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GENETICS IN PRACTICE

FERAGEN
Labor für genetische Veterinärdiagnostik

# Breed Certificate

**from**

# Fella H431789

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## Dear owner of Fella H431789!

As part of the breed identification, numerous analyzes were used to check if your dog's results matches with the DNA markers of purebred Border Collie. The results showed high match with the data of purebred dogs based on currently available reference samples in the database.

Each of the analyzes used in breed identification were performed independently. They vary in their specificity, which may cause them to diverge. The overall result of breed determination is based on a weighted average of all individual results, with the most emphasis being placed on pedigree analysis.

The results were confirmed by the following analyzes:

- In a principal component analysis (PCA), your dog's DNA sample was found within the expected cluster of purebred dogs.
- In a general comparison of your dog's DNA markers with dogs of other breeds, the sample appears within the expected cluster of purebred dogs.
- When comparing your dog’s DNA with the markers of other breeds, which showed a very high similarity as found in dog's analysis, the markers are also located in the group of purebred dogs.
- In the ancestry analysis of your dog, only a single breed was identified. The genetic markers showed a very high match with the samples of purebred dogs from this reference breed.
- The observed homozygosity (number of identical genetic markers) of your dog’s DNA data is in the expected range of purebred dogs.

Details and explanations can be found on the following pages of your report.

If you have any questions, please directly contact:

service@vhl.com

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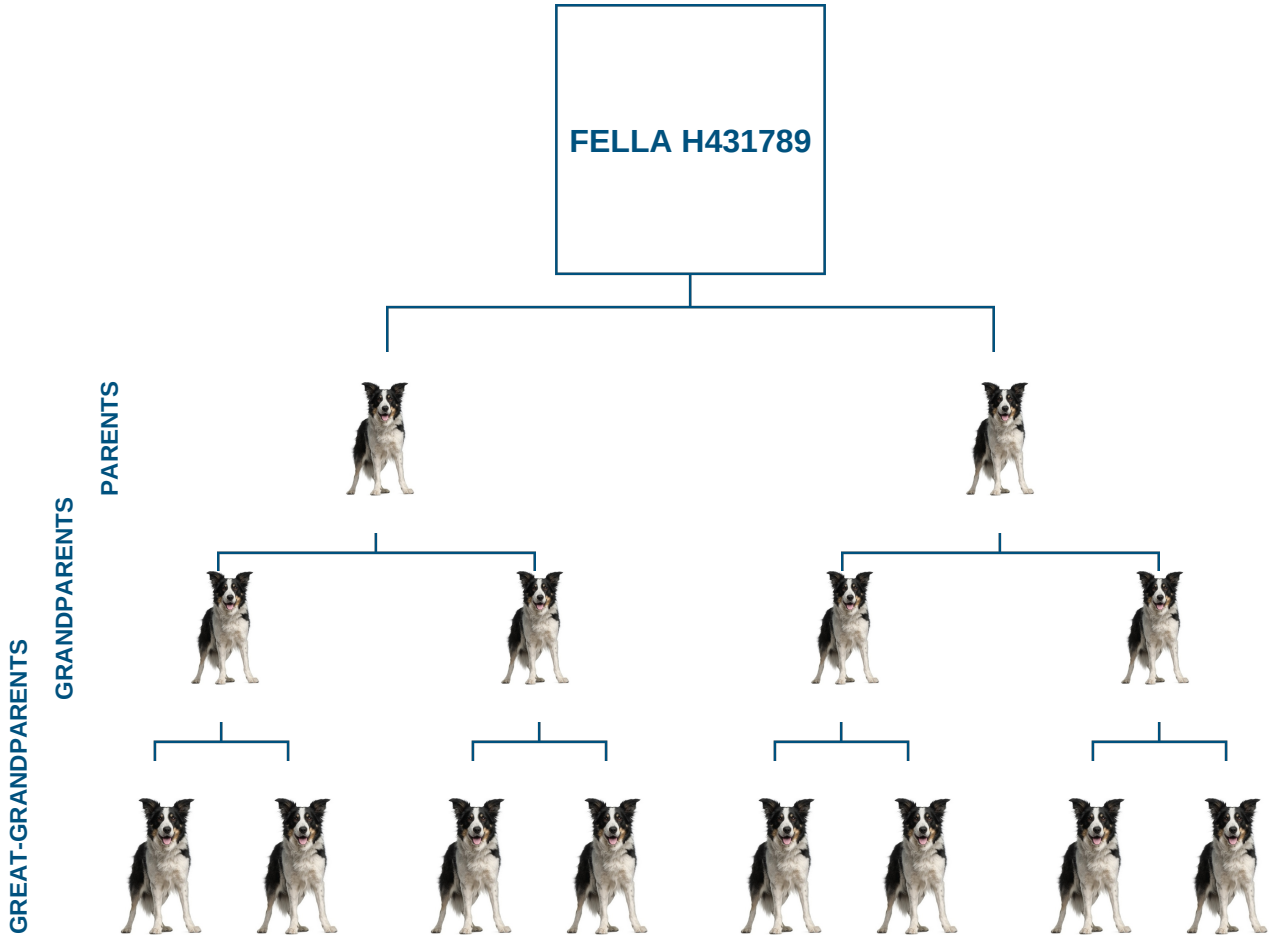
# Breed Identification Results:

Fella H431789 is a

## Border Collie

The computer algorithm performed over seven million calculations using 11 different models (from a single breed to complex combinations of breeds) to predict the most likely combination of pure and mixed breed dogs in the last 3 ancestral generations that best fit the DNA marker pattern observed in Fella H431789. The ancestry chart depicting the best statistical result of this analysis is shown in the picture below.



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## WHAT DOES THIS RESULT MEAN?

### Parents:

The parents of Fella H431789 are purebred Border Collie. If there is no information on the breeds of at least one parent, the maternal or paternal line can't be determined. The parent's breeds contribute about 50% to the genome of Fella H431789. The physical characteristics and behaviors of the parents are very likely to be reflected in your dog.

### Grandparents:

The grandparents of Fella H431789 are also purebred Border Collie. The grandparent's breeds contribute about 25% to the genome of Fella H431789. Some of the physical characteristics and behaviors of the grandparents can likely be reflected in your dog.

### Great-grandparents:

Also in the great-grandparents of Fella H431789 only the following breeds were idientified: Border Collie. The great-grandparent's breeds contribute about 12,5% to the genome of Fella H431789. It is highly unlikely that physical characteristics and behaviors of the great-grandparents are reflected in your dog.

## PREDICTED ADULT WEIGHT

Based on the markers from genetic analysis and the breeds found in Fella H431789’s ancestry, the likely adult weight of Fella H431789 was calculated. The weight profile represents the unique mix of the different breeds identified.

- If intact, the predicted weight is between 15 - 26 kg
- If neutered, the predicted weight is between 16 - 27 kg

There are many factors influencing a dog’s adult weight, including sex and neuter status. Both factors were used to calculate the predicted body weight of your dog. An additional influence on body weight has a proper diet and sufficient exercise. Please keep in mind that overweight is not only a serious human problem but can also affect your dog. Overweight should be taken seriously!

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## EXAMPLE-DOG KIRA:
## HOW GENETIC TRAITS CAN BE INHERITED

In your report you got a list of individual breeds found in your dog. Different breeds can contribute to a mixed breed dog's appearance in different and fascinating ways. These combinations make your dog unique. Your dog may look and behave very similar to one of the identified breeds, but much more often the look and personality are an interesting mixture of the different breeds. Below you can find our example-dog Kira. Based on her experience we would like to show you, how interaction of different breeds can result in different physical characteristics.

**Floppy-Ears**
Floppy ears are usually inherited recessively and erected ears are dominant. In Kira's ancestors, the Labrador Retriever and the Parson Russell Terrier had floppy ears, so they were passed on to Kira.

**Black saddle**
The black saddle is a typical characteristic of the German Shepherd Dog. This gene is inherited dominantly and for this reason the trait is also found in Kira.

**Short hair**
The gene for short hair is dominant over the gene for long hair. Since all three breeds are short-haired in Kira's ancestors, Kira also has short hair.

**Black pigment**
The black coloring of the nose, the rim of the eyes, the lips and the foot pads was inherited from all three ancestors by a gene variant responsible for the black color.

**Dominant** = 1 gene copy needed for showing the trait (one from the mother or the father)
**Recessive** = 2 gene copies needed for showing the trait (one from the mother and the father)

### THE FOLLOWING BREEDS WERE FOUND IN KIRA:

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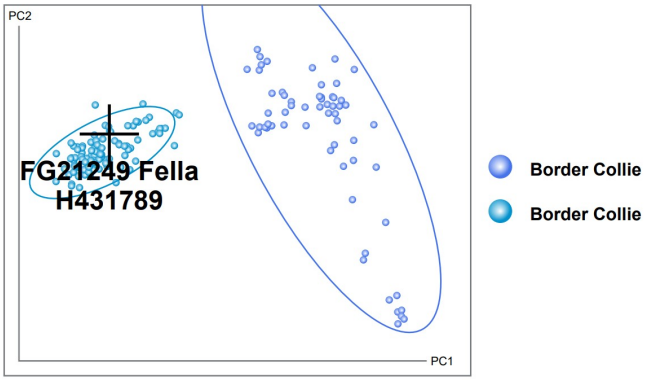
# RESULTS OF THE BREED IDENTIFICATION

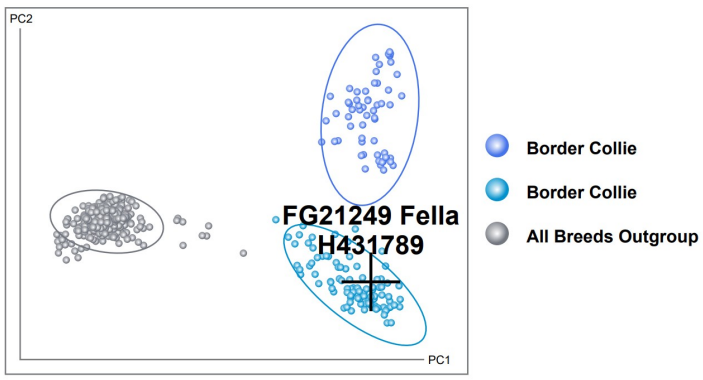
## Comparison of your dog's DNA with the DNA of purebred dogs from the database

Principal component analysis can be used to determine how similar DNA samples are. Closely related samples, like samples from dogs of the same breed, will be expected to be closer together than samples from other breeds. They tend to create a cluster as shown in the following figure. If a sample falls within a cluster of closely related dogs it is a good indication that it is likely a pure member of this breed. The following figure shows the DNA data of your dog compared to the reference data of purebred dogs from the database. If the sample of your dog falls within the purebred cluster this a good indication that the genetic profile of your dog is consistent with other dogs from this breed.




## Comparison of your dog's DNA with purebred dogs and all other breeds of the database

The following principal component analysis shows the DNA data of your dog compared to samples of purebred dogs, as well as a representative sample of dogs of other breeds from the database (All Breed Outgroup). This is another possibility to confirm that your dog's DNA is more consistent with the purebred cluster than with any other breed in the outgrouped cluster. If the sample of your dog falls within the purebred cluster this a good indication that the genetic profile of your dog is consistent with other dogs from this breed.



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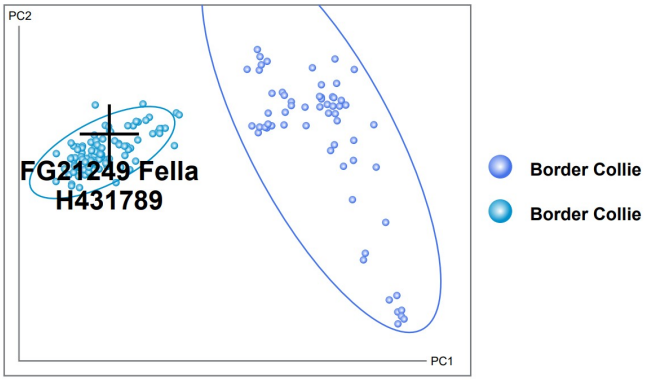
## Comparison of your dog's DNA with the DNA of genetically related breeds of the database

If applicable, the following principal component analysis shows the DNA data of your dog compared to samples of the next most appropriate breeds from ancestry analysis. In some cases, there is such a high match of the genetic markers between the dog tested and a primary reference breed that a consideration of other breeds is neglected. If the sample of your dog falls within the purebred cluster and there are no other breeds shown in the figure, it is a good indication that the genetic profile of your dog is consistent with other dogs from this breed.

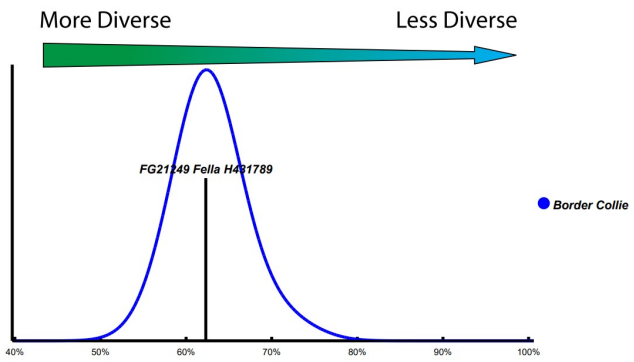



## Pairwise comparison test for best breed match

A pairwise comparison of your dog's DNA data and data from more than 10,000 dogs in the database of purebred dogs, showed as a top match the aforementioned breed.

## Homozygosity profile

Homozygosity is a measure of how many genetic markers are identical because sire and dam passed down the same marker variants. Purebred dogs tend to have a higher degree of the same markers compared to mixed breed dogs. Every breed within the database has a certain range of homozygosity scores. The score of your dog is exactly in the range of many other purebred dogs.



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## HOW THE TEST WORKS

At the very beginning of your dog's breed determination, DNA was isolated from the cells and analyzed using more than 1800 genetic markers. Each breed has its own genetic make-up and marker distribution and this fact can be used to determine which breeds are represented in your dog. This is done by a computer or to be more specific by a special algorithm designed to consider all the possible pedigree trees in the last three generations. The considered trees include simple pedigrees with just one breed as in purebred dogs, two different breeds like in designer dog, all the way up to highly complex trees with eight different great-grandparent breeds included. The computer program uses information of numerous breeds and varieties (e.g. miniature schnauzers, giant schnauzers, etc.) included in the breed database. For each of the million possible combinations of pedigree trees the computer gave each a score representing how well the selected breeds match with your dog's DNA data. The pedigree with the best overall score is shown in the ancestry chart. Only breeds that reached confidence threshold for reporting are shown in the ancestry chart.

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# Certificate

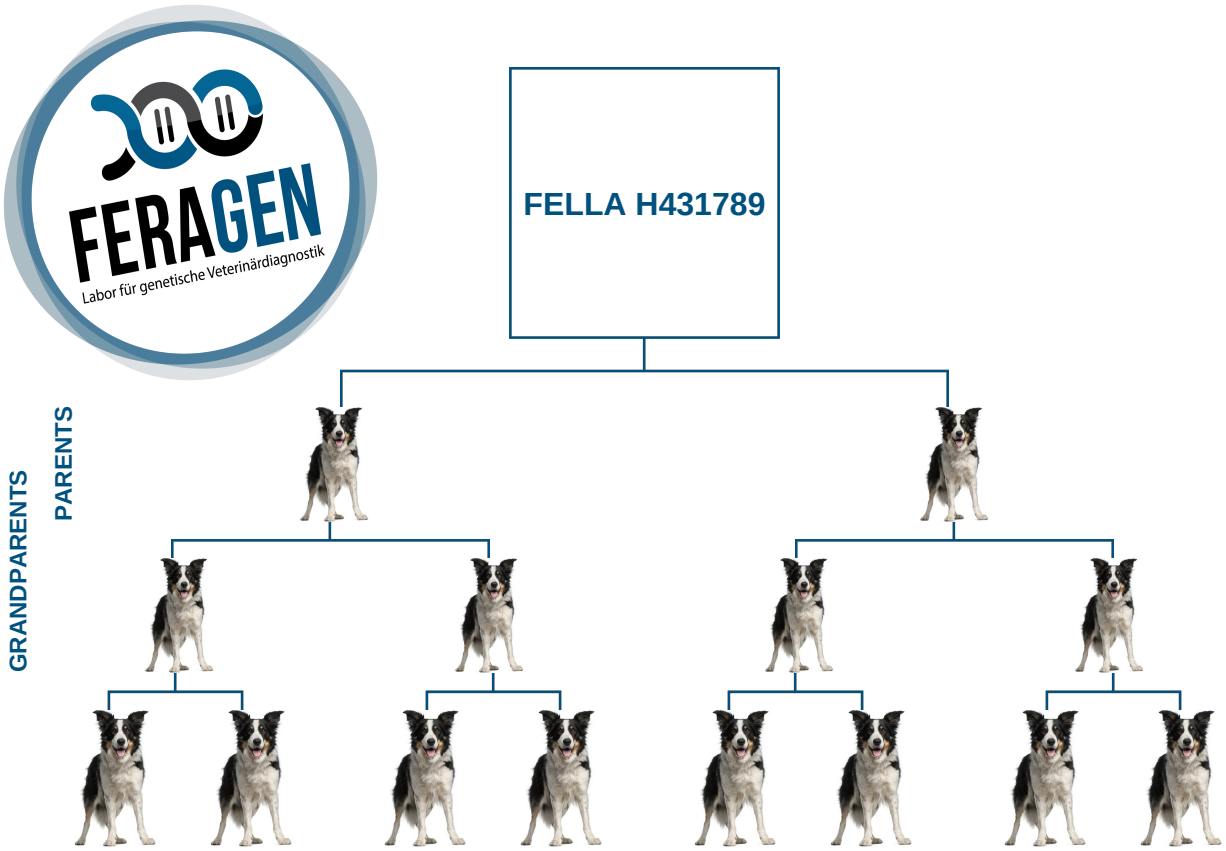
## Breed Identification of

## Fella H431789

This certificate confirms the genetic background of Fella H431789, following careful analysis of more than 1800 genetic markers. The resulting matches of purebred dog breed signatures listed above included the last 3 generations of your dog's ancestry and were performed by using proprietary breed detection algorithm.

Fella H431789 is a

## Border Collie



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TERMS & CONDITIONS

Each dog is unique with its individual physical and behavioral traits resulting from various factors like genetics, training and environment. Breed identification can provide an insight into the breed ancestry of your dog. This test was solely designed to identify the genetic breed makeup, to confirm the genetic breed profile of a dog or predict the adult weight/size of a dog. No other uses are intended, authorized or permitted. After receiving a dog's sample, the DNA of this sample will be analysed to determine potential breeds in the ancestry of your dog. In the case that your dog is likely purebred, comparisons of the genetic profile of your dog with the corresponding breed will be performed. In the case your dog is a crossbred dog from two purebred parents, this will involve determining the heritage of your dog's sire and dam. In each case this will be done with a reasonable degree of certainty. Testing procedures were designed to provide reliable and accurate results. FERAGEN, its partner laboratory or other associated companies are not responsible for errors during buccal swab sample taking or for any injuries or loss that may occur as a result. In the unlikely case that it is not possible to determine any breed history of your dog or that an error occurs during analysis, liability by FERAGEN, the partner laboratory or other associated companies or individuals is expressly disclaimed. Damages, if any, are limited to the payment received by FERAGEN. Breed identification is based upon a database of validated breeds. If your dog contains other breeds, which are not actually available in the database, it may result in the identification of breeds, or a combination of breeds, related to the breeds in the ancestry of your dog. This breed identification in not intended to be used by regulatory authorities or in certain countries or territories to identify breeds that may require special handling or prohibit the ownership of some dogs because of their genetic background. FERAGEN nor the partner laboratory or other associated companies are responsible for the approval or notification regarding this matter. Our current terms and conditions and privacy policy as well as conditions of revocation are valid and have been made available to you during placing your order. They can be found at www.feragen.at/agb and www.feragen.at/datenschutz as well as www.feragen.at/widerruf. 