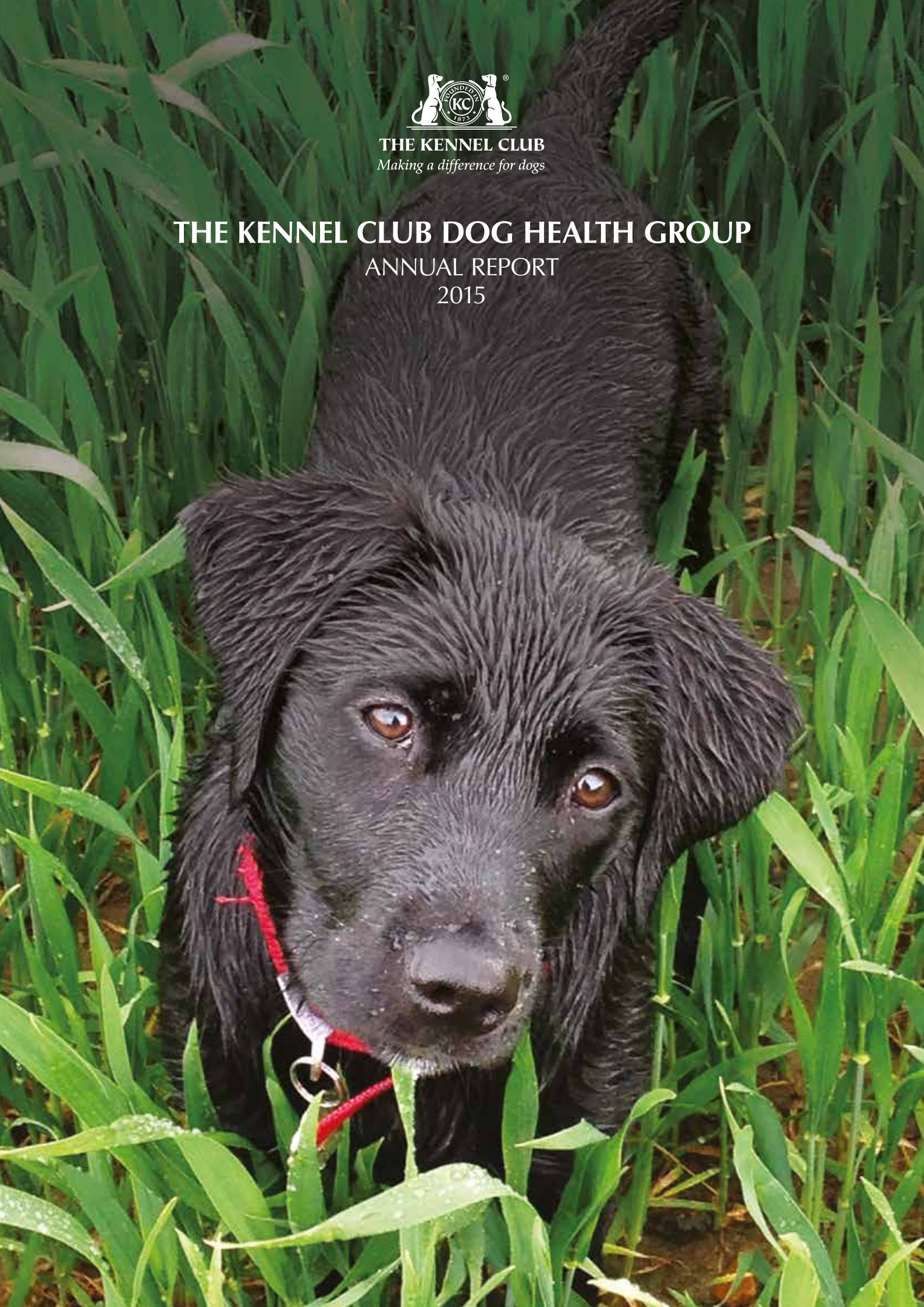




THE KENNEL CLUB
Making a difference for dogs

THE KENNEL CLUB DOG HEALTH GROUP
ANNUAL REPORT
2015



CONTENTS

PAGE 1

INTRODUCTION

PAGE 2

REMIT OF THE DOG HEALTH GROUP

PAGE 3

DOG HEALTH GROUP ACHIEVEMENTS IN 2015

PAGE 5

FEATURE - THE KENNEL CLUB'S HEALTH INITIATIVES:
SUPPORTING THE ART AND SCIENCE OF DOG BREEDING

PAGE 9

ACTIVITIES, HEALTH AND WELFARE SUB-GROUP

PAGE 10

ASSURED BREEDER SCHEME SUB-GROUP

PAGE 12

BREED STANDARDS AND CONFORMATION SUB-GROUP

PAGE 14

GENETICS AND HEALTH SCREENING SUB-GROUP

PAGE 15

CONCLUSION

ANNEXES:

PAGE 16

ANNEX A

ANNUAL SUMMARIES:
DNA TEST RESULTS AND HEALTH DATA
GENERATED BY BVA/KC HEALTH SCHEMES

PAGE 24

ANNEX B

COMPOSITION OF DOG HEALTH GROUP
AND SUB-GROUPS

PAGE 26

ANNEX C

KENNEL CLUB GENETICS CENTRE REPORT

PAGE 28

ANNEX D

KENNEL CLUB CANCER CENTRE REPORT

INTRODUCTION

The Dog Health Group develops strategy on the health and welfare aspects of the Kennel Club's work, co-ordinating and monitoring initiatives via the specialist sub-groups. These sub-groups allow for a dynamic approach on emerging issues, with their diverse external memberships each ensuring that perspective and balance is maintained throughout the Kennel Club's drive towards ever improving health and welfare.

This report intends to update the information given in previous reports, highlight new developments over the year, and focus on key steps that have been achieved.

As a special feature in this year's report there is a briefing from the Kennel Club's Head of Health and Research, Aimée Llewellyn, about the ongoing initiatives that are being pursued and plans for future developments on health, both within the Kennel Club and in partnership with other organisations.

Full information on all of our health work can be obtained from the Kennel Club website, www.thekennelclub.org.uk



REMIT OF THE DOG HEALTH GROUP

- To develop strategy for the Kennel Club’s health work.
- To provide overall co-ordination and monitoring of such work.
- To supervise the *Fit for Function: Fit for Life* campaign and other ‘public’ campaigns.
- To be responsible for recommending, on advice from the various sub-groups, the requirements for health schemes, the Assured Breeder Scheme requirements and other breeding strategies.
- To produce an annual report on the Dog Health Group’s work.



© Picture by: Jeffrey Farr / The Kennel Club Picture Library

DOG HEALTH GROUP ACHIEVEMENTS IN 2015

Several key achievements are highlighted below. The individual sub-group sections which follow report more specifically on the notable activities of 2015 within each group’s remit.

KENNEL CLUB CHARITABLE TRUST

The Kennel Club regularly donates approximately two-thirds of the Charitable Trust’s income to health initiatives as well as bearing all the Trust’s administrative costs. In 2015 the Trust made grants totalling £544,816 to projects aimed at improving the health of dogs, as follows:

| | |
|--|----------|
| Animal Health Trust Year 2 of support for KC Genetics Centre (being year 7 of 10) | £270,000 |
| University of Cambridge A genetic approach to causation of Brachycephalic Obstructive Airway Syndrome in dogs | £82,165 |
| International Canine Health Awards Prizes and expenses | £80,000 |
| Royal Veterinary College - VetCompass Year 2 of support for project improvement of the health of pedigree dogs in the UK | £45,005 |
| Animal Health Trust Year 2 of funds for oncology research programme | £20,500 |
| University of Glasgow Study into the role of pathogens in the aetiology of canine periodontitis | £10,000 |
| University of Cambridge Final year of study into the respiratory cycle of brachycephalic dogs | £9,925 |
| Royal Veterinary College Study into jumping kinetics and kinematics of take off and landing | £7,670 |
| Davies Veterinary Services Study into phenotypic characterisation of canine epileptoid cramping syndrome | £7,480 |
| University of Cambridge Study into polysystemic autoimmune disease in Cocker Spaniels | £4,425 |
| Royal Veterinary College - Emma Suiter Research into Epilepsy | £3,500 |
| University of Bristol Research into spinal cord injury in dogs | £1,912 |
| Royal Veterinary College Study into haemolytic anaemia in the Japanese Spitz | £1,434 |
| University of Nottingham Study investigating the factors influencing the development and outcome of GDV in Deerhounds | £800 |
| Total £544,816 | |

[International Canine Health Awards were funded by Vernon & Shirley Hill]

PEDIGREE BREED HEALTH SURVEY

The Pedigree Breed Health Survey was conducted November - December 2014 to find the most prevalent conditions affecting live dogs and the most common causes of death/euthanasia. This data may aid in prioritisation of improving any inherited conditions and help improve the health and welfare of future generations of dogs. The survey received responses representing 43,207 living dogs & 5,684 deceased dogs. A summary and breed specific reports will be released in March 2016 - these will also be freely and publicly available on the Kennel Club website.

CHIARI-LIKE MALFORMATION/SYRINGOMYELIA SYNDROME

The Kennel Club remains committed to addressing these conditions which affect a number of breeds. To progress this, it is essential that robust data is collected and to that end, widespread testing and submission of results is being actively encouraged. Test results are included on the Health Test Results Finder on the Kennel Club website, along with explanatory notes and guidance on breeding. Annex A includes data on this condition.

EDUCATION AND TRAINING

The Kennel Club has this year continued to offer practical education on canine health, the scale and diversity of which is ever increasing, to reach all stakeholders. There have been breed specific seminars, a sports science seminar, judges training, and lectures for the veterinary community. Additionally, the Kennel Club has collaborated with other organisations with participation in their conferences and training programmes. Greater detail is given throughout this report.

INTERNATIONAL PARTNERSHIP FOR DOGS (IPFD)

The Kennel Club joined the International Partnership for Dogs (IPFD) in 2014. The partnership was founded to support "cooperation, collaboration and sharing of information and resources across the global dog community to enhance the health, well-being and welfare of pedigree dogs and all dogs". The IPFD offers benefits through collaboration and data/information exchange between member kennel clubs. It also serves as a resource to highlight the Kennel Club as being outstanding in terms of free, and open-access health tools and resources. There are regular international meetings, with Kennel Club Secretary, Caroline Kisko, as a committee member. Its workshops for canine health, welfare, and research professionals encourage joined-up thinking in tackling common problems and concerns across all aspects of dog wellbeing. The Kennel Club's health department contributes to the Partnership's website about our health and welfare initiatives. More details can be found at dogwellnet.com/



© Picture by: Darren Hall / The Kennel Club Picture Library

THE KENNEL CLUB'S HEALTH INITIATIVES: SUPPORTING THE ART AND SCIENCE OF DOG BREEDING A SPECIAL REPORT FROM AIMÉE LLEWELLYN

Behind any good breeder's policy is the question, "will this improve the breed?" The Kennel Club's health and breeding initiatives are working to support, encourage and educate traditional and new breeders and dog owners to ensure that the future is focused on the *art and science* of improving the dog.

RESEARCH AND DATA

Underpinning all of the recent advances in health resources for dog owners and breeders is the integration of robust research, and the development and utilisation of the Kennel Club database as a source of health-relevant data. Building collaborations across the veterinary and canine research sector has been key to recent advances in resources and understanding. The Kennel Club Charitable Trust has provided funding to assist in a number of fundamental research needs - particularly those of the Kennel Club Genetics Centre and Kennel Club Cancer Centre at the Animal Health Trust. Working more closely with veterinary schools has enabled projects to be cross-supporting the needs of the researchers with the needs of improving breeds. A good example is the recent BOAS (Brachycephalic Obstructive Airway Syndrome) work being undertaken by the University of Cambridge - demonstrating collaboration between the researchers, Breed Clubs, and the Kennel Club.

Increasingly, the Kennel Club is undertaking in-house research to target breed-wide research needs. In 2015, data from the Pedigree Breed Health Survey 2014 has been analysed to produce breed-specific reports capturing the state of health of all 215 breeds at a moment in time. These reports will be published in March 2016. In addition, a study exploring breed population structures over 35 years, *Trends in genetic diversity for all UK registered pedigree dog breeds*, (Lewis et al, 2015, CGE) was published in an independent scientific journal, *Canine Genetics and Epidemiology* (CGE, Biomed Central). This journal is also provided by the Kennel Club Educational Trust, with publication bursaries to authors to help improve access to peer-reviewed scientific research for the general public.

Trends in canine genetic diversity in 30 years of pedigree dogs



Aim

The study's aim was to **analyse population data** for all **215 breeds** currently recognised by the UK Kennel Club **between 1980 and 2014** to **determine trends in registration, rate of loss of genetic diversity, degree of inbreeding and popular sire usage**.



Data and method

All electronic pedigree information held by the Kennel Club was used to **calculate inbreeding coefficients for every registered individual born from 1980 to 2014**. The rate of change of average inbreeding coefficient per breed (**rate of inbreeding**) describes the rate of **loss of genetic diversity** over this period.

STRATEGIES FOR THE FUTURE

The plans for the future of health developments for the Kennel Club include continued building and development of professional relationships and collaborations across canine health stakeholders and researchers. This makes the most of the data held by the Kennel Club and any potential increases in this data resource, in order to continue to lead in pedigree breed health advances. With the complexity of genetic tools and resources available, the next steps are to work towards evidence-based breeding strategies to support breeders. Any strategy should be developed to prioritise health and welfare, utilising the best information on disease and disease prevalence, population genetics, available and commissioned research, and crucially a practical plan that includes facilities to measure, monitor, and adapt to breed needs.



LEADING

The Kennel Club continues to work to lead in all aspects of pedigree dog breeding and health. Our healthy future lies in equipping ourselves to help in the early identification of emerging disease concerns, developing preventative disease strategies, and our already impressive work in breed conservation. Ultimately, the work we are undertaking, and aspiring to, will lead to a healthier future for all dogs.



© Picture by: Elena Skovajsova Rosivalova / The Kennel Club Picture Library

ACTIVITIES HEALTH AND WELFARE SUB-GROUP

REMIT

- Contribute towards guidance, advice and opinion to the Kennel Club's Activities Sub-Committee, based on clinical veterinary experience and the latest available scientific research.
- Proactively review the available scientific research and bring any relevant information or findings to the attention of the Sub-Committee for discussion and action where appropriate.
- Recommend areas for further research and investigation in order to address issues raised by the Sub-Group or the Activities Sub-Committee, and; to define and scope the parameters for any research recommended.

ACHIEVEMENTS

During 2015 the Activities Health and Welfare Sub-Group (AHWSG) continued its role of identifying health and welfare issues relating to the canine activities which fall within its remit, namely Agility, Obedience, Rally, Working Trials and Heelwork to Music, and where necessary, undertaking relevant research.

The Sub-Group consists of representatives from the various disciplines together with specialists with relevant expertise such as veterinary surgeons, academic researchers, lecturers, and Kennel Club staff. The ongoing support and commitment of those involved provides a valuable contribution to the work of the Sub-Group and is very much appreciated.

A brief overview of the key research projects conducted in 2015 is given below:

JUMPING AND JUMPING KINEMATIC STUDIES

Results from Canine Jumping Kinematics research carried out at Nottingham Trent University using data gathered at the International Agility Festival in 2013 have been published. The research had been key in assessing the effects of different distances between obstacles on jump kinematics and apparent joint angulation of dogs competing in agility.

Further research into jumping, funded by a grant from the Kennel Club Charitable Trust, was carried out by Dr Thilo Pfau and his team at the Royal Veterinary College (RVC) using data collected at the RVC on 20 - 22 April 2015. The study concentrated on dogs measured as Large.

HEALTH QUESTIONNAIRES

Following the completion of health questionnaires for all disciplines, the Sub-Group agreed that an additional survey should be undertaken, for purposes of comparison, within the general dog population. Data would be collected from specialist veterinary surgeons dealing with injuries, and a review of results carried out with the aim of indicating injury prevalence in companion dogs against competitive dogs.

INTERNATIONAL AGILITY FESTIVAL 2015 SURVEY

Once again a survey was conducted to identify dog related incidents during the Festival, with the objective of adding to existing data relating to the number of incidents and injuries occurring within the context of the number of competitive runs, and to use the information to identify any potential health and welfare issues which may require additional research.

REPORTING OF INCIDENTS AT AGILITY SHOWS

A Dog Agility Incident Form (similar to that used at the International Agility Festival) was approved by the Sub-Group and made available for use at other shows in order to enable a fuller picture of equipment-related incidents at agility shows to be understood. It will also assist in identifying future areas for research.

NUMBERS OF PARTICIPANTS

Surveys were instigated in other activities in order to ascertain how many dogs took part in each discipline on any one weekend. The objective of carrying out such surveys was to provide baseline information regarding numbers of competing dogs to provide context to the incident reports.

CANINE SPORTS SCIENCE SEMINAR

The seminar took place on 1 November 2015 at the Kennel Club Building in Stoneleigh and was very successful, attracting 77 attendees.

ASSURED BREEDER SCHEME [ABS] SUB-GROUP

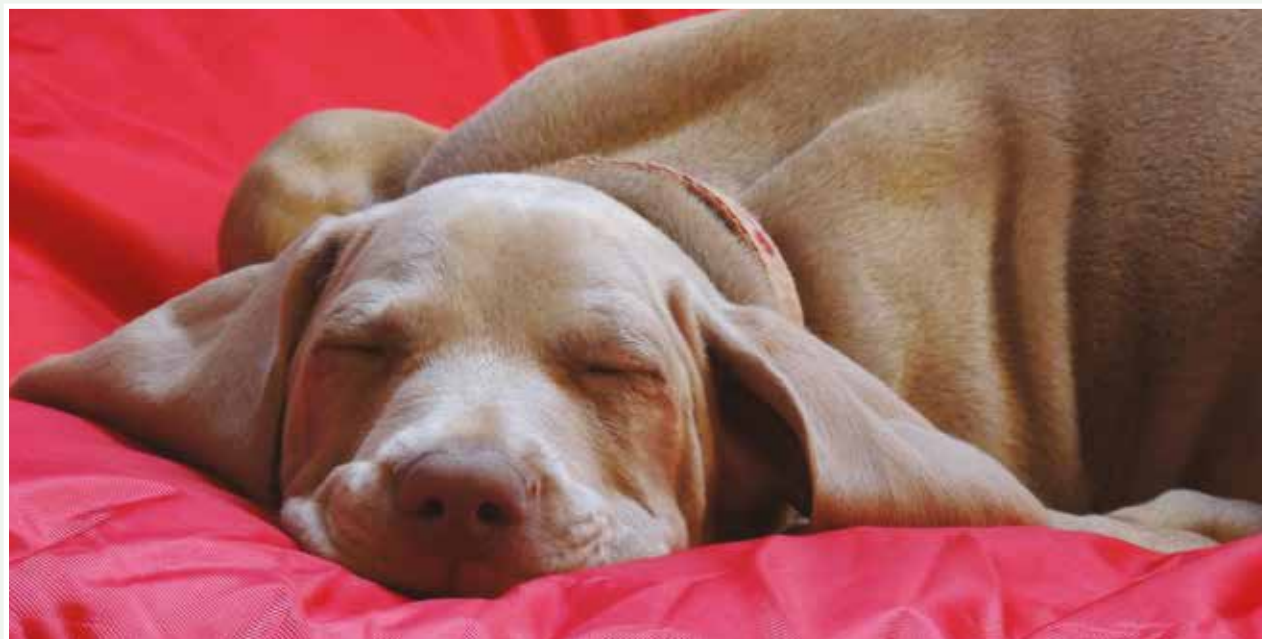
REMIT

- To act as an impartial unit which provides for the participation of all parties significantly concerned with the Kennel Club Assured Breeder Scheme.
- To manage the impartiality of certification activities and to identify and eliminate or minimise any risks which may arise, whether actual or perceived. To include but not be limited to:
 - Risks to or from financial freedom
 - Risks to or from any Kennel Club activities
 - Risks caused from or by any relationships
 - Risks caused from or by any relationships of personnel
- To advise on the formulation of policy matters relating to the operation of the scheme.
- To oversee the running of the ABS, with particular regard to the performance of the processes of admitting, monitoring and excluding breeders from the scheme, as well as the receipt and evaluation of puppy buyer feedback and use of ABS resources.
- To make recommendations as to the husbandry aspects of the ABS and to put into operation those health screening requirements/recommendations agreed by the Dog Health Group and in liaison with breed clubs/councils.

ACHIEVEMENTS

BREED SPECIFIC REQUIREMENTS AND RECOMMENDATIONS

A number of updates to the breed-specific requirements and/or recommendations of the ABS have been implemented. These include the addition of three clinical tests and one DNA test as recommendations. Two welfare aspects were also added as recommendations. The latest list can be found by visiting www.assuredbreeders.com and clicking on 'Breed-specific Requirements and Recommendations'. Any breeds with recent updates are marked with an asterisk.



© Picture by: Caroline Tillson/The Kennel Club Picture Library

ABS VISITS

Around 1,000 Assured Breeders were visited during 2015, exceeding the target set as a result of new protocols brought in which require all members of the scheme to be visited before they can register puppies under the ABS. These visits were carried out in line with guidelines laid down by the United Kingdom Accreditation Service (UKAS) from which the Kennel Club received accreditation in 2013. As of 2014, all breeders applying to join the ABS must be visited by a Regional Breeder Assessor (RBA) before their application can be considered.

REGIONAL BREEDER ASSESSORS (RBAs)

In 2015, the network of RBAs changed from being made up of staff and volunteers - it is now solely made up of staff as it was felt these people were best placed to deal with the increase in visits required as a result of gaining UKAS accreditation. At the time of writing, the team consists of one Assessment Manager, who carries out visits on a full time basis, as well as seven permanently employed staff. A number of formal training days were held during the year for these RBAs, to ensure a consistent and high standard for members. The Kennel Club takes this opportunity to thank those volunteer RBAs who helped in the past to get the ABS into the strong position it enjoys today.

ABS MEMBERSHIP

Overall membership of the ABS as at 1 January 2016 stood at 5,871, which constitutes a drop of 1,089 members on the previous year. A total of 629 breeders resigned from the scheme during 2015, which was not wholly unexpected in view of visits now being mandatory. In addition to this, 196 breeders were suspended from the scheme. A further 264 memberships expired - this administrative category includes members who have died or altered their membership format (e.g. after divorce) or not paid their membership renewal fee for over three years.

SUB-GROUP COMPOSITION

The composition of the sub-group represents all relevant parties involved in the breeding and selling of dogs and assures impartiality of the ABS on strategy and policy, certification and evaluation. As such it includes representation from puppy buyers, dog trainers, breeders, the veterinary profession and the Kennel Club. A further member was appointed during 2015 from the animal welfare sector. The sub-group currently has nine voting members and there is capacity for one more.

Assured Breeders must now use microchipping when permanently identifying their breeding stock, in line with legislation being introduced in 2016 - previously they could choose tattooing and DNA profiling as alternatives, but now, if breeders use these methods, they must be in addition to microchipping. Puppies must also be microchipped prior to sale or by eight weeks, whichever is the sooner, unless otherwise advised in writing by a veterinary surgeon. The relevant microchip numbers must be registered on a national database in accordance with the law.



© Picture by: Pawel Prus/The Kennel Club Picture Library

BREED STANDARDS AND CONFORMATION SUB-GROUP

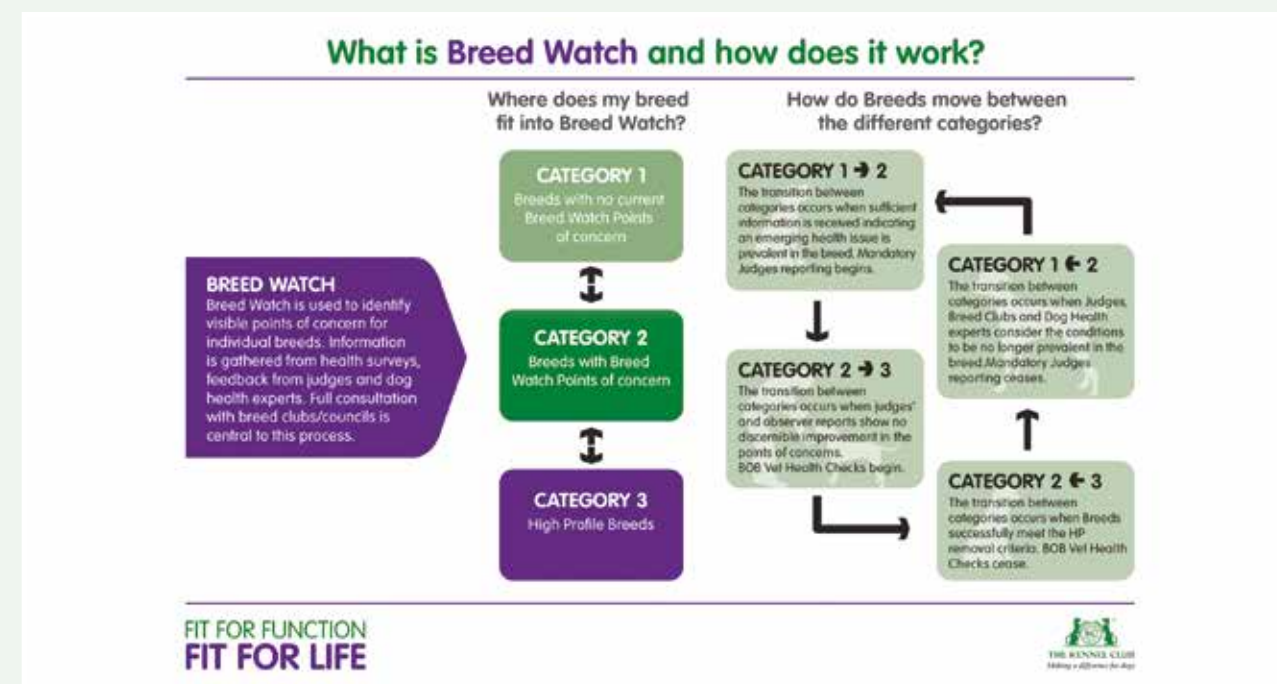
REMIT

- To advise on conformation related health issues as they relate to breed standards.
- To work with breed clubs/councils and other organisations on specific conformation related health issues.
- To liaise with Kennel Club departments and committees on judges' involvement, training and monitoring related to health issues.

ACHIEVEMENTS

BREED WATCH

Breed Watch is an important resource which provides up to date information on visible health conditions and exaggerated conformational issues that are detrimental to the health and welfare of dogs. The online tool also serves as an 'early warning system' to help identify emerging points of concern for individual breeds. Breed Watch classifies the Kennel Club recognised breeds into categories 1, 2 and 3. Its primary purpose is to enable anyone involved in the world of dogs, but in particular dog show judges, to find out about any breed specific conformational issues which may lead to health problems. Further information on Breed Watch can be found at: www.thekennelclub.org.uk/services/public/breed/watch/



BREED WATCH EDUCATION DAY

The 2015 Breed Watch education day was part of the wider Breed Watch initiative. This second education day, held in February 2015, gave judges, exhibitors and breeders the opportunity to help secure the future of healthy and happy pedigree dogs. The event focused on health & welfare concerns for breeds listed in categories two and three of the Kennel Club's Breed Watch initiative and aimed to give in-depth guidance to identify visible health and welfare concerns in dogs at shows. Following the event, Nick Blayney, Dog Health Group Chairman, who led the skin workshop at the event, said: "It was very gratifying to see the enthusiasm with which the judges attended the workshops. There was a lot of talk about the importance of health and welfare in the judging process. Judges are recognising their increasingly crucial role in the selection of healthy dogs."

MONITORING BY JUDGES OF CATEGORY 2 & 3 BREEDS

The programme of obtaining reports from the category 2 & 3 breed judges at Championship Shows continued throughout 2015 with 1249 forms completed.

Every judge of a category 2 and 3 breed scheduled at Championship Shows in 2015 was requested to complete a breed specific report giving their opinion on the health and well-being of exhibits shown under them. As a result of the information collected from judges' forms, the Dog Health Group is able to provide more valuable feedback to breed clubs.

The Dog Health Group is grateful to judges for submitting constructive and informative reports and to observers who have given their time to watch individual breeds.

BULLDOG AND PUG HEALTH EDUCATION DAY

A new education day to focus on Bulldog and Pug health was held in October 2015. The event was designed for breeders of Pugs and Bulldogs, both novice and experienced, and those considering breeding from their Pug or Bulldog, wishing to learn more about the health and welfare concerns affecting these breeds. Thus, the day aimed to provide new knowledge and cement existing knowledge, to jointly help to further improve the health of these two breeds. The day featured seminars on breathing, eyes, skin, weight and body conditioning, delivered by renowned veterinary experts.

Both breeds are classified as category 3 on the Kennel Club's Breed Watch initiative, as both are breeds in which some dogs can be affected by visible conditions or exaggerations that can cause pain or discomfort.

VETERINARY HEALTH CHECKS

Veterinary health checks are conducted at General and Group Championship shows to ensure that dogs of breeds classified in Breed Watch category 3 are fit and healthy. During 2015 a total of 310 veterinary health checks took place at Group & General Championship Shows on dogs winning Best of Breed and Champion title awards. Of these checks, 306 were passes and 4 were fails.



© Picture by: Andrei Opalatenko/The Kennel Club Picture Library

GENETICS AND HEALTH SCREENING SUB-GROUP

REMIT

- To advise on strategy for development of health screening (clinical/DNA) tests.
- To advise on which of the above should be requirements or recommendations in the Kennel Club Assured Breeder Scheme.
- To advise on breeding and registration issues to protect or enhance genetic diversity.
- To set up review processes on effectiveness of health screening schemes.
- To provide scientific input, where appropriate, to breeding strategies on phenotypic issues.
- To monitor progress on external data collection and surveillance.

ACHIEVEMENTS

2015 for the Genetics and Health Screening sub-group saw many expansions to accessing health information from different platforms - from research journals and the Kennel Club's own Health section on the Kennel Club website, to involvement with international research symposia. This year also included improved facilities for recording and publishing important health screening results.

BAER HEALTH PROGRAMME

Publication of BAER hearing screening as part of the 2014 health programme has proven so successful, that the facility is now available across all breeds. Now, the results of BAER testing are centrally collated and results of individual tested dogs are published. All participating dogs are Kennel Club registered and microchipped, to ensure verification of the dog being screened. The BAER Health Programme provides useful information on an individual dog's health to breeders, owners, and puppy buyers, and by collecting this data centrally, it opens the possibility of furthering research into hearing loss.

MATE SELECT

Developments in expanding Mate Select's Health Test Results Finder include continued development of laboratory acceptance criteria, along with the Animal Health Trust and the International Partnership for Dogs, investigating inclusion of select linkage marker testing, and the review of the efficacy of Control Schemes. In addition, another 13 breeds have Estimated Breeding Values available for Hip and/or Elbow Dysplasia.

HEALTH CONFERENCES

The summer of 2015 saw the Kennel Club and Kennel Club Charitable Trust's involvement in the support of two international conferences on canine genetics. Working with Guide Dogs for the Blind, Dogs Trust, the Animal Health Trust, and the United States Military, the Kennel Club and these collaborators developed an international conference on the genetics of behaviour, held in June 2015. This conference saw the best and brightest research into the genetics behind behaviour and breeding for quality attributes - including research from the Kennel Club's Quantitative Geneticist, Dr Tom Lewis.

As part of the Kennel Club's continued support of students and young researchers, the International Canine Health Awards were hosted as part of the 8th International Conference on Advances in Canine and Feline Genomics and Inherited Disease, held June 2015, in Cambridge. In addition, a special Kennel Club award of £1000 was given to the best student speaker. This funding from the International Canine Health Awards, and the Kennel Club Student Speaker Award, helps to support important research into inherited diseases and continues to highlight the importance of health and welfare research.

RESEARCH JOURNAL

Support from the Kennel Club Educational Trust for the research journal, *Canine Genetics and Epidemiology (CGE)*, continues to grow and improve access to both dog owners and breeders, and the wider canine research community. Several individual research papers, including work from the Kennel Club's Dr Tom Lewis and Miss Bonnie-Marie Abhayaratne, inspired access by more than 8,000 individuals, with many papers ranging from 2,000-8,000 hits. This is particularly significant considering *CGE* is only in its second year of publication. It is now also available through PubMed, in recognition of its growth and increasing importance on the research journal stage.

EDUCATION

Veterinary students were again hosted by the Health team at Crufts, where more than 800 students attended, gaining valuable insight into the world of dog breeding and the positive contribution of dog showing and activities. Lectures, provided by Dr Dan O'Neil of the Royal College of Veterinary Surgeons, and Dr Katy Evans, University of Nottingham and Guide Dogs, reached 400 of the students attending Crufts. The Kennel Club Health stand at Crufts continues to be extremely popular, providing hands-on genetic and breeding advice as well as highlighting all of the health resources available from the Kennel Club.

During the year, the Sub-Group also made the following recommendations to the Dog Health Group:

- The Sub-Group discussed the benefit of recording appropriate, carefully considered linkage and marker test results, following approval of suitable protocols.
- Comprehensive Breeding for Health Strategies would be strongly supported and positively impact canine health and welfare.
- The Sub-Group recognised that control schemes should be phased out in favour of more balanced breeding recommendations.
- The Kennel Club's expertise should contribute to proposed BSAVA (British Small Animal Veterinary Association) publications for owners/breeders.



© Picture by: Kelly Diamond/The Kennel Club Picture Library

CONCLUSION

The 2015 Dog Health Group annual report has highlighted the main achievements of the work of the Dog Health Group for the year, provided updates on ongoing projects and outlined the future direction of the group's work. The depth and diversity of the Kennel Club's commitment to health issues is self-evident and, as an organisation, the drive to improve canine health and welfare remains our firm priority.

The Kennel Club is extremely grateful to all who contribute to this work, from donations to the Kennel Club Charitable Trust through to breed health co-ordinators, judges, observers, show veterinary surgeons and those who form the membership of the Dog Health Group and its sub-groups.

ANNEX A

HEALTH TESTS

BVA/KC HIP DYSPLASIA SCHEME

Data calculated to 01/11/2015

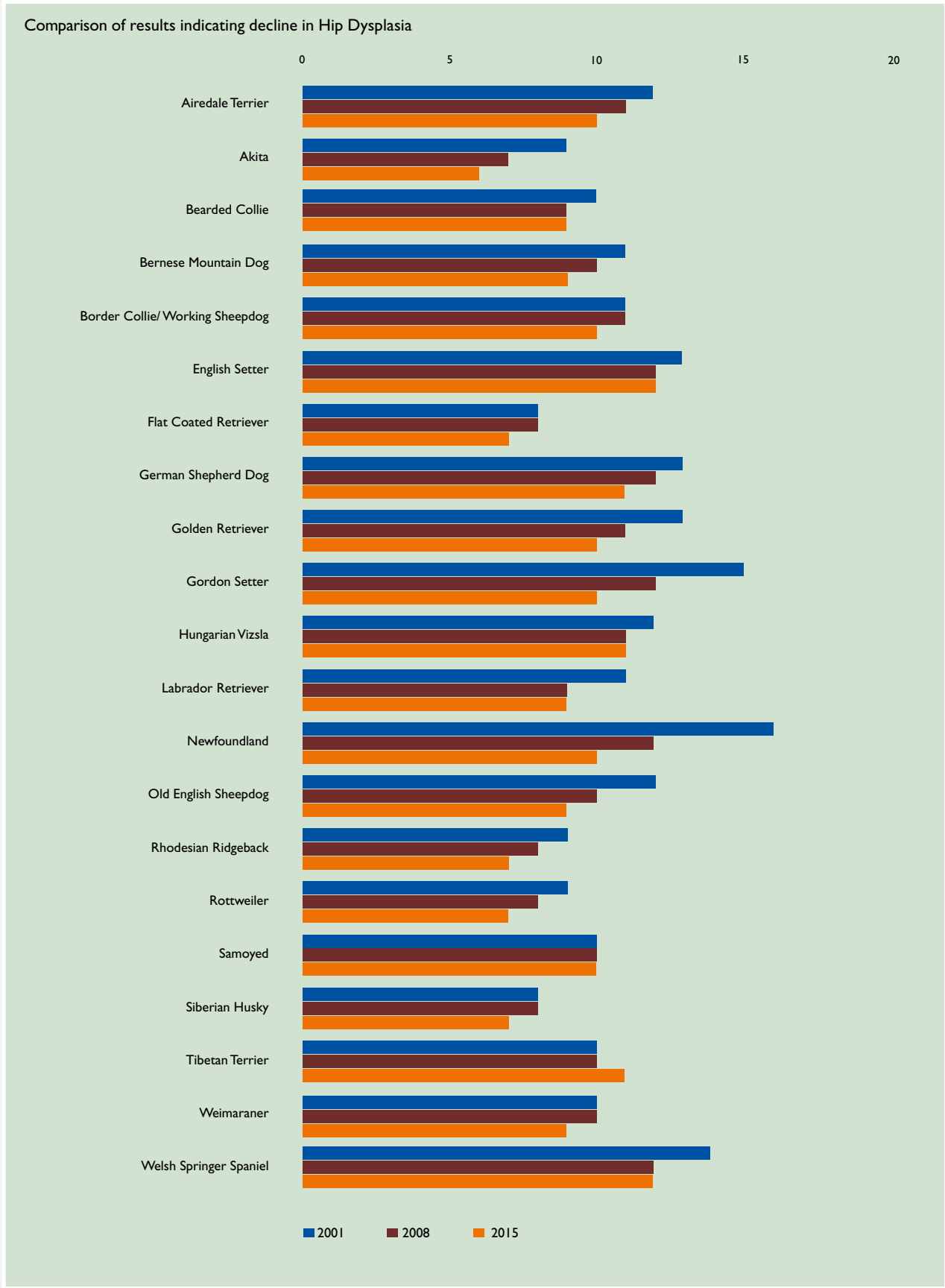
‘Five year Rolling Median Scores’ are maintained for the breeds that have a high throughput of annual scoring. The five year rolling median is derived from dogs scored in the previous 5 years. So, the 2001 5-year median represents the median of the dogs scored between 1st November 1996 and 31st October 2001. For the 2002 5-year median, the start date moves on by a year as does the end date, and so on.

In previous years this data has been presented as a 5-year rolling mean, but this has been changed to median to be in keeping with the most up to date BVA/KC recommendations.

For further information by breed please refer to:
www.thekennelclub.org.uk/vets-researchers/dog-health-group-annual-report/

5-YEAR ROLLING MEDIAN HIP SCORES FOR THE MAJOR BREEDS USING THE SCHEME

| Breed | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Airedale Terrier | 12 | 12 | 11 | 11 | 11 | 11 | 11 | 11 | 12 | 11.5 | 11 | 11 | 11 | 10 | 10 |
| Akita | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 |
| Bearded Collie | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Bernese Mountain Dog | 11 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Border Collie/Working Sheepdog | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 10 |
| English Setter | 13 | 13 | 13 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Flat Coated Retriever | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| German Shepherd Dog | 13 | 12 | 12 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 11 |
| Golden Retriever | 13 | 12 | 12 | 12 | 12 | 12 | 11.5 | 11 | 11 | 11 | 11 | 11 | 11 | 10 | 10 |
| Gordon Setter | 15 | 15 | 13 | 13 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 10 |
| Hungarian Vizsla | 12 | 12 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| Labrador Retriever | 11 | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Newfoundland | 16 | 16 | 14.5 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 10 |
| Old English Sheepdog | 12 | 12 | 11 | 12 | 11 | 11 | 11 | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 9 |
| Rhodesian Ridgeback | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 |
| Rottweiler | 9 | 9 | 8 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 7 |
| Samoyed | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 10 |
| Siberian Husky | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 |
| Tibetan Terrier | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 11 |
| Weimaraner | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 | 9 |
| Welsh Springer Spaniel | 14 | 14 | 13 | 13 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |



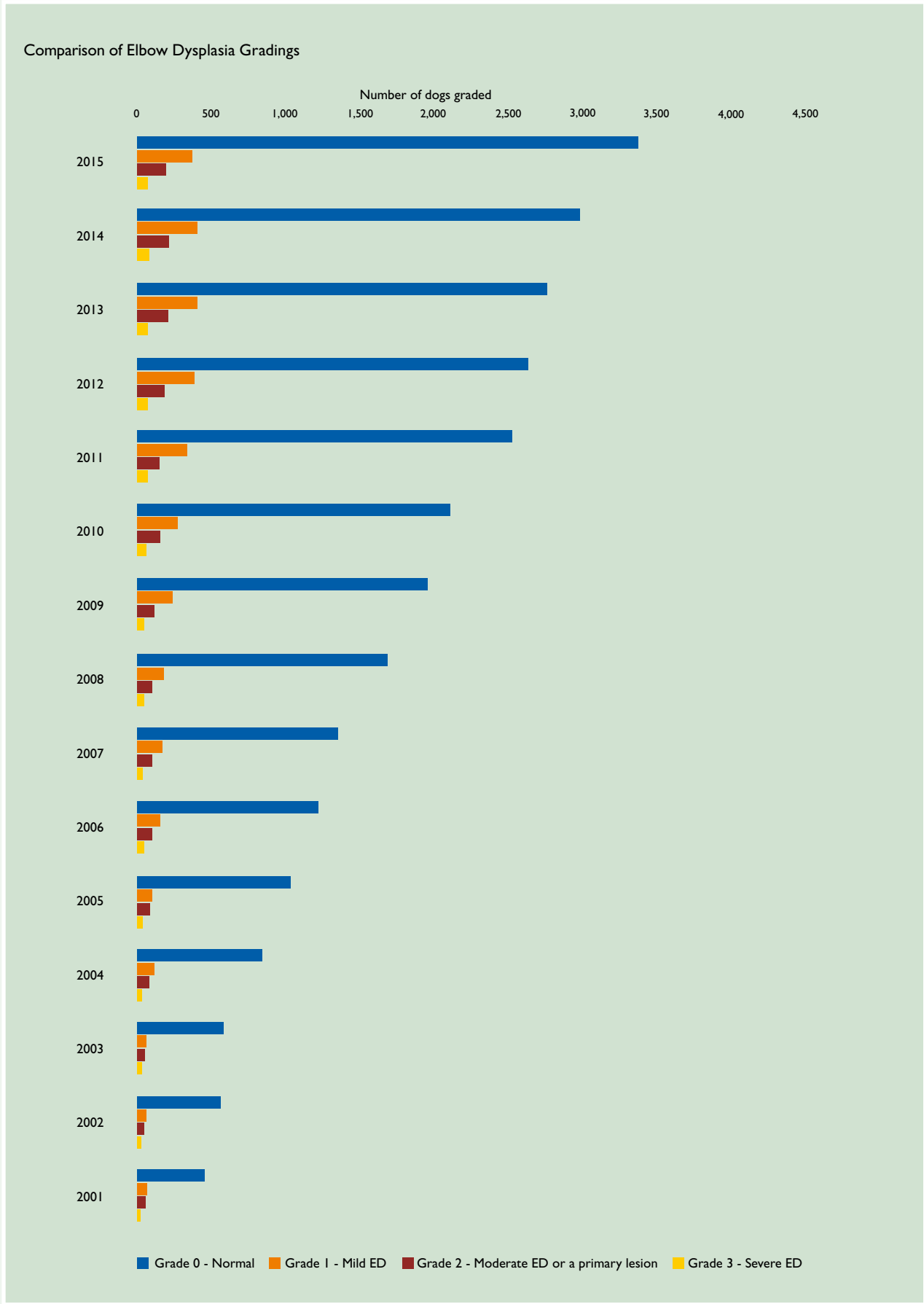
BVA/KC ELBOW DYSPLASIA SCHEME
Data calculated to 01/01/2016

The following table contains the outcome of dogs scored under the scheme in the last 15 years and is broken down by year, number and percentage of dogs in each elbow grade. For further information by breed please refer to www.thekennelclub.org.uk/vets-researchers/dog-health-group-annual-report/

| Year | Total dogs graded | Grades | | | | |
|------|-------------------|--------------|-------------|-------------|------------|-----------|
| | | 0 | > 0 | 1 | 2 | 3 |
| 2015 | 4030 | 3397 (84.3%) | 633 (15.7%) | 366 (9.1%) | 194 (4.8%) | 73 (1.8%) |
| 2014 | 3679 | 2989 (81.2%) | 690 (18.8%) | 399 (10.8%) | 211 (5.7%) | 80 (2.2%) |
| 2013 | 3453 | 2774 (80.3%) | 679 (19.7%) | 402 (11.6%) | 208 (6.0%) | 69 (2.0%) |
| 2012 | 3270 | 2637 (80.6%) | 633 (19.4%) | 380 (11.6%) | 185 (5.7%) | 68 (2.1%) |
| 2011 | 3080 | 2529 (82.1%) | 551 (17.9%) | 332 (10.8%) | 152 (4.9%) | 67 (2.2%) |
| 2010 | 2582 | 2099 (81.3%) | 483 (18.7%) | 268 (10.4%) | 153 (5.9%) | 62 (2.4%) |
| 2009 | 2354 | 1956 (83.1%) | 398 (16.9%) | 234 (9.9%) | 116 (4.9%) | 48 (2.0%) |
| 2008 | 1994 | 1675 (84.0%) | 319 (16.0%) | 172 (8.6%) | 101 (5.1%) | 46 (2.3%) |
| 2007 | 1639 | 1335 (81.5%) | 304 (18.5%) | 167 (10.2%) | 99 (6.0%) | 38 (2.3%) |
| 2006 | 1501 | 1206 (80.3%) | 295 (19.7%) | 152 (10.1%) | 100 (6.7%) | 43 (2.9%) |
| 2005 | 1229 | 1014 (82.5%) | 215 (17.5%) | 97 (7.9%) | 81 (6.6%) | 37 (3.0%) |
| 2004 | 1046 | 828 (79.2%) | 218 (20.8%) | 111 (10.6%) | 75 (7.2%) | 32 (3.1%) |
| 2003 | 714 | 570 (79.8%) | 144 (20.2%) | 57 (8.0%) | 54 (7.6%) | 33 (4.6%) |
| 2002 | 598 | 471 (78.8%) | 127 (21.2%) | 59 (9.9%) | 43 (7.2%) | 25 (4.2%) |
| 2001 | 578 | 441 (76.3%) | 137 (23.7%) | 62 (10.7%) | 53 (9.2%) | 22 (3.8%) |



© Picture by: Lynda Hilborn/The Kennel Club Picture Library



BVA/KC/ISDS EYE SCHEME
Data calculated to 01/01/2016

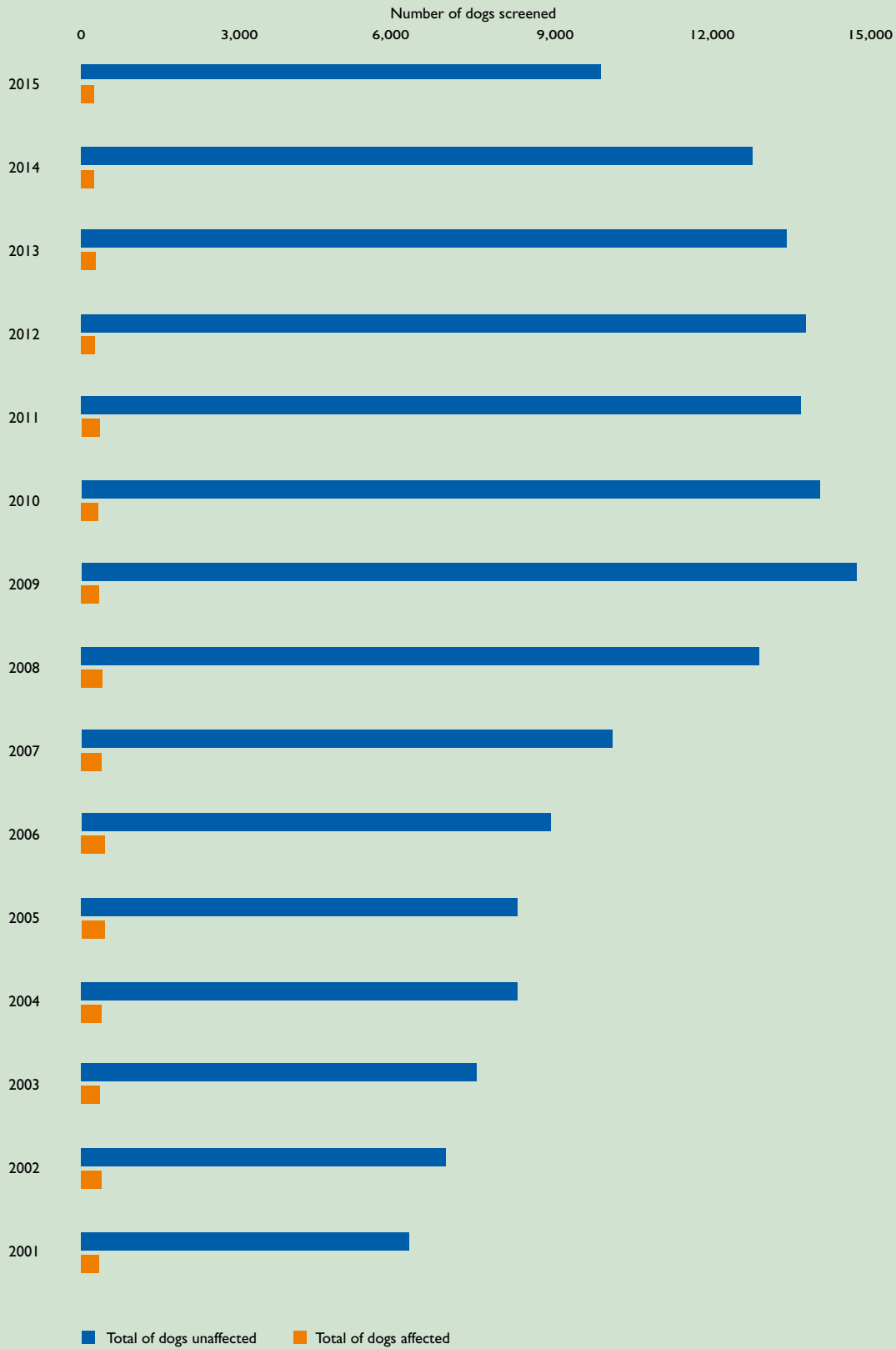
The following table contains the results of eye examinations performed under schedule A of the scheme in the last 15 years and is broken down by year, number and percentage of dogs found to be affected. For further information by breed please refer to www.thekennelclub.org.uk/vets-researchers/dog-health-group-annual-report/

| Year | Total Screened | Unaffected | Affected | CEA | TRD | CHC | PHPV | PPM | G | gPRA | cPRA | HC | PLL | RD | POAG |
|------|----------------|---------------|------------|-----|-----|-----|------|-----|----|------|------|-----|-----|----|------|
| 2015 | 9987 | 9787 (98.0%) | 200 (2.0%) | 22 | 0 | 0 | 2 | 0 | 22 | 11 | 0 | 141 | 1 | 0 | 0 |
| 2014 | 12901 | 12693 (98.4%) | 208 (1.6%) | 28 | 1 | 0 | 0 | 0 | 39 | 3 | 0 | 129 | 0 | 0 | 8 |
| 2013 | 13586 | 13353 (98.3%) | 233 (1.7%) | 24 | 0 | 0 | 4 | 0 | 40 | 12 | 0 | 152 | 2 | 0 | 0 |
| 2012 | 13896 | 13686 (98.5%) | 210 (1.5%) | 22 | 0 | 0 | 1 | 0 | 40 | 8 | 2 | 137 | 1 | 0 | 0 |
| 2011 | 13864 | 13569 (97.9%) | 295 (2.1%) | 34 | 0 | 2 | 3 | 0 | 52 | 12 | 0 | 192 | 2 | 0 | 0 |
| 2010 | 14203 | 13930 (98.1%) | 273 (1.9%) | 29 | 0 | 0 | 6 | 0 | 47 | 11 | 1 | 178 | 2 | 0 | 0 |
| 2009 | 14921 | 14629 (98.0%) | 292 (2.0%) | 38 | 0 | 1 | 3 | 0 | 58 | 14 | 0 | 177 | 3 | 0 | 0 |
| 2008 | 13182 | 12827 (97.3%) | 355 (2.7%) | 36 | 1 | 0 | 0 | 0 | 69 | 17 | 0 | 237 | 0 | 0 | 0 |
| 2007 | 10363 | 10035 (96.8%) | 328 (3.2%) | 27 | 0 | 0 | 4 | 0 | 69 | 14 | 0 | 209 | 7 | 0 | 0 |
| 2006 | 9264 | 8874 (95.8%) | 390 (4.2%) | 37 | 0 | 1 | 6 | 1 | 59 | 17 | 1 | 268 | 8 | 0 | 0 |
| 2005 | 8571 | 8249 (96.2%) | 322 (3.8%) | 30 | 0 | 1 | 2 | 0 | 37 | 12 | 0 | 236 | 4 | 0 | 0 |
| 2004 | 8575 | 8241 (96.1%) | 334 (3.9%) | 25 | 0 | 1 | 2 | 1 | 53 | 18 | 1 | 229 | 6 | 0 | 0 |
| 2003 | 7780 | 7472 (96%) | 308 (4%) | 31 | 0 | 0 | 4 | 1 | 31 | 26 | 0 | 216 | 2 | 0 | 0 |
| 2002 | 7206 | 6881 (95.5%) | 325 (4.5%) | 43 | 0 | 0 | 4 | 1 | 45 | 18 | 2 | 214 | 2 | 0 | 0 |
| 2001 | 6480 | 6195 (95.6%) | 285 (4.4%) | 29 | 0 | 0 | 3 | 0 | 30 | 11 | 2 | 206 | 6 | 0 | 0 |



© Picture by: John Malley/The Kennel Club Picture Library

Breakdown of eye examination results into unaffected and affected figures



KENNEL CLUB DNA TESTING SCHEMES
Data calculated to 01/01/2016

The following table contains the outcome of Kennel Club registered dogs tested under official Kennel Club DNA testing schemes in the last 15 years and is broken down by year and test result. Further data is presented to show the number of dogs born each year with a known hereditary status (i.e. both parents have been tested and the puppies’ health status for the relevant condition is predictable). For further information by breed please refer to: www.thekennelclub.org.uk/vets-researchers/dog-health-group-annual-report/

| Year | DNA tested | Clear | Carrier | Affected | Dogs born with hereditary status known |
|------|------------|--------------|--------------|------------|--|
| 2015 | 6051 | 4811 (79.5%) | 1131 (18.7%) | 109 (1.8%) | 37948 |
| 2014 | 5862 | 4751 (81.0%) | 1014 (17.3%) | 97 (1.7%) | 39456 |
| 2013 | 7022 | 5720 (81.5%) | 1188 (16.9%) | 114 (1.6%) | 36384 |
| 2012 | 7134 | 5684 (79.7%) | 1324 (18.6%) | 126 (1.8%) | 31591 |
| 2011 | 5485 | 3910 (71.3%) | 1380 (25.2%) | 195 (3.6%) | 26914 |
| 2010 | 4616 | 3413 (73.9%) | 1091 (23.6%) | 112 (2.4%) | 23397 |
| 2009 | 4020 | 2923 (72.7%) | 976 (24.3%) | 121 (3.0%) | 18403 |
| 2008 | 3206 | 2500 (78.0%) | 603 (18.8%) | 103 (3.2%) | 15030 |
| 2007 | 3293 | 2655 (80.6%) | 554 (16.8%) | 84 (2.6%) | 12083 |
| 2006 | 2507 | 2122 (84.6%) | 347 (13.8%) | 38 (1.5%) | 8602 |
| 2005 | 1199 | 950 (79.2%) | 220 (18.3%) | 29 (2.4%) | 6111 |
| 2004 | 422 | 321 (76.1%) | 96 (22.7%) | 5 (1.2%) | 4218 |
| 2003 | 550 | 398 (72.4%) | 141 (25.6%) | 11 (2.0%) | 3156 |
| 2002 | 217 | 178 (82.0%) | 38 (17.5%) | 1 (0.5%) | 2775 |
| 2001 | 319 | 241 (75.5%) | 73 (22.9%) | 5 (1.6%) | 2275 |



© Picture by: Marie Warwick/The Kennel Club Picture Library

CHIARI-LIKE MALFORMATION/SYRINGOMYELIA SYNDROME (CM/SM)
TESTING SCHEME SUMMARY BY BREED
Data Calculated to 01/11/15

The following summary covers the results of Kennel Club registered dogs screened under the BVA/KC CM/SM screening scheme since the scheme began in 2012. This data is further broken down by test result.

| Breed | Chiari-like malformation (CM) | | | Syringomyelia (SM) | | |
|---|-------------------------------|---------|-----|--------------------|----|----|
| | 0 | Grade 1 | 2 | 0 | 1 | 2 |
| Affenpinscher | | | | | | |
| A | 0 | 2 | 2 | 2 | 1 | 1 |
| B | 0 | 2 | 3 | 5 | 0 | 0 |
| C | 0 | 5 | 5 | 7 | 1 | 2 |
| Boston Terrier | | | | | | |
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 1 | 0 | 0 | 0 | 1 |
| C | 0 | 0 | 0 | 0 | 0 | 0 |
| Cavalier King Charles Spaniel | | | | | | |
| A | 0 | 1 | 28 | 11 | 6 | 12 |
| B | 0 | 0 | 57 | 14 | 14 | 29 |
| C | 0 | 2 | 121 | 57 | 34 | 32 |
| Chihuahua (Long coat) | | | | | | |
| A | 0 | 0 | 4 | 0 | 1 | 3 |
| B | 1 | 0 | 7 | 4 | 1 | 3 |
| C | 0 | 2 | 14 | 10 | 3 | 3 |
| Chihuahua (Smooth coat) | | | | | | |
| A | 0 | 0 | 1 | 0 | 0 | 1 |
| B | 0 | 0 | 4 | 1 | 2 | 1 |
| C | 0 | 3 | 7 | 2 | 4 | 4 |
| French Bulldog | | | | | | |
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 1 | 0 | 1 | 0 | 0 |
| Griffon Bruxellois | | | | | | |
| A | 0 | 0 | 6 | 1 | 1 | 4 |
| B | 1 | 4 | 10 | 4 | 5 | 6 |
| C | 1 | 2 | 7 | 4 | 2 | 4 |
| Papillon | | | | | | |
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 0 | 1 | 1 | 0 | 0 |
| C | 0 | 0 | 2 | 1 | 0 | 1 |
| Pekingese | | | | | | |
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 1 | 0 | 1 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 |
| Pomeranian | | | | | | |
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 0 | 2 | 0 | 1 | 0 | 1 |
| C | 0 | 3 | 2 | 3 | 2 | 0 |
| Key | | | | | | |
| A = Aged 5 + B = Aged 3 – 5 C = Aged 1 – 3 | | | | | | |
| Chiari-like malformation (CM) | | | | | | |
| Grade 0 No Chiari malformation | | | | | | |
| Grade 1 Cerebellum indented (not rounded) | | | | | | |
| Grade 2 Cerebellum impacted into, or herniated through the opening at the rear of the skull (the foramen magnum) | | | | | | |
| Syringomyelia (SM) | | | | | | |
| Grade 0 Normal (no central canal dilation, no presyrinx, no syrinx) | | | | | | |
| Grade 1 Central canal dilation (CCD) less than 2mm in diameter | | | | | | |
| Grade 2 Syringomyelia (central canal dilation which has an internal diameter of 2mm or greater), or separate syrinx, or pre-syrinx with or without central canal dilation | | | | | | |

ANNEX B

COMPOSITION OF DOG HEALTH GROUP AND SUB-GROUPS

| COMPOSITION OF THE DOG HEALTH GROUP | |
|--|---|
| External | Mr Nick Blayney, <i>Veterinary surgeon</i> Prof. Sheila Crispin, <i>Veterinary surgeon with specialist expertise in comparative ophthalmology and systemic disorders with ocular manifestations</i> Mr Sean Wensley, <i>President, British Veterinary Association</i> Prof. Mike Herrtage, <i>Veterinary surgeon, Dean of University of Cambridge Veterinary School</i> Dr Sarah Blott, <i>Associate Professor in Animal Breeding and Genetics, University of Nottingham</i> Dr Cathryn Mellersh, <i>Canine Genetics Research Group Leader, Animal Health Trust</i> Dr Sally Everritt, <i>BSAVA Scientific Policy Officer</i> |
| Kennel Club Members | Mr Kevin Clifford, <i>Veterinary surgeon</i> Mr Frank Kane, <i>General Committee member and Chairman Breed Standards Sub-Committee</i> Mrs Gil Simpson, <i>General Committee member and Veterinary surgeon</i> Mr Mike Townsend, <i>Chairman Kennel Club Charitable Trust and General Committee member</i> |
| Kennel Club Staff | Mrs Caroline Kisko, <i>Secretary/Director of Communications</i> Mr Bill Lambert, <i>Health and Breeder Services Manager</i> Mrs Caroline Hallett, <i>Registered Societies Manager</i> Ms Aimee Llewellyn, <i>Head of Health and Research</i> |
| COMPOSITION OF THE ACTIVITIES HEALTH AND WELFARE SUB-GROUP | |
| Kennel Club Members | Mr Steve Croxford, <i>General Committee member, Activities Sub-Committee member, Disciplinary Sub-Committee Chairman</i> Mr Dave Jolly, <i>Activities Sub-Committee member, Accredited Judges Trainer for Agility, Judges Working Party Member</i> |
| External | Dr Jacqueline Boyd, <i>Lecturer/Senior Lecturer in Animal Science, School of Animal, Rural and Environmental Sciences, Nottingham Trent University</i> Mr Gary Doyle, <i>Lecturer School of Health, Sport and Bioscience, University of East London</i> Mrs Rachel Mowbray, <i>Kennel Club GB Agility Team Veterinary surgeon</i> Miss Carolyne Tranquille, <i>Graduate Research Assistant, Equine Orthopaedic Research, Animal Health Trust</i> Mr Barry Gilbert, <i>Working Trials</i> Mrs Lesley Brocklehurst, <i>Heelwork to Music</i> Miss Natasha Wise, <i>Agility</i> Mrs Carole Patrick, <i>Obedience</i> |
| Kennel Club Staff | Miss Debbie Deuchar, <i>Working Dog Activities Team Manager</i> Ms Rachel Mansfield, <i>Working Dog Activities Specialist</i> Mrs Angela Mitchell, <i>Committee Secretary</i> |

COMPOSITION OF DOG HEALTH GROUP AND SUB-GROUPS

| COMPOSITION OF THE ASSURED BREEDER SCHEME SUB-GROUP | |
|---|---|
| External | Mr Tony Buckwell, <i>Veterinary surgeon</i> Miss Annette Conn, <i>Behaviourist</i> Ms Sharon Edwards, <i>Trading Standards Authority Inspector</i> Mr Frank Geraghty, <i>Field Trial competitor & Assured Breeder</i> Mr Steve Goody, <i>Animal welfare worker</i> Mr Gavin Robertson, <i>Boarding kennel owner & Assured Breeder</i> Ms Philippa Robinson, <i>Canine Health Strategist</i> Mr Graham Thurlow, <i>Veterinary surgeon</i> |
| Kennel Club Member | Mrs Jan Wood, <i>General Committee member & Assured Breeder</i> |
| Kennel Club Staff | Mr Bill Lambert, <i>Health and Breeder Services Manager</i> Mr Glen Dymock, <i>Assured Breeder Scheme Manager</i> Mr Nick Sutton, <i>Health Information Officer</i> |
| COMPOSITION OF THE BREED STANDARDS AND CONFORMATION SUB-GROUP | |
| External | Prof. Sheila Crispin, <i>Veterinary surgeon with specialist expertise in comparative ophthalmology and systemic disorders with ocular manifestation</i> Prof. Mike Herrtage, <i>Veterinary surgeon, Dean of University of Cambridge Veterinary School</i> |
| Kennel Club Members | Mr Frank Kane, <i>General Committee member and Breed Standards Sub-Committee Chairman</i> Dr Ron James, <i>General Committee member and Veterinary surgeon</i> Mrs Meg Purnell-Carpenter, <i>General Committee member and Breed Standards Sub-Committee Vice-Chairman</i> Mr Ian Seath, <i>Kennel Club member</i> |
| Kennel Club Staff | Mrs Caroline Kisko, <i>Secretary/Director of Communications</i> Mr Bill Lambert, <i>Health and Breeder Services Manager</i> Mrs Caroline Hallett, <i>Registered Societies Manager</i> Miss Charlotte McNamara, <i>Health Education and Engagement Manager</i> Dr Tom Lewis, <i>Quantitative Geneticist</i> Miss Bonnie Wiles, <i>Health Data Co-ordinator</i> |
| COMPOSITION OF THE GENETICS AND HEALTH SCREENING SUB-GROUP | |
| External | Prof Neil Gorman, <i>Vice-Chancellor, Nottingham Trent University (retired)</i> |
| Canine Genetics | Dr Cathryn Mellersh, <i>Canine Genetics Research Group Leader, Animal Health Trust</i> |
| Human Genetics | Prof. Bill Ollier, <i>Professor of Immunogenetics at Manchester University and Director of the Centre for Integrated Genomic Medical Research</i> |
| Canine Epidemiologist | Dr Dave Brodbelt, <i>Royal Veterinary College Lecturer in Companion Animal Epidemiology and a European Veterinary Specialist in Anaesthesia</i> |
| BVA nominated Veterinary Surgeons | Dr Ruth Dennis, <i>Head of Diagnostic Imaging Unit AHT and European Specialist in Veterinary Diagnostic Imaging, Chief Scrutineer BVA/KC Hip and Elbow Dysplasia schemes</i> Dr Ian Mason, <i>Chief Eye Panelist, BVA/KC Eye scheme</i> |
| Kennel Club Members | Mr Mike Townsend, <i>Chairman Kennel Club Charitable Trust and General Committee member</i> Dr Ron James, <i>General Committee member & Veterinary surgeon</i> |
| Kennel Club Staff | Mrs Caroline Kisko, <i>Secretary/Director of Communications</i> Ms Aimee Llewellyn, <i>Head of Health and Research</i> Dr Tom Lewis, <i>Quantitative Geneticist</i> |

ANNEX C

REPORT FROM THE KENNEL CLUB GENETICS CENTRE (KCGC)
AT THE ANIMAL HEALTH TRUST

NEW DNA TESTS

PRIMARY OPEN ANGLE GLAUCOMA IN THE PETIT BASSET GRIFFON VENDEEN

Primary open angle glaucoma (POAG) is a painful and blinding condition caused by a gradual increase of intraocular pressure. This form of glaucoma is not associated with any observable abnormality, cannot therefore be screened for clinically and has thus been difficult for breeders to control. Using a novel form of association study and whole-genome sequencing we successfully identified the mutation responsible for POAG in the Petit Basset Griffon Vendéen (PBGV), and a DNA test was launched at Crufts. The PBGV breed community is to be congratulated; the uptake of this test has been phenomenal and we have now tested well over 1000 PBGVs from around 25 different countries.

This project was co-funded by the Waltham Foundation.

SENSORY NEUROPATHY IN THE BORDER COLLIE

Sensory neuropathy (SN) is a severe neurological disease affecting young Border Collies for which there is no treatment. Affected dogs progressively lose the sensation in their limbs due to the degeneration of sensory and motor nerve cells and have to be euthanised. The onset of the disease is usually between two and seven months of age and clinical signs include knuckling of the feet, self-mutilation wounds (caused by excessive chewing or licking due to the lack of feeling in the limbs) and a progressive lack of coordination (ataxia). SN is currently a rare disease but cases have been seen in the UK, USA, Belgium, Japan and Italy.

Two SN cases were diagnosed by neurologists in the AHT's Small Animal Centre, providing DNA samples to begin a genetic investigation. A third DNA sample was provided from the University of Glasgow. DNA from the three cases were compared to the DNA of 170 Border Collies whose DNA has been submitted to the KCGC from owners to aid our epilepsy research in the Border Collie. This extensive bank of DNA was crucial in enabling us to identify the chromosome that harboured the genetic mutation for SN very quickly and with just the 3 cases we had available. We then performed whole-genome sequencing of one of the cases to identify the mutation responsible for SN.

Once the mutation had been found the KCGC worked in collaboration with the University of Glasgow and the University of Missouri to test DNA from 11 affected dogs, all of which were confirmed to have two copies of the mutation we had identified.

The use of whole-genome sequencing and our ability to make use of our epilepsy data enabled us to develop this DNA test for less than £3000. The DNA test launched in April 2015.

GLAUCOMA

James Oliver, a veterinary ophthalmologist and a BVA Eye panelist, is undertaking a PhD in the KCGC to investigate the genetics of primary closed angle glaucoma (PCAG) in multiple breeds. PCAG is associated with an abnormality of the iridocorneal angle of the eye, called goniodysgenesis, which is screened for using a procedure called gonioscopy. Since he started his PhD in 2014 James has performed gonioscopy and measured intraocular pressure of over 1500 dogs, of several different breeds, from all over the UK. This has enabled us to estimate the prevalence of goniodysgenesis in four different breeds and also obtain robust evidence that the condition is progressive in all breeds examined to date. These data are currently enabling the BVA Eye Scheme to revise its recommendations regarding the frequency of gonioscopy screening, and also the Schedule A/B designation of these breeds.

PRIMARY OPEN ANGLE GLAUCOMA IN BASSET HOUNDS

During the course of screening Basset Hounds, James identified two dogs affected with primary open angle glaucoma (POAG), a form of glaucoma currently unknown in this breed. Building on our studies of POAG in the PBGV we sequenced a strong candidate gene in these affected dogs and found the causal mutation. Screening our collection of Basset Hound DNA samples indicates ~ 15% of this breed are carriers of this mutation. A DNA test was made available in June 2015.

WHOLE GENOME SEQUENCING

Sequencing entire genomes is a relatively new but very powerful technology that has recently become available to geneticists at the Kennel Club Genetics Centre. Since 2014 we have sequenced the whole-genomes of nearly 30 dogs. These dogs are a mixture of older, healthy dogs and dogs affected with disorders that are likely to be caused by recessive mutations in single genes. The establishment of IT infrastructure capable of downloading, processing and storing the huge datasets that are produced by whole genome sequencing has now been achieved and we are well positioned to scale up our sequencing efforts in the coming months and years.

One of the dogs whose genome we have sequenced is a Vizsla affected with a novel form of inherited ataxia. Using a range of in-silico prediction tools to compare the sequence of the dog's genome with the genomes of other dogs we have been able to identify the mutation responsible for the disease. This is an example of the power of whole genome sequencing to identify disease mutations from a very small number of affected dogs and at a very modest cost.

THE GIVE A DOG A GENOME PROJECT

The Kennel Club Genetics Centre at the Animal Health Trust is embarking on an exciting new initiative - the *Give A Dog A Genome project*. The aim of the project is to sequence the entire genomes of at least 50 additional dogs, of 50 different breeds, by the end of 2016. In 2015, the Kennel Club Charitable Trust pledged £50,000 to the Kennel Club Genetics Centre at the AHT to be spent on genome sequencing between 2015-2016. It costs around £2000 to sequence a genome. The aim of *Give a Dog a Genome* is to collaborate with 50 different breed communities and raise donations of £1000 from each breed. These donations will be matched with £1000 from the KCCT funding, enabling the entire genomes of 50 dogs to be sequenced. Each genome we sequence will have the potential to help its own breed and also other breeds. The bigger our bank of genomes, the more powerful it is and the more dogs we can help.

For more information about *Give a Dog a Genome* please visit www.aht.org.uk/gdg



© Picture by: Roselyanne Jones/The Kennel Club Picture Library

ANNEX D

KENNEL CLUB CANCER CENTRE REPORT

The Oncology Research Group in the Kennel Club Cancer Centre at the Animal Health Trust continued with a programme of research aimed at the development of more reliable prognostic tests for cancers in dogs. Through use of the GeneAtlas machine, funded by a grant from the Kennel Club Charitable Trust, the Group is able to analyse the ‘molecular fingerprints’ of ‘old’ tumour specimens that were originally collected for histopathological examination. In 2015 the focus has been a project seeking to identify new biomarkers of canine mast cell tumour metastasis through the ‘molecular profiling’ of archival mast cell tumour biopsies.

INTRODUCTION

Mast cell tumours (MCTs) are the most common skin tumour in dogs, and display variable behaviour. Approximately 20% of affected dogs develop metastatic disease and these dogs, if untreated, have a median survival time of 7 months. MCTs are most commonly classified by histological grade, applying one of two grading schemes. However, neither of the grades most often diagnosed (the ‘Patnaik intermediate grade’ and the ‘Kiupel low grade’) can unequivocally predict whether an individual MCT will metastasise (spread).

The identification of gene expression markers of metastasising MCTs would be a significant step towards development of an objective, quantitative prognostic test that will accurately predict whether a MCT will metastasise, and therefore whether a patient will benefit from adjuvant chemotherapy. The sensitivity with which the ‘levels’ of gene expression markers can be detected in tissues means that a prognostic test targeting such markers could be run on fine needle aspirate biopsies of tumours collected from conscious dogs, sparing some dogs from ultimately ineffective and potentially disfiguring surgery.

SUMMARY OF PROGRESS

A cohort of 40 formalin-fixed paraffin-embedded biopsies of canine MCTs, originally collected for diagnostic histopathology between 1997 and 2010, was assembled. Half of the dogs that bore the tumours died (or were euthanised) due to tumour metastasis within 560 days of surgery, whilst the remaining dogs were alive over 1000 days post-surgery. Employing the ‘GeneAtlas’ system, the ‘expression levels’ of 20,000 genes in each of the tumours were measured using Canine Gene 1.1 ST Arrays (Affymetrix).

A total of 25 genes exhibited statistically significant >2-fold level differences in expression between the metastasising and non-metastasising MCTs. Several of the genes have previously been implicated as being important in the metastasis of a number of human cancers. Potentially the most interesting result is the reduced level in the metastasising MCTs of a gene also shown to be present in decreased quantities in metastasising human gastrointestinal stromal tumours (GISTs). GISTs are generally regarded as being likely to arise by the same molecular mechanism as canine MCTs because a significant proportion of both tumours share a mutation in a common gene (c-Kit).

Using a computer algorithm, the expression levels of 15 of the 25 genes are predicted to classify ‘unknown tumours’ with a sensitivity of 88.9% and a specificity of 56.3%.

For a subset of the 25 genes, the differences in expression between the metastasising and non-metastasising MCTs, detected using the Canine Gene 1.1 ST Arrays, are to be validated by a second, independent experimental means.



THE KENNEL CLUB
Making a difference for dogs

HEAD OFFICE
Clarges Street, London W1J 8AB
Telephone 01296 318540 Facsimile 020 7518 1058

AYLESBURY OFFICE
4a Alton House Office Park, Gatehouse Way,
Aylesbury, Bucks HP19 8XU
Telephone 0844 4633 980 Facsimile 01296 486725

www.thekennelclub.org.uk



INVESTOR IN PEOPLE