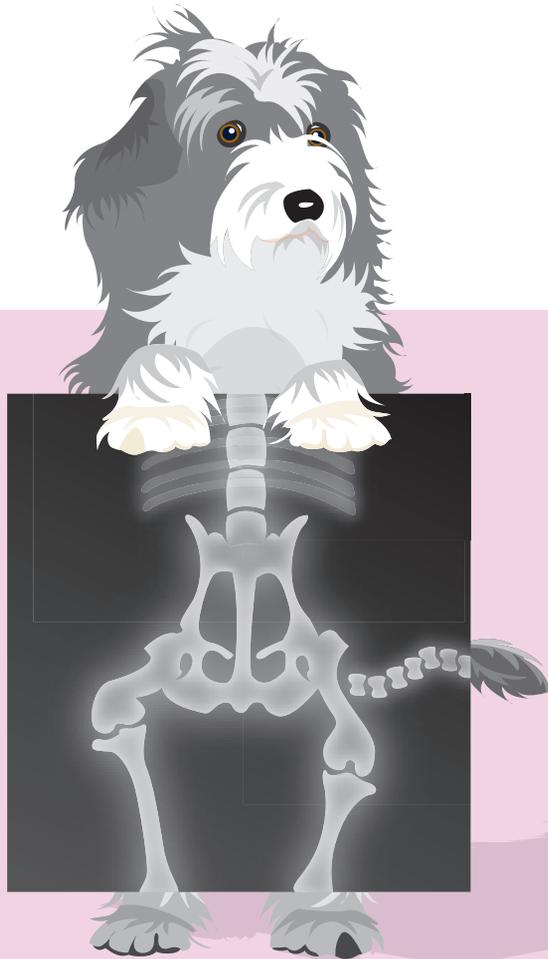




THE KENNEL CLUB
Making a difference for dogs

Information Guide

Health screening and the Kennel Club



www.thekennelclub.org.uk

For many years we have supported and promoted health schemes and extensive research into inherited diseases in all breeds. We have also encouraged breeders and owners to make health and welfare a priority. In fact, as long ago as 1986 we began making fundamental changes to our Breed Standards (the picture in words which describes the ideal dog of a particular breed). And it was why, in 2003, we formed the Kennel Club Breed Health Dog Health Group.

However, we recognise that more needs to be done to fight the inherited diseases that can cause ill health to all dogs, whether pure breed, crossbreed or mixed breed. With this in mind, and to promote further improvements to the health of all breeds, we have launched our Fit for Function: Fit for Life campaign. A campaign dedicated to ensuring that every dog should be fit for purpose. Especially if that purpose is simply to be a much-loved pet, every dog is entitled to lead a healthy, happy life.

We work alongside judges, breeders and exhibitors towards eliminating the excesses caused by over-exaggeration in some breeds. We've funded a health survey of 52,000 pedigree dogs in the UK to identify breed-specific problems. There is a wide range of screening initiatives to help breeders identify dogs suitable for healthy breeding: four clinical screening programmes are run in conjunction with the British Veterinary Association and many breeds take part in Kennel Club DNA testing schemes. We also administer the Kennel Club Assured Breeder Scheme, which places health screening at the core of responsible breeding.

Health screening and the Kennel Club

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Page 3 **Inherited diseases – simple and complex.**

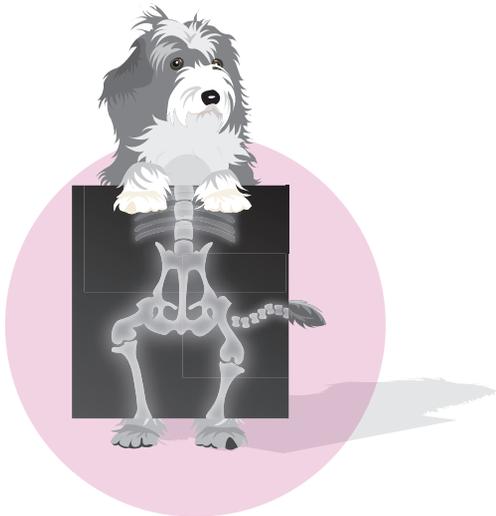
Page 4 **What health screening schemes are available?**

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Why is health screening important?



An introduction to basic genetics and terminology is available at www.thekennelclub.org.uk/doghealth

Inherited diseases fall into two broad classes: simple and complex.

- 1 Simple inherited diseases** are the result of mutation of a single gene and represent around 70-75% of the known inherited diseases in the dog. The mutation may be recessive or dominant. If recessive, then a dog has to inherit the recessive mutation from both parents before it is clinically affected; a dog that has one recessive mutant gene version and one normal gene version is a clinically normal carrier. If a dog inherits a dominant mutant gene from either of its parents it will usually be clinically affected despite having a normal copy of the relevant gene. Often, individual breeds, or related breeds, will have a predisposition to these simple, single gene disorders, although even in predisposed breeds, the prevalence of the disease is usually, but not always, low.
- 2 Complex inherited diseases** are often described as multifactorial because they involve the inheritance of a number of different mutant genes, that is, they are polygenic, and the clinical expression of these mutant genes can be altered by environmental influences. These complex diseases give rise to clinical conditions that worry breeders the most, diseases like hip and elbow dysplasia, epilepsy and heart disease. These complex diseases rarely show breed specificity and are seen across many different breeds as well as being described in both cross breed and mixed breed populations, often at prevalences akin to those seen in pure breed populations.

Some inherited conditions only become apparent at later stages in a dog's life.

One other important consideration is that not all inherited conditions are congenital, i.e. present at birth. It should also be remembered that not all congenital conditions are inherited.

Sometimes the clinical consequences of an inherited disease do not become apparent in an affected dog until late in the dog's life, and these late onset diseases present real challenges to the dog breeder because a dog could be well past its reproductive phase, and have been bred from, before it's clinically affected state is recognised.

What can breeders do?

Breeders of pure bred dogs have a real opportunity to address these inherited diseases and reduce their prevalence, because it is the breeder that decides which sire is to be mated to which dam to produce a litter of puppies. It is thus possible, where screening schemes are available, for breeders to screen all of their potential breeding stock for signs of these inherited diseases, before they are bred from, and then use the results to formulate breeding programmes to reduce the prevalence of the diseases in future generations. Putting all of the potential breeding stock through these health screening schemes gives breeders a better understanding of the kind of genes a particular dog carries and therefore what it is likely to pass on to its offspring. Armed with this information breeders can avoid mating two dogs that have an increased chance of producing clinically affected puppies.

What health screening schemes are available?

There are two general types of health screening programmes that are available to dog breeders: Clinical screening programmes and DNA testing schemes.

Clinical Screening Programmes

Look for clinical signs of the disease in an individual dog; these screening programmes identify clinically affected dogs. The Kennel Club, in conjunction with the British Veterinary Association (BVA), runs four such clinical screening schemes:

- 1 **The BVA/KC Hip Scoring Scheme** which has been designed to address the problem of hip dysplasia, one of those complex inherited diseases. The scheme evaluates radiographs that have been taken of an individual dog's hips. Each hip is evaluated by two experts who score nine anatomical features of the hip and score each hip out of a total of 53.

The two hip scores are then added together to give the dog's overall hip score. So, a dog's hip score can range from 0 – 106, and the lower the hip score the better the anatomy of the dog's hips. In breeds where significant numbers of dogs have been through the hip scheme it is possible to calculate a breed mean hip score, which gives a feel for the average quality of the hips within that breed.



Advice to breeders is to use dogs with hip scores well below the breed mean score for breeding. Current Breed Mean Scores (BMS) can be viewed at www.thekennelclub.org.uk/doghealth

- 2 The BVA/KC Elbow Grading Scheme**, to address elbow dysplasia. Again, each dog is assessed from radiographs that are taken of the dog's elbows. Each elbow is graded on a scale of 0-3, again by two specialists. The lower the grade the better the elbow's anatomy. In this scheme if the dog has two different elbow grades, the higher of the two is used as the dog's elbow grade.



Advice to breeders is to use only dogs with an elbow grade of 0 or 1 for breeding.

- 3 The BVA/KC/ISDS (International Sheep Dog Society) Eye Scheme.** This scheme has a list, Schedule A, which contains all of the known inherited eye diseases and the breeds that are currently known to be affected by these conditions. It also has a Schedule B, which lists breeds and conditions where further investigation is urged. Specialist panelists, appointed by the BVA, can examine any individual dog for clinical signs of these diseases. Because some of these inherited eye diseases are not congenital, breeders are advised to have their breeding stock examined each year throughout their dog's life.



A current list of breeds and conditions on Schedule A and Schedule B can be viewed at www.thekennelclub.org.uk/doghealth

4. **The BVA/KC chiari malformation/syringomyelia (CM/SM) scheme.** Launched January 2012. MRI scans, scanned under BVA procedures, are reviewed by a panel of BVA appointed neurologists and radiologists, and graded by two scrutinisers. Grading is assigned according to the severity of the CM and SM changes. As CM/SM is a progressive condition, scans throughout the dog's lifetime is recommended, generally at years 1, 3-5, and over 5. Procedure Notes and submission details are available from the BVA Canine Health Schemes (CHS) office. For more information: www.bva.co.uk/chs

- **Results are published by the Kennel Club**

The outcome of each of these four schemes is a certificate which states the observations made during the screening process. A copy of this report is returned to the owner/agent of the dog and a second copy is sent directly to the KC, where the information is noted on the dog's record on the KC registration database. So, for the hip and elbow schemes the dog's hip score and elbow grade are recorded on the database. The results of the eye scheme are recorded as either clear of clinical signs of the conditions specific for the breed on Schedule A, or affected by one or more of the breed conditions. For the CM/SM scheme, the dog will be given a grade for CM and a separate grade for SM, followed by a letter which relates to the age of the dog at scanning. Once this information is deposited on the registration database it will be published in the next available Breed Records Supplement (BRS) against the dog's KC registered name, and it will also appear on any new registration document issued for the dog and on the registration documents of all of the tested dog's future progeny.



For more information about Mate Select
please visit www.mateselect.org.uk

- **Breed Clubs run health screening schemes too.**

Besides these four BVA/KC Health Screening Schemes, individual breed clubs can also have their own health screening programmes, organised by the breed club using specialist veterinarians that they have identified. For example, the Cavalier King Charles Spaniel Breed Clubs have established a heart testing scheme to look for clinical signs of a heart disease known as

mitral valve disease in the breed. The Boxer breed clubs have a similar heart screening programme, but this time for a heart condition known as aortic stenosis. The results of these screening programmes are collated and disseminated by the breed clubs.

DNA Testing Schemes.

The second type of health screening programme available to breeders can give results with a lot more clarity. The last ten years has seen spectacular progress in our understanding of the canine genome, the genes that make up the dog. Significant technological advances and injection of substantial funding to support research means that we are now able to directly read the genetic code that is embedded in each and every one of the 20,000-or so canine genes. This means that not only can we now identify the genes that are involved in inherited disease in the dog, but we can also identify the mutation, the error in the gene's code, that is responsible for the disease.

- **DNA tests give unequivocal results**

One of the very practical consequences that this understanding has given us is the ability to develop very simple DNA tests that can be used to determine whether an individual dog possesses one or two copies of a mutant, disease-causing gene. At the moment, DNA tests only exist for the mutations involved in the simple, single gene conditions, but world-wide the number of these inherited diseases for which DNA tests have been developed must be approaching 100. Use of these tests is very straightforward and relatively inexpensive. Some tests require a small blood sample, which needs to be drawn by a qualified person, but increasingly these DNA tests are based on a simple mouth swab that is totally non-invasive and can be performed by the dog's owner. A small brush is used to gently rub the inside of the dog's cheek. The loose cheek cells that this removes stick to the bristles of the brush, which is then dried and returned by post to the laboratory, where the cheek cells are broken open to liberate their DNA, which is produced in sufficient amounts to allow the genetic status of any dog to be determined. Since most of these single gene disorders are the result of a single recessive mutation,

the usual outcome of one of these DNA tests is that the dog is identified as normal (two copies of the normal gene), a carrier (one copy of the normal gene and one copy of the mutant gene) or affected (two copies of the mutant gene).

- **The Kennel Club has embraced this new technology**

Realising that it provides powerful new tools for breeders to use in their efforts to minimise the spread of inherited diseases to future generations, the Kennel Club Charitable Trust has provided substantial research funds to facilitate the development of further DNA tests and the Kennel Club has worked with relevant breed clubs and councils to develop DNA testing schemes for diseases that are known to affect their breed. These official DNA Testing Schemes involve collaboration between the Kennel Club, the breed clubs and the DNA testing facility.

Under one of these schemes, the breeder/owner agrees for the result of their tested dog to be sent independently to the Kennel Club by the testing laboratory. The Kennel Club then notes the result on the dog's record in the registration database, which triggers publication in the same way as described above for hip scores, elbow grades and the outcome of eye testing. In addition, lists of tested dogs and their DNA result are maintained and updated on the Kennel Club web site.

- **Using DNA technology to eradicate disease from breeds.**

Some of these official DNA Testing Schemes have evolved into DNA Control Schemes, usually after several years of operation as an official DNA Testing Scheme. A DNA Control Scheme links DNA testing to registration, limiting registration to those dogs that are either DNA tested normal or those that are hereditarily clear, i.e. the offspring of two DNA tested normal parents. More about control schemes will follow later in this guide.



- **Will there ever be a DNA test for complex hereditary diseases?**

Presently, all of the available DNA tests relate to diseases that are the result of single gene mutations. However, technology doesn't stand still and increasingly sophisticated analytical tools are being developed which means that it will not be that long before breeders are provided with DNA tests that identify the multiple genetic mutations involved in the complex.

Breeding Advice – How can breeders use these screening schemes?

Breeders use health screening, whether it be clinical screening or DNA testing, to try to predict what genes a dog carries and therefore what it is likely to pass on to its offspring, to try to reduce the prevalence. Remember, each dog has two copies of each and every gene and one copy is inherited from the dog's dam and the other from its sire. Screening a dog before it is bred from will thus provide valuable information to the breeder and help them avoid matings which run the risk of producing a clinically affected offspring.

The difference between 'clinically clear' and 'genetically clear' is vital.

For diseases that result from single recessive gene mutations, clinical screening programmes identify the clinically affected dog, but they cannot discriminate between a dog that is clinically and genetically normal, with two normal copies of the gene, from the clinically normal carrier, with one normal gene and one mutant copy of the gene. Identification of the affected dog is valuable, however, because you know that if the dog is bred from, each of its offspring will receive a copy of the recessive mutant gene, whether it then goes on to develop the disease or not will be determined by the gene copy it receives from the other parent. The most effective way of breeding away from disease in a breed will vary depending on the disease frequency and the breed in question. Generally the use of affected dogs for breeding should be avoided. Knowing that a dog is clinically affected provides the breeder with far more information. For example, if the affected dog's parents are both clinically normal, they must both be carriers of the mutation, because both must have passed a mutant gene onto the affected offspring. Furthermore, each of the affected dog's clinically normal siblings will have a 2 in 3 chance of being a carrier. Breeders can also predict the likelihood that the aunts and uncles and cousins of an affected dog are carrying a version of the mutant gene. All of this is important information that will allow breeders to select mating pairs to minimise the spread of mutant genes to future generations. Many of the conditions that are examined under the BVA/KC/ISDS Eye Schemes are the result of single, recessive mutations.

Tackling complex conditions

The BVA/KC Hip and Elbow Schemes are designed to help breeders address complex inherited conditions. Again, the hip and elbow scores are believed to reflect the genetic makeup of an individual dog and both schemes offer advice to the breeder using the scheme.

For example, an individual dog's hip score can be measured against the average hip score for the breed; dogs with scores lower than the breed average have above average hips and dogs with scores above the mean score have below average hips. Breeders are thus advised to have their breeding stock hip scored before breeding and then to breed from dogs and bitches that have hip scores well below the breed mean score.

Responsible breeders use the BVA/KC Hip Scheme in large numbers, particularly in those breeds where hip problems are present, and analysis of the year on year data suggests that through selective breeding they are managing to reduce the breed average hip score.



An evaluation of BVA and Kennel Club Schemes can be found at www.doggenetichealth.org.uk

Looking to the future

Health screening based on DNA testing for the presence or absence of mutant genes is expanding rapidly as more and more DNA tests become available. In many ways these represent the 'Rolls Royce' of health testing because they are based on the genes that a dog carries, unlike the clinical screens which predict the genetic make-up from clinical observations. This gives much greater precision to breeders' breeding selections based on DNA results. Again, the aim is to test all potential breeding stock before they are bred from. One of the main advantages of DNA testing is that the DNA a dog is born with is essentially the same DNA as it dies with, so dogs can be DNA tested early in life and the result will not change during the dog's life.



This means that such tests are particularly valuable for those late onset diseases; dog's can be DNA tested early in life and if they are affected, the DNA test will show this long before any clinical signs become apparent, and breeders can take this information into account when deciding whether to breed from the dog or not, or when choosing a compatible mate.



The current list of DNA tests available in the UK can be viewed at www.thekennelclub.org.uk/doghealth

DNA Control Schemes - Shaping Kennel Club Registrations

In 2000 a DNA test was provided to Irish Setter breeders in the UK which allowed them to assess the genetic status of their dogs with regard to an inherited disease known as Canine Leucocyte Adhesion Deficiency (CLAD). This was known to be caused by a single recessive mutation in a gene that was crucial for normal immune surveillance. Setters that inherited two copies of the mutant gene were clinically affected and severely immunologically compromised because they couldn't mount a response to even simple infections. Following consultation with the Irish Setter breed clubs an official DNA testing scheme was established and the breeders agreed to have all of their dogs tested before considering whether they should be mated. Few clinically affected dogs were identified because the condition usually leads to death or euthanasia early in life, long before the affected dog reaches reproductive age. However, clinically normal carriers were identified as a result of DNA testing and the breeder community agreed that if they had a dog that DNA tested as a carrier, and if they decided to breed from that carrier dog, then they would only mate it to a DNA tested normal dog.



This they could do with confidence knowing that none of the litter would become clinically affected, because each of the puppies would get a normal gene from the DNA tested normal parent, which would

override any recessive mutant gene that it might inherit from the carrier parent. Furthermore, the breeders agreed to DNA test all of the puppies in the litter to identify those that were genetically normal and those that were carriers. During the next five years over a thousand Irish Setters were DNA tested and breeder

What health screening schemes are relevant for my breed?

selections based on these results were so successful that a DNA Control Scheme was introduced in 2005, meaning that the KC would only register Irish Setter litters from parents that were either DNA tested normal or were hereditarily clear.

Currently available health screening is very much dependent on the breed of dog that you are interested in. The Kennel Club introduced its Assured Breeder Scheme back in 2004 and central to this is an obligation for Scheme members to health check their breeding stock with all available schemes for the breed. So, a look at the breed health screening programmes under the Assured Breeder Scheme will give you a good idea of the breed specific health screening that is available.

The Kennel Club's online Breed Information Centre includes all recommended health tests, breed club contacts, Kennel Club Assured Breeders, breed standards and breed rescues.



THE KENNEL CLUB

ASSURED BREEDER SCHEME



Access the Breed Information Centre online visit www.thekennelclub.org.uk/breedhealth

This will show the required and recommended health screening schemes for each breed. The distinction between required and recommended is largely operational. For a scheme to be required, we need to be able to check for member compliance at the point of litter registration.



This means that only official KC screening schemes can be required, because these are the only schemes for which results are present on our registration database. The recommended schemes are those that are run by individual breed clubs, where the KC does not have direct access to the dogs that have been screened and their result. A recommended scheme does not mean that the health screening is less important.



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1-5 Clarges Street, Piccadilly, London W1J 8AB
Telephone 0844 4633 980 Email hbs@thekennelclub.org.uk

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THE KENNEL CLUB

Making a difference for dogs

The Kennel Club works to protect and promote the health and welfare of all dogs in the UK. We want happy, healthy dogs living long lives with responsible owners. All profits from the organisation go straight into funding the many programmes run in the best interest of dogs and dog owners and to support the Kennel Club Charitable Trust to re-invest into a wide variety of welfare and health programmes.

Anyone can register their dog with the Kennel Club. By registering you will demonstrate your commitment to your dog's well-being and to the health and welfare of all dogs. You can register online today at www.thekennelclub.org.uk/dogregistration.

What ever your dog's needs, the Kennel Club is here to help and support you.

Find out more by contacting us on **0844 4633 980**, or visit our website at www.thekennelclub.org.uk to find out more about the wonderful world of dogs.

Additional guides on a wide range of subjects are also available to download from our website at www.thekennelclub.org.uk:

- Asthma and your dog
- Breeding from your bitch
- Choosing and bringing home the right dog for you
- DNA profiling and parentage analysis services
- Do you know dog law?
- Do you know how to look after your dog in its senior years?
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