants, these genes stand out much more obviously than they would in a population of unrelated, or genetically dissimilar, animals.

The large number of reported diseases is due to the founder effect and inbreeding practices in pure-bred dogs that uncover recessive disease alleles. Through aggressive breeding programs man has created over 400 different breeds of dog and burdened them with over 400 inherited diseases during the last 400 years. This places dogs as the species with the second largest number of known genetic diseases, surpassed only by humans. Genetic analysis of man's best friend will also help to uncover the genes responsible for the physical features and behaviours unique to each breed as well as the diseases to which they are commonly susceptible, such as cancer, epilepsy, allergies, deafness, blindness, heart disease and hip dysplasia.

More than 60% of canine inherited diseases are shared with humans and the coding sequences of dogs and humans show an overall greater similarity to each other than to mouse coding sequences. Thus, dogs can be used as models to understand many human diseases and to develop new more efficient and side-effect free therapies. Importantly, genetic research in dogs is believed to facilitate the understanding of genetic background of the common complex diseases, which have proven difficult to crack down in human. Dogs have faithfully served man in many duties and they are now also the best assistants of the geneticists!

I have started a canine genetic program in the University of Helsinki, Finland. Our objective is to collect many breeds of dogs with different inherited diseases and try to identify the genetic defects behind them. Potential gene discoveries will help us to devise DNA markers and tests, which can be used to reliably distinct affected, carrier and healthy dogs. This will help the breed club to redesign the breeding programs to start systemically to prevent or eradicate the disease in the breed. This is important since it allows us to keep also the carrier dogs in the population and develop the breed in a more controlled way.

We have initiated several research projects in multiple breeds of dogs in Finland. We have started to collect pedigrees and DNA samples for many breeds with variety of diseases such as epilepsy, autoimmune diseases, cancers, vision disorders and behavioural problems. It is important for the success of the projects that the owners and breeders would participate openly and actively with the research group to help them to get enough DNA samples, pedigree information and clinical data to ensure necessary resources for disease gene identification.

To be able to conduct these studies, we need blood samples from the affected dogs and their healthy siblings and parents as much as possible. More samples we get, faster we can proceed. All the dog names and owner information will not be revealed to anybody and will be handled confidentially. Although the research group is responsible for the major funding of the projects, we welcome also any external help.

We have also shown recently the genetic power of dogs in epilepsy research by cloning the first canine epilepsy gene, Epm2b ([Lohi et al. 2005](#)), in a collection of privately owned pets, miniature wirehaired dachshunds from the United Kingdom. A dodecamer repeat expansion mutation was identified in the Epm2b gene, the first example of a repeat expansion disease outside human genome.

Epilepsy afflicts 1% of humans. Most of the epilepsy syndromes are polygenic disorders. Epilepsy is 5-10 times more common in dogs than in human. Currently only a few epilepsy genes has been described in human mainly in rare large families segregating Mendelian forms of epilepsy. Dozens of genes contributing to the common human epilepsy syndromes still need to be identified. The high prevalence of epilepsy in various breeds of dogs provides a great resource to identify more causative genes, especially in common polygenic epilepsies. Identified canine loci can be directly tested in collections of human epilepsy patients to expedite human gene cloning. This type of research will help both canine and human health in epilepsy and many other common diseases.

We wish an open and fruitful collaboration with all dog owners, breeders and friends, and welcome as many sample as you can contribute for the projects. Together we can now start to advance the healthiness of our breeds and make sure we have happy dogs in future!

If you want to participate in this research, please email hannes.lohi@helsinki.fi for more information.

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Blood samples:

Instructions for blood sample collection can be found [here](#). The sample form is also available from [this link](#).

Questionnaires:

Disease questionnaires available in English at this time are

[epilepsy questionnaire](#) (more information about epilepsy research [here](#))

and

[missing teeth questionnaire](#).

News in English

[Academy of Finland Award to Hannes Lohi](#)