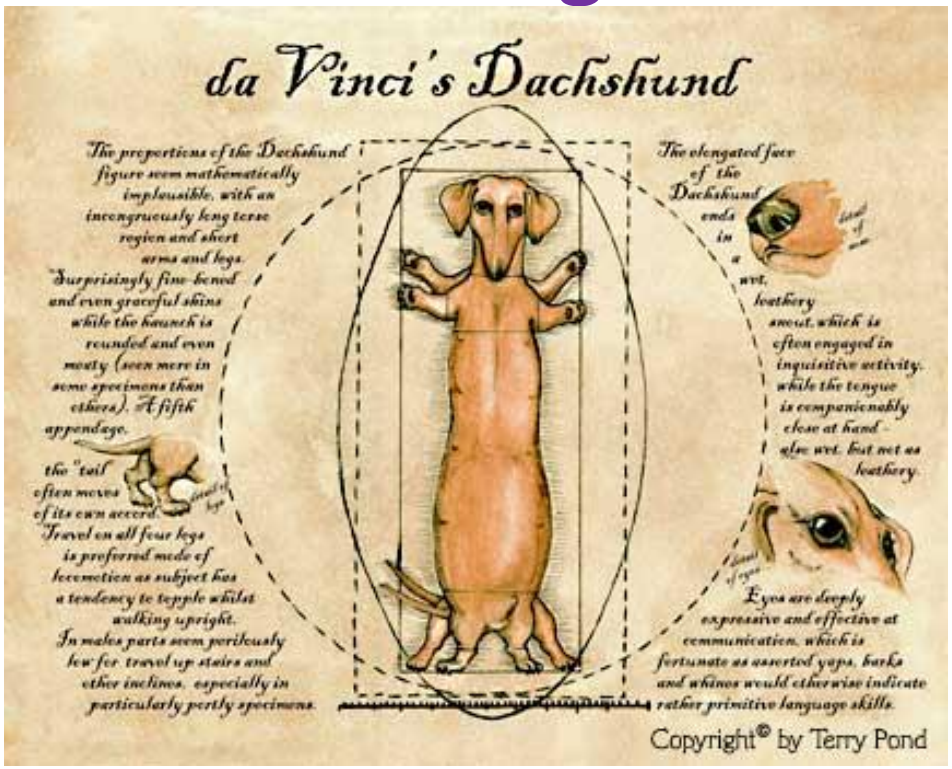
The Dog Health Balancing Act – how to balance health resources for breeding for "whole dog" health



Aimée Llewellyn-Zaidi

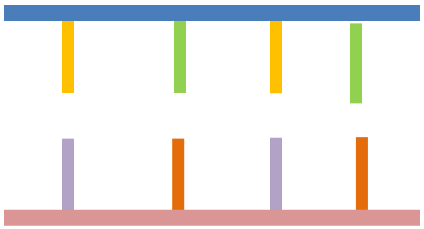
Head of Health and Research

Today's Talk

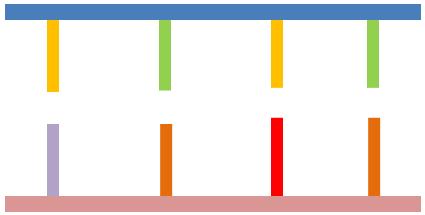
- What resources are available for testing for simple diseases
- A refresher on disease modes of inheritance
- Optimising DNA tests, not all tests are the same!
- Complex inherited disorders – help is out there!
- How to eliminate disease with minimum impact on biodiversity
- A dog is more than a test result – behaviour and conformation.
- Free resources and information

What is a simple inherited disease?

- A “simple” inherited disease means that there is a single specific gene identified that, when abnormal, can cause disease.
- Two abnormal genes (one from each parent) must be inherited to cause disease
- Many simple diseases have associated DNA tests



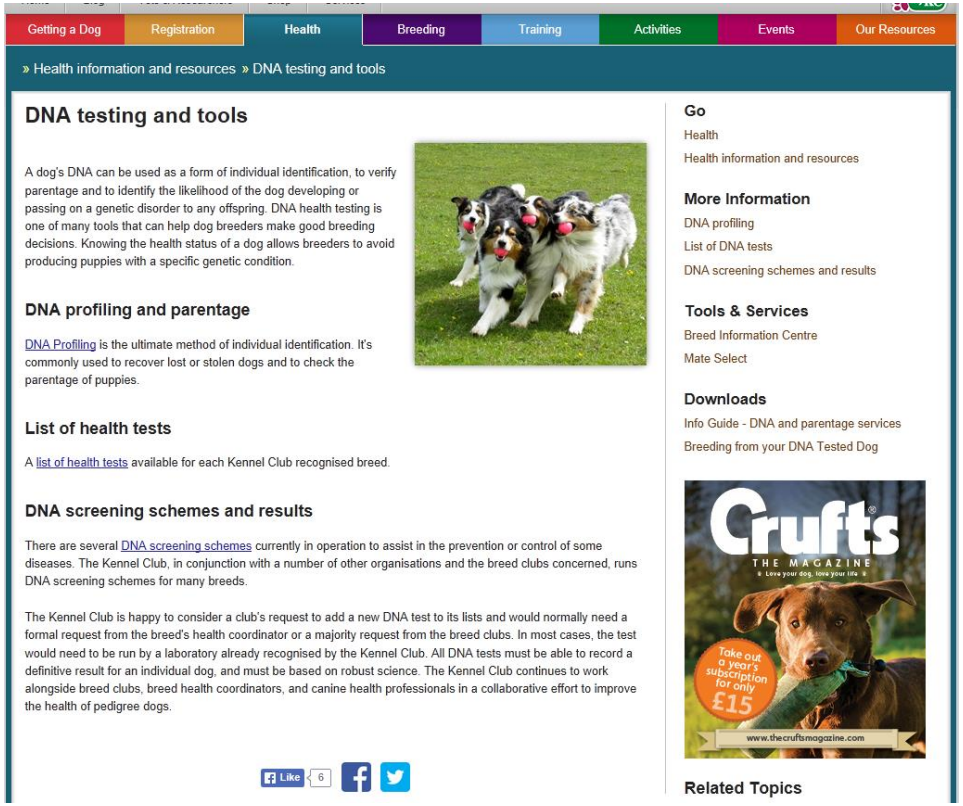
Normal recombination with dam/sire



Abnormal recombination with dam/sire

What tests are available?

- Single-gene mutations are normally breed-specific
- Most are buccal (mouth) swab, saliva, or occasionally blood samples
- Often owners will take and submit samples themselves
- The veterinary practice can help by offering a sampling service, including double-checking microchip/dog ID
- A summary list of many health-related tests can be found on the KC website



Getting a Dog | Registration | Health | Breeding | Training | Activities | Events | Our Resources

» Health information and resources » DNA testing and tools

DNA testing and tools

A dog's DNA can be used as a form of individual identification, to verify parentage and to identify the likelihood of the dog developing or passing on a genetic disorder to any offspring. DNA health testing is one of many tools that can help dog breeders make good breeding decisions. Knowing the health status of a dog allows breeders to avoid producing puppies with a specific genetic condition.

DNA profiling and parentage

DNA Profiling is the ultimate method of individual identification. It's commonly used to recover lost or stolen dogs and to check the parentage of puppies.

List of health tests

A list of health tests available for each Kennel Club recognised breed.

DNA screening schemes and results

There are several DNA screening schemes currently in operation to assist in the prevention or control of some diseases. The Kennel Club, in conjunction with a number of other organisations and the breed clubs concerned, runs DNA screening schemes for many breeds.

The Kennel Club is happy to consider a club's request to add a new DNA test to its lists and would normally need a formal request from the breed's health coordinator or a majority request from the breed clubs. In most cases, the test would need to be run by a laboratory already recognised by the Kennel Club. All DNA tests must be able to record a definitive result for an individual dog, and must be based on robust science. The Kennel Club continues to work alongside breed clubs, breed health coordinators, and canine health professionals in a collaborative effort to improve the health of pedigree dogs.

Like 6

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Health
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More Information
DNA profiling
List of DNA tests
DNA screening schemes and results

Tools & Services
Breed Information Centre
Mate Select

Downloads
Info Guide - DNA and parentage services
Breeding from your DNA Tested Dog

Related Topics

Health Information

You may be aware that some breeds of dog (and crossbreeds too) can be susceptible to inherited disease. Of course you want to be sure that the dog you choose is as healthy as possible, and you would like to know that it has not inherited any undesirable disease-causing genes from its parents. There is some help in that DNA tests for diseases in purebred dogs are available for some conditions in some breeds, but there are not very many such tests just yet! There are also, however, a number of clinical veterinary screening schemes that dog breeders can use to increase the probability of producing healthy puppies.

Details of the various screening schemes, both veterinary and DNA, that are available to breeders in the UK can be found at www.thekennelclub.org.uk/doghealth

Potential dog owners should be aware that, at present, the application of various health screening results to breeding programmes is not always straightforward, and breeders may make choices for various reasons. A responsible breeder though, will always be willing to discuss relevant health issues with you. Breed clubs are often useful sources of breed-specific information.

Schemes or advice relevant to this breed

Kennel Club Assured Breeders must use the following screening schemes for sires and dams

BVA/KC Hip Dysplasia Scheme
BVA/KC/ISDS Eye Scheme

Kennel Club Assured Breeders are strongly recommended to use the following screening schemes and/or advice for sires and dams

BVA/KC Elbow Dysplasia Scheme
DNA test - prcd-PRA

The following other health tests are also available.

DNA test - CNM
DNA test - EIC

The list above is not necessarily comprehensive. Breed clubs and experienced breeders are useful sources of information on health issues in the breed. All breeds have a Breed Health

All-breed List

KC http://www.thekennelclub.org.uk/media/14688/dnatestsworldwide.pdf KC thekennelclub.org.uk

File Edit Go to Favorites Help

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Breed-Specific Health Tests

(as of June 2014)

The Kennel Club, together with the British Veterinary Association, runs several clinical screening schemes, such as hip and elbow dysplasia, CM/SM and eye diseases, which enable breeders to choose and produce healthy breeding stock. Additionally, the Kennel Club runs DNA tests and schemes in conjunction with breed clubs and laboratories, some of which are recorded by The Kennel Club on The Kennel Club's Registration Database and available to view via the online tool Health Test Results Finder.

The list below displays the screening schemes and DNA tests available for each breed, along with an indication as to whether they are part of the Assured Breeder Scheme (recommended or required) and whether they are recorded on the KC Registration Database.

Please note that some of the tests and laboratories listed below are not necessarily part of official Kennel Club testing schemes.

This list is accurate at the time of publish and will be updated every six months.

Breed	Test	Company or Testing Laboratory	Part of ABS	ABS Requirement	ABS recommendation	Recorded by Kennel Club
Affenpinscher	Patella testing under breed club scheme					
Afghan Hound	Canine Coat and Nose Colour	HealthGene				
	Coat Colour Gene Variations	VetGen, Davis Veterinary Genetics Laboratory (University of California)				
	Canine Mask Test	Pinmoore Animal Laboratory Services Ltd				

Example of a DNA test result

Owner gets a certificate, which may or may not have advise or information about what the results mean. Often results are sent directly to the KC for recording on Mate Select

Understanding results is **key** to preventing the spread of a specific condition

Just breeding from clear dogs only is *not* good enough

Advise is available

OPTIGEN LLC — for the genetic advantage

Test Report

1001627232 Paterson
28 Southbrook Road
Melksham, Wiltshire, SN12 8DT
United Kingdom

Optigen Accession #: 13-8346
VHL#: 52283
Report issued for: VHL_ID H52283

OptiGen Test Certificate

Optigen Accession #: 13-8346

Test Completed: 08/12/2013
Report Issued: 08/13/2013

Test Performed: CEA/CH test

Result: Normal
Sample Type: DNA - Blood

Registered Name: Lorahdian Campbell Clan

Reg#: AP00377503

Breed: Shetland Sheepdog
Sex: Male
Date of Birth: November 30, 2011

ID#: 985 154 000 377 523

Owner(s):
1001627232 Paterson

OptiGen Authorized Signature

www.optigen.com

est Results . Genotype of your dog is NORMAL/CLEAR.
sk for developing Collie Eye Anomaly/Chorioretinal Hypoplasia (CEA/CH): This dog will never develop CEA/CH
gnificance for breeding: This dog can be bred to any mate and will produce no pups affected with CEA/CH

is interpretation is based on the test result of the DNA test for the specific mutation identified as causing CEA/CH in Shetland Sheepdogs as of the
e of this report.

r further information, please consult the OptiGen website at www.optigen.com. Note: The use of this test is patent protected and licensed to OptiGen. See
p://www.optigen.com/patent.htm for details.

ational DNA Based Genetic Database. To release this result with DFA, make a copy, sign below, mail WHL LIST to DFA, 2907 S. Kellogg Blvd, Cal. ohio, KO
27-3056 or FAX to 573-375-5073, www.ucr.org
ereby certify that the sample submitted was of the animal described on this application. I authorize the DFA to use all information on this test report and permit the results
the genetic community. I hereby release DFA from any and all liability associated with the release of test information.

gnature of owner or authorized representative: _____

Cornell Business & Technology Park — tel: 607.257.0301 — fax: 607.267.6353

707 Warren Road, Suite 200 Ithaca NY 14850 — email: genetics@optigen.com — web: www.optigen.com

Example of a BVA/KC eye scheme certificate

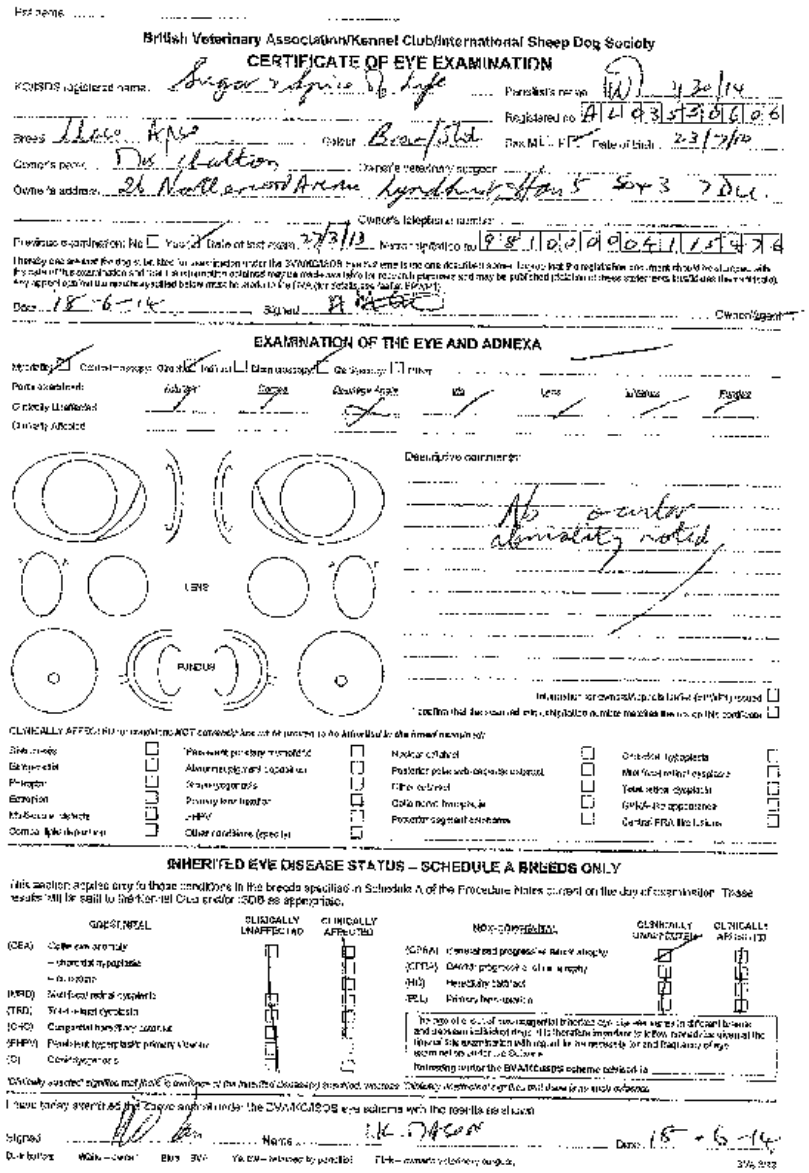
Performed by opthamalgic specialists from the BVA Eye Panel

Informs on breed-specific diseases known to be inherited (affected/unaffected)

Also provides information on any other visual anomalies in the eye – injury, emerging inherited diseases, non-inherited diseases, adnexa

Currently, only known inherited diseases results are recorded and published – this may change to the future

Results are recorded and published by the KC for inherited disease results only



British Veterinary Association/Kennel Club/International Sheep Dog Society

CERTIFICATE OF EYE EXAMINATION

EXAMINATION OF THE EYE AND ADNEXA

INHERITED EYE DISEASE STATUS – SCHEDULE A BREEDS ONLY

Once you know what you should be testing for…

Is it a “simple” gene mutation? i.e. DNA test?

Test result ➡ Health Test Results Finder!

Is it a “complex” condition? i.e. KC/BVA Hip, Elbow scheme?

Scheme result ➡ Health Test Results Finder + EBVs

Informed decisions: Health Schemes and Programs

What is published on Mate Select's Health Test Results Finder

Breed-specific DNA Schemes :

Clear

Carrier

Affected

BVA/KC/ISDS Eye Scheme :

Unaffected

Affected

(cannot identify "carriers")

Other: Complex disease information, ex: BVA/KC Hip, Elbow, CM/SM schemes

The importance of publication

- Results available to dog breeders, owners, and puppy-seekers
- Promotes openness and honesty
- Encourages health testing
- Allows breeders to clearly demonstrate good practices

What isn't yet published…

Some recommended testing not currently recorded:

- Breed Club testing recommendations – breed specific recommendations

Examples: Patella testing, Heart, thyroid, kidney

- Breed Club breeding recommendations

Example: Boxer Breed Clubs recommend " Heart Testing (aortic stenosis)"

Breed-specific breed club recommendations are published, but of course do not have "results"

ex: "bitches under 2 years not to be mated" (many breeds)

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Mate Select Health Test Results Finder

Dog Details

Registered Name or Registration/Studbook Number

Miley Twerk en botton

MATE SELECT

When searching by name you must include the **exact** spelling of the dog's registered name as it appears on the dog's registration certificate and in the BRS.

This tool will allow you to search for any health results for a dog which is registered on the Kennel Club's Breed Register either by its registered name or registration number (or stud book number).

It will display any screening results received and recorded by the Kennel Club from a British Veterinary Association/Kennel Club (BVA/KC) health scheme or an official Kennel Club DNA testing scheme.

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Mate Select Home

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What can I do with the results?

All tests/schemes we can record on the database are included

Click on the **links** for more information on the tests/schemes

Click on the **tabs** for health results for Parents, Siblings, and Progeny (where available)

Download, and print-off for your records or for puppy seekers

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Mate Select Health Test Results Finder

Test Results | Parents | Siblings | Progeny

Miley Twerk en Botton

Retriever (Labrador)

The following test results have been received by the Kennel Club.

Select a scheme name for more information on that scheme and what the result value means.

Test/Scheme	Result	Date	Age
DNA test - prod-PRA	Clear	28/06/2007	1 year, 6 months
DNA test - CNM	Clear	09/07/2008	2 years, 6 months
BVA/KC Elbow Dysplasia Scheme	0	16/02/2007	1 year, 1 month
BVA/KC Hip Dysplasia Scheme	3/3 = 6	16/02/2007	1 year, 1 month
BVA/KC/ISDS Eye Scheme	Unaffected	01/10/2008	2 years, 9 months
BVA/KC/ISDS Eye Scheme	Unaffected	01/10/2009	3 years, 9 months

Need to link to these results?

http://services.thekennelclub.org.uk/6a96281aeb294e4bb59c7b6ec8923116.healthtest

Schemes or advice relevant to this breed

Kennel Club Assured Breeders must use the following screening schemes and/or advice for sires and dams

Scheme/Advice	
BVA/KC Hip Dysplasia Scheme	About this test
BVA/KC/ISDS Eye Scheme	About this test

Kennel Club Assured Breeders are strongly recommended to use the following screening schemes and/or advice for sires and dams

Scheme/Advice	
BVA/KC Elbow Dysplasia Scheme	About this test
DNA test - prod-PRA	About this test

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Reviewing results of Parents, Siblings, and Progeny

Test Results | **Parents** | Siblings | Progeny

Retriever (Labrador)

BVA/KC Elbow Dysplasia Scheme

Tested	Result	Date
This dog	0	16th February 2007
Dam	0	22nd August 2000

BVA/KC Hip Dysplasia Scheme

Tested	Result	Date
This dog	3/3 = 6	16th February 2007
Dam	4/3 = 7	8th August 2000

BVA/KC/ISDS Eye Scheme

Tested	Result	Date
This dog	Unaffected	1st October 2008
This dog	Unaffected	1st October 2009
Dam	Unaffected	27th April 2006

DNA test - CNM

Tested	Result	Date
This dog	Clear	9th July 2008

DNA test - prcd-PRA

Tested	Result	Date
This dog	Clear	28th June 2007

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Test Results | Parents | Siblings | **Progeny**

Retriever (Labrador)

4 puppies from 1 litter have been registered with this bitch as the dam.

BVA/KC Elbow Dysplasia Scheme

Tested	Sex	Result	Date
This dog	Bitch	0	16th February 2007
Progeny 1	Bitch	1	8th December 2011
Progeny 2	Bitch	3	8th December 2011

BVA/KC Hip Dysplasia Scheme

Tested	Sex	Result	Date
This dog	Bitch	3/3 = 6	16th February 2007
Progeny 1	Bitch	4/2 = 6	1st December 2011
Progeny 2	Bitch	5/6 = 11	1st December 2011

BVA/KC/ISDS Eye Scheme

Tested	Sex	Result	Date
This dog	Bitch	Unaffected	1st October 2008
This dog	Bitch	Unaffected	1st October 2009
Progeny 1	Bitch	Unaffected	10th April 2012

DNA test - CNM

Tested	Sex	Result	Date
This dog	Bitch	Clear	9th July 2008

DNA test - prcd-PRA

Tested	Sex	Result	Date
This dog	Bitch	Clear	28th June 2007
Progeny 1	Bitch	Hereditary Clear	24th September 2010

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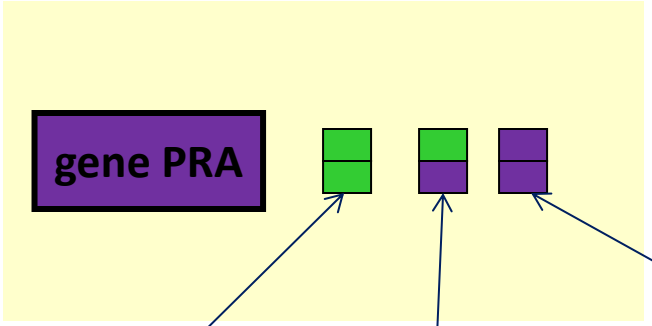
Autosomal recessive conditions (most DNA tests)

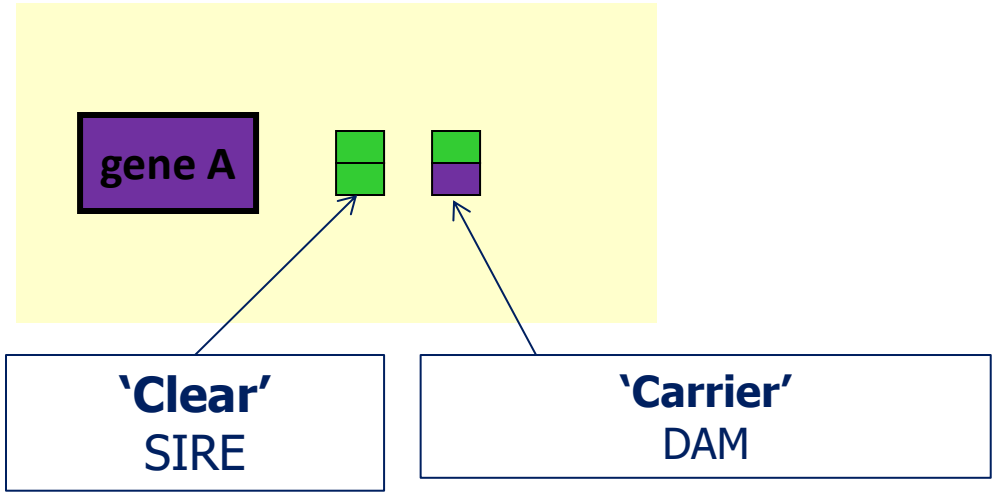


'Clear'
Both copies of the gene are normal variants, and so the protein is produced and functions as it should.

'Affected'
Both copies of the gene are abnormal, and so an incorrect version of the protein is produced (or is not produced at all). The protein therefore either does not function, or does so less well than the normal copy, leading to disease.

'Carrier'
One normal variant and one abnormal variant. Half the protein produced functions normally. This is often enough and so no disease is apparent. However, the abnormal copy may be inherited by offspring.

Autosomal Recessive conditions (most DNA tests)

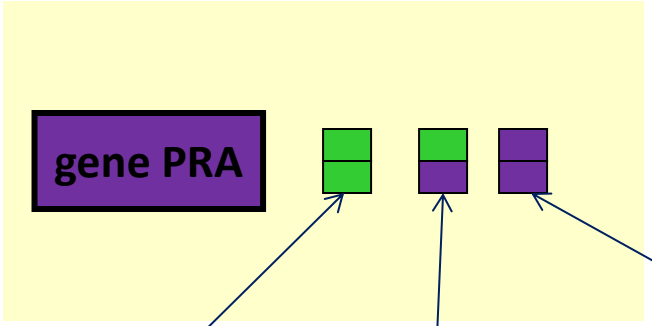


Resulting puppies will average 50% carrier, and 50% clear. None will be affected by the specific disease

Simple Disease Prevention – autosomal recessive

- Clear + Clear = ALL Clear
- Clear + Carrier = Some Clear (1 in 2) and Some Carrier (1 in 2)
- Clear + Affected = ALL Carrier
- ~~Carrier + Carrier = Some Clear (1 in 4), Some Carrier (2 in 4), Some Affected (1 in 4)!~~

Autosomal-dominant conditions (few DNA tests)

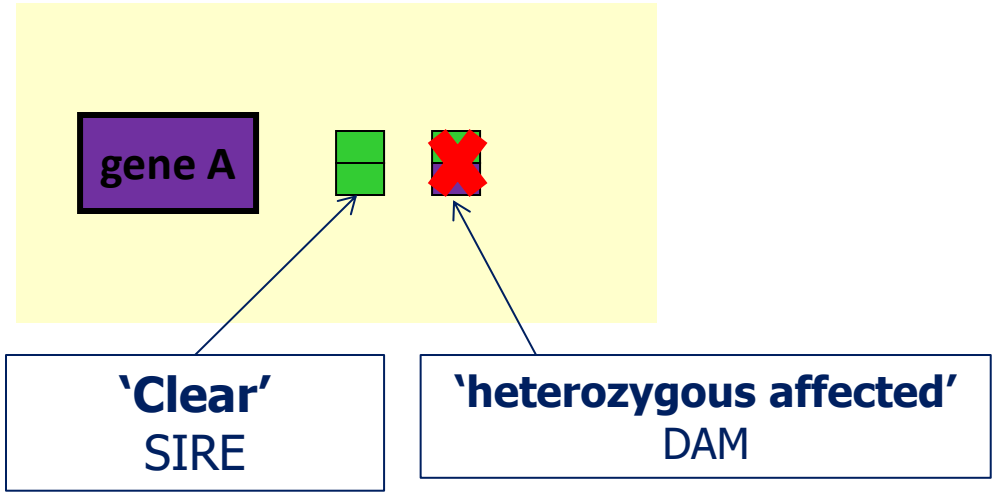


'Clear'
Both copies of the gene are normal variants, and so the protein is produced and functions as it should.

'homozygous affected'
Both copies of the gene are abnormal, and so an incorrect version of the protein is produced (or is not produced at all). The protein therefore either does not function, or does so less well than the normal copy, **leading to disease**.

'heterozygous affected'
One normal variant and one abnormal variant. Half the protein produced **does not function normally**. The dog **will be affected for the disease, and may pass on one abnormal copy** to offspring.

Autosomal Recessive conditions (most DNA tests)



Only two clear tested dogs will produce ONLY disease-free puppies

Simple Disease Prevention – autosomal dominant

- Clear + Clear = ALL Clear
- Clear + ~~Heterozygous affected~~= Some Clear (1 in 2) and ~~Some heterozygous affected~~ (1 in 2)
- Clear + ~~Homozygous affected~~ = ALL ~~heterozygous affected~~

Consider the whole dog!

- There are thousands of genes in a dog – around 600,000 SNPs mapped (SNPs = single nucleotide polymorphisms, where the variations in DNA occur)
- There are fewer than 100 single-gene mutation DNA tests across all breeds
- A tested dog is predictable. No test results? Don’t assume clear. A known carrier can be safely used, and protects genetic diversity

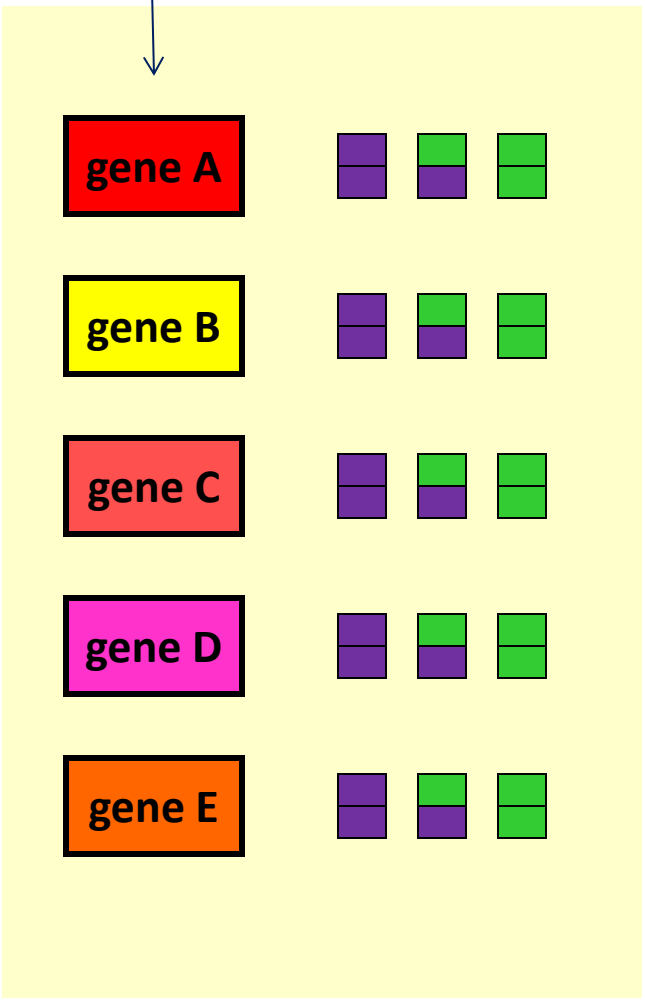
But what about known complex conditions?

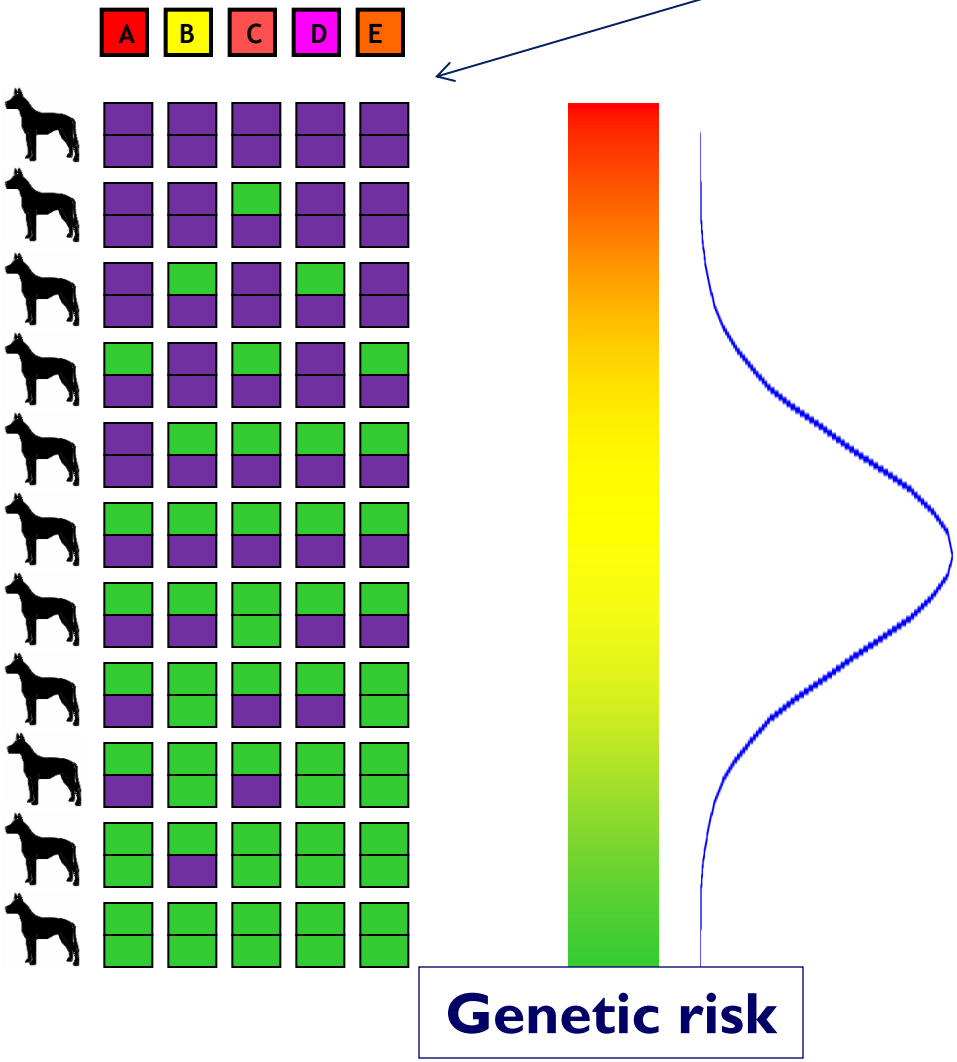
- There could be several/many genes involved (multi-variant)
- There could be “outside” influences (environmental factors)
- Currently only assessed through “Schemes” – using these individual scores was the best option up until now, but harder to predict risk

Genetic variation

Most traits (and diseases) are affected by multiple genes (often hundreds), each gene adding a small amount of increased or decreased risk. Each gene can have the 3 combinations of normal and abnormal copies as before

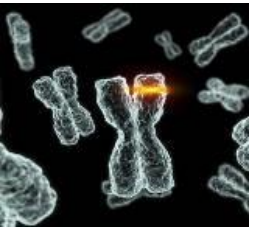
So if we look at a sample of dogs we can see the number of different combinations. This produces genetic variation in the risk of disease. Thus we get a continuous spectrum of genetic risk, which is normally distributed (Bell curve – few at either end, more in the middle)

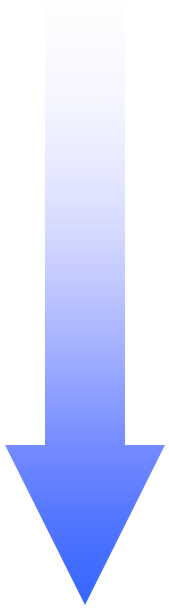


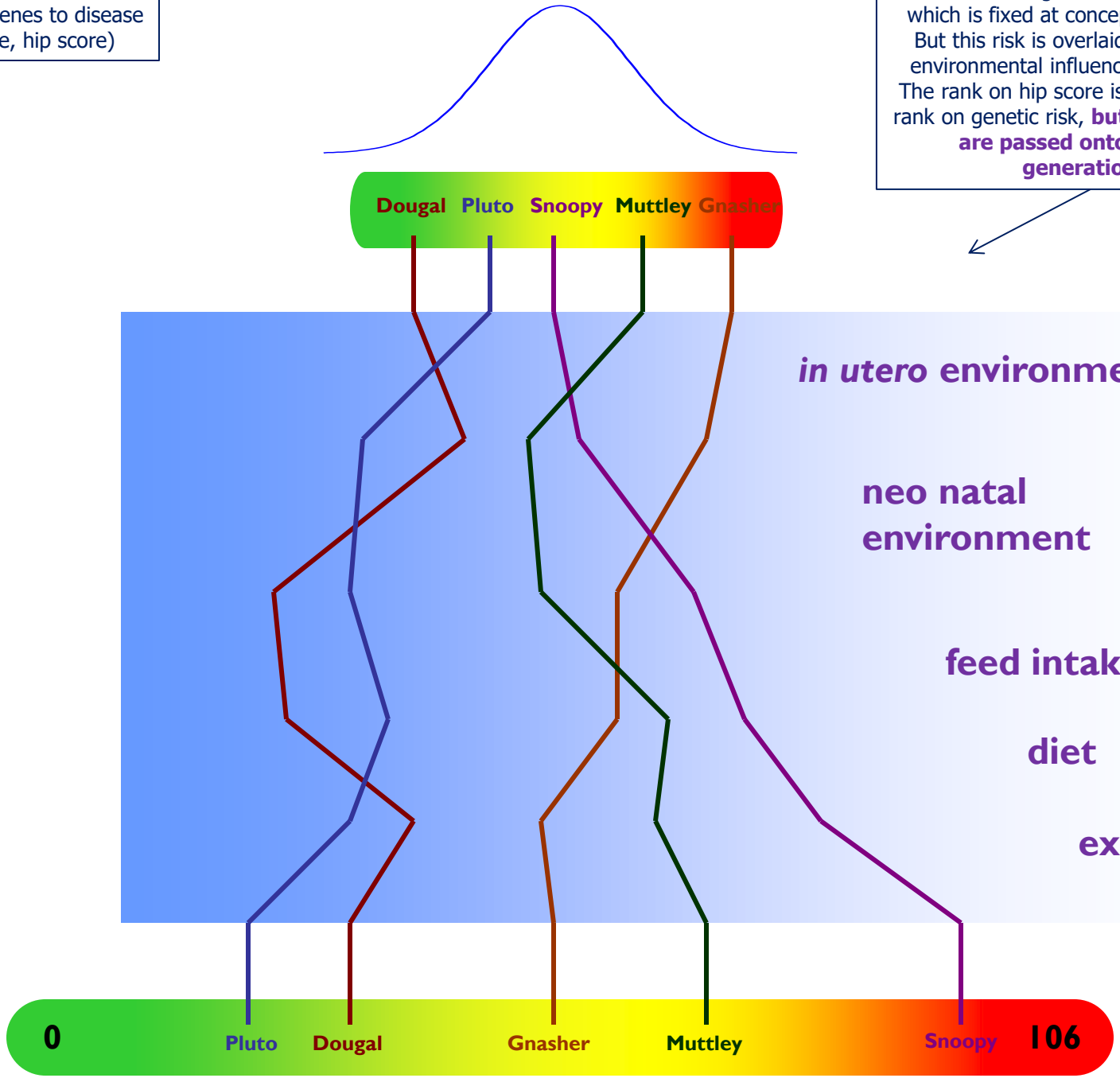


So, going from genes to disease (or in this case, hip score)

We have the genetic variation in risk, which is fixed at conception for 5 dogs. But this risk is overlaid or modified by environmental influences on hip score. The rank on hip score is not the same as rank on genetic risk, **but only the genes are passed onto the next generation…**







The Tool: Estimated Breeding Values (EBVs)

- EBVs have been used for many years in other species, and are “tried and tested”
- In principle, you can make an EBV for anything that is measurable: complex conditions, size/shape, yields (i.e. milk in cows), etc.
- 15 breeds with hip or hip + elbow: Akita, BMD, Bearded Collie, Border Collie, Eng. Setter, Flat Coated Retriever, Gordon Setter, GSD, Golden Retriever, Labrador, Newfoundland, Siberian Husky, Rottweiler, Rhodesian Ridgeback, Tibetan Terrier

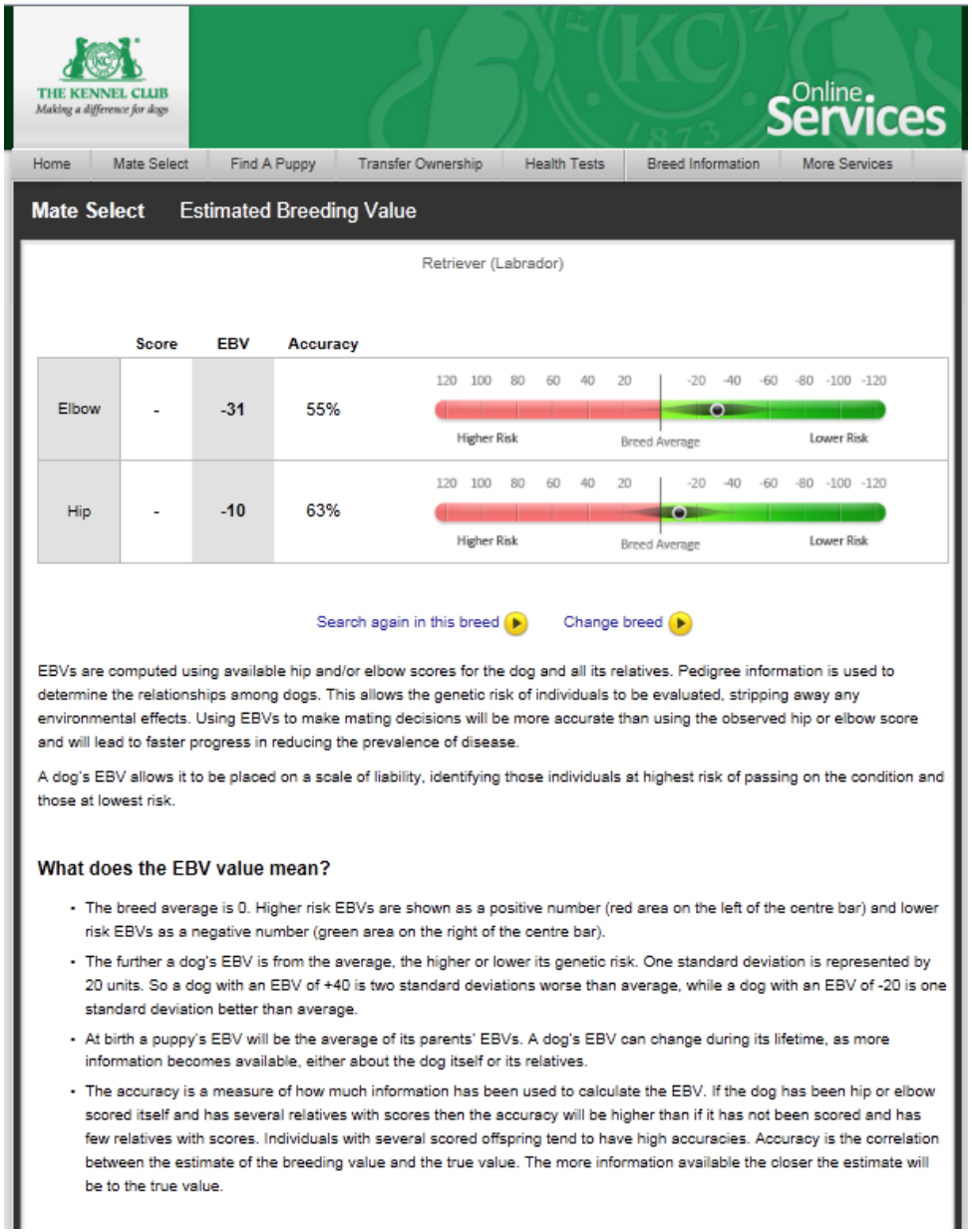
EBVs

EBV stands for: Estimated Breeding Values

They estimate the ***genetic*** risk of complex diseases

EBVs are a more efficient way to estimate risk, and breed away from undesirable traits more quickly than by individual dog results (phenotypic) alone

EBVs use Health Scheme data for calculation



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Mate Select Estimated Breeding Value

Retriever (Labrador)

	Score	EBV	Accuracy
Elbow	-	-31	55%
Hip	-	-10	63%

Search again in this breed Change breed

EBVs are computed using available hip and/or elbow scores for the dog and all its relatives. Pedigree information is used to determine the relationships among dogs. This allows the genetic risk of individuals to be evaluated, stripping away any environmental effects. Using EBVs to make mating decisions will be more accurate than using the observed hip or elbow score and will lead to faster progress in reducing the prevalence of disease.

A dog's EBV allows it to be placed on a scale of liability, identifying those individuals at highest risk of passing on the condition and those at lowest risk.

What does the EBV value mean?

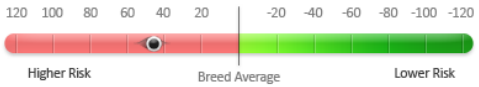
- The breed average is 0. Higher risk EBVs are shown as a positive number (red area on the left of the centre bar) and lower risk EBVs as a negative number (green area on the right of the centre bar).
- The further a dog's EBV is from the average, the higher or lower its genetic risk. One standard deviation is represented by 20 units. So a dog with an EBV of +40 is two standard deviations worse than average, while a dog with an EBV of -20 is one standard deviation better than average.
- At birth a puppy's EBV will be the average of its parents' EBVs. A dog's EBV can change during its lifetime, as more information becomes available, either about the dog itself or its relatives.
- The accuracy is a measure of how much information has been used to calculate the EBV. If the dog has been hip or elbow scored itself and has several relatives with scores then the accuracy will be higher than if it has not been scored and has few relatives with scores. Individuals with several scored offspring tend to have high accuracies. Accuracy is the correlation between the estimate of the breeding value and the true value. The more information available the closer the estimate will be to the true value.

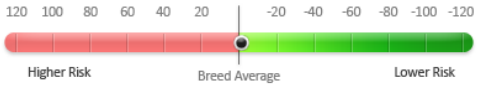
Mate Select Estimated Breeding Value

Retriever (Labrador)

Harry Styles von Floppy Hair

	Score	EBV	Accuracy
Elbow	0	**45**	89%
Hip	4/3 = 7	**0**	98%





Search again in this breed Change breed

EBVs are computed using available hip and/or elbow scores for the dog and all its relatives. Pedigree information is used to determine the relationships among dogs. This allows the genetic risk of individuals to be evaluated, stripping away any environmental effects. Using EBVs to make mating decisions will be more accurate than using the observed hip or elbow score and will lead to faster progress in reducing the prevalence of disease.

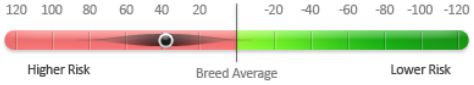
A dog's EBV allows it to be placed on a scale of liability, identifying those individuals at highest risk of passing on the condition and those at lowest risk.

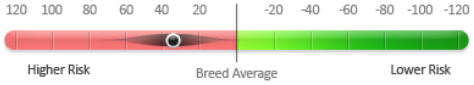
Mate Select Estimated Breeding Value

Retriever (Labrador)

Miley Twerk de Botton

	Score	EBV	Accuracy
Elbow	-	**38**	52%
Hip	-	**34**	62%





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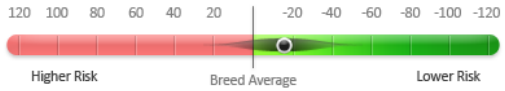
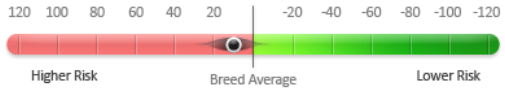
Mate Select Estimated Breeding Value

Retriever (Labrador)

Lyndsay Lowhaan

	Score	EBV	Accuracy
Elbow	0	**-15**	59%
Hip	12/5 = 17	**9**	81%





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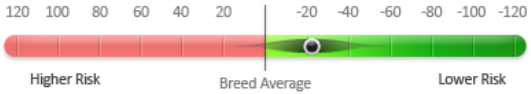
A dog's EBV allows it to be placed on a scale of liability, identifying those individuals at highest risk of passing on the condition and those at lowest risk.

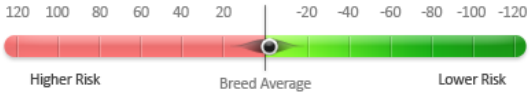
Mate Select Estimated Breeding Value

Retriever (Labrador)

Taylor Swifty

	Score	EBV	Accuracy
Elbow	0	**-22**	63%
Hip	8/6 = 14	**-1**	82%





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A dog's EBV allows it to be placed on a scale of liability, identifying those individuals at highest risk of passing on the condition and those at lowest risk.

Benefits of EBVs to Dog Health and Breeders

- More accurate assessment of a dog's *genetic* risk
- The lower the EBV, the better but there isn't a need to seek out the very lowest EBV – selecting any animal with a lower risk EBV than average will apply selective pressure to improve hip scores faster than an individual hip score alone
- More flexibility in choosing mates as the EBV measures genetic (heritable) risk, as opposed to the individual score, which measures the risk for that dog
- More flexibility to balance and prioritise health considerations – temperament, DNA test results, health screening results, genetic diversity, conformation, etc…

There isn’t a test…

- Get a full diagnosis
- Is the disease actually inherited?
  - Google, PubMed, CGE, PlosOne, Vet Record, In Practice…
  - *Peer-reviewed and lots of dogs*
- If not inherited…
  - Treat/manage/cure
  - Breeding?

Honesty

- Should these genes continue, to improve the breed?
- How much risk?
- Can I reduce the risk?
  - Family history?
  - Risk-free or low-risk lines?
- Tell the new owners.

Support – You are not alone

- New Inherited disease tests (all breeds) - £250,000 (AHT)
- Syringomyelia - £2,670 (Bristol)
- Gait studies – £13,325 (Bristol)
- Brachycephalic conditions – £19,145 (Cambridge)
- Soft-tissue sarcomas – £2639 (Glasgow)
- Osteosarcoma (Rotties) - £700 (Notts)
- MANY breed clubs
- Karlton Index
- Guide Dogs, Hearing Dogs, BSAVA, BVA
- Kennel Club health section: mateselect@thekennelclub.org.uk OR hbs@thekennelclub.org.uk

BRACE YOURSELF! Here comes population genetics…

I promise it will be okay.

Breed Conservation – genetic diversity

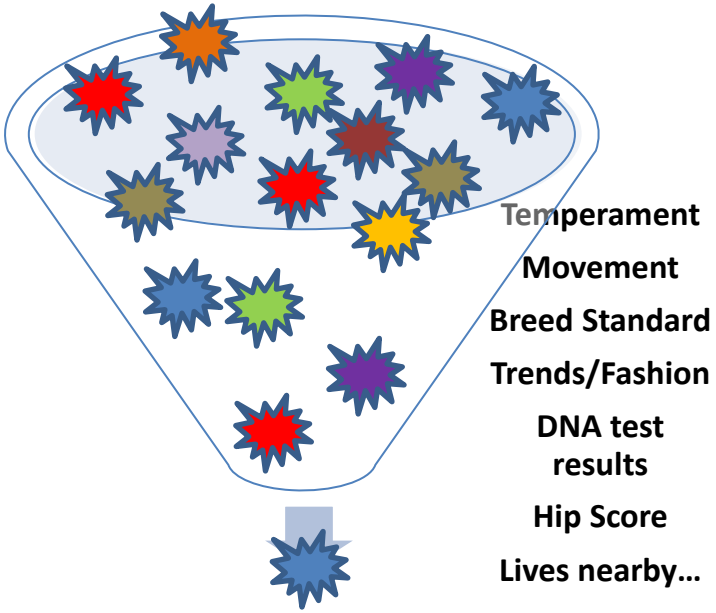
- To create a breed, there is a level of inbreeding
- The more in-bred the more shared genes – the good and the bad
- Reducing, or slowing the rate of inbreeding, and increasing diversity where possible will give breeders more options and reduce risk across the breed
- Mate Select has an inbreeding calculator for breeds, individual dogs, and matings
- Helps to breed for traits, not relatedness

Selection Pressure

- Every breeder (of any species) has criteria for selection
- For dog, there is known and unknown – i.e. assessments available, by observation only, random mutation, false selection (non-inherited)
- Every selection pressure alters the available genetic material – not always bad, but must be in balance and done with care!

Selection Pressure – genetic bottlenecks

- The Good:
  - Elimination of known inherited disease
  - Reduced disease risk for ***specific*** inherited conditions
  - Promotion / “fixing” of desirable traits
- The Bad:
  - Reduced options for ***unknown*** inherited disease (genetic diversity)
  - Inbreeding Coefficients rise
  - Effective population size diminished
- The Ugly:
  - Unintended Consequences: Rapist Chickens



Solutions?

- Reduce relatedness of sire to dam – TOOL: Coefficient of Inbreeding
- Limit numbers of offspring by individual dogs (popular sire)
- Use all available healthy stock (randomise)
- Inner-breed “crossing” (working vs. showing)
- Make use of overseas bloodlines
- Outcross – smart ones

Selection Pressure – Every sperm is precious

- Example: Otterhound
- Health (perceived): epilepsy, hips…were they too strict? (1st degree relatives with epy banned, hips suffered)
- Health (actual): NEED MORE DOGS and GENES
  - Low EEPS (28.5 in 2012)
  - Low reg. numbers (42 dogs in 2013)
  - No room to manoeuvre for known inherited diseases
  - Will become extinct NOW
- Outcross?

What is an Inbreeding Coefficient?

- The inbreeding coefficient of an individual is the probability that two copies of the same gene have been inherited from a common founder – that is, an ancestor shared by both parents
- The lower the inbreeding coefficient, the lower the probability (risk) this will happen

Individual Inbreeding Coefficient

Search for an individual KC registered dog using name or registration number

Results compare the dog to the breed average

Mate Select Individual Inbreeding Coefficient

Result

Inbreeding Coefficient

Retriever (Labrador)

Lady Lass

3%

Breed Average

6%

More information

Health Tests for this dog

What does this value mean?

- Inbreeding is defined as the mating of related individuals, whether they are closely related or more distantly related. The inbreeding coefficient of an individual is the probability that two copies of the same gene have been inherited from a common founder, that is an ancestor shared by both parents. The lower the inbreeding coefficient, the lower the probability (risk) that this will happen.

An inbreeding coefficient of 12.5% means that there is a 1 in 8 chance that a dog will inherit the same version of gene from the same dog that appears in both the sire's and dam's pedigree. The puppies born to a mother/son, father/daughter or brother/sister mating (which the Kennel Club will no longer accept for registration), would be at least 25%. The inbreeding coefficient of puppies born from a grandfather/granddaughter mating would be at least 12.5%.

Find out more about inbreeding...

Go

Mate Select Home

New Calculation

Change Breed

Other services

Breed Information Centre

Health Test Results Finder

Predict COI of a mating with this dog as the dam

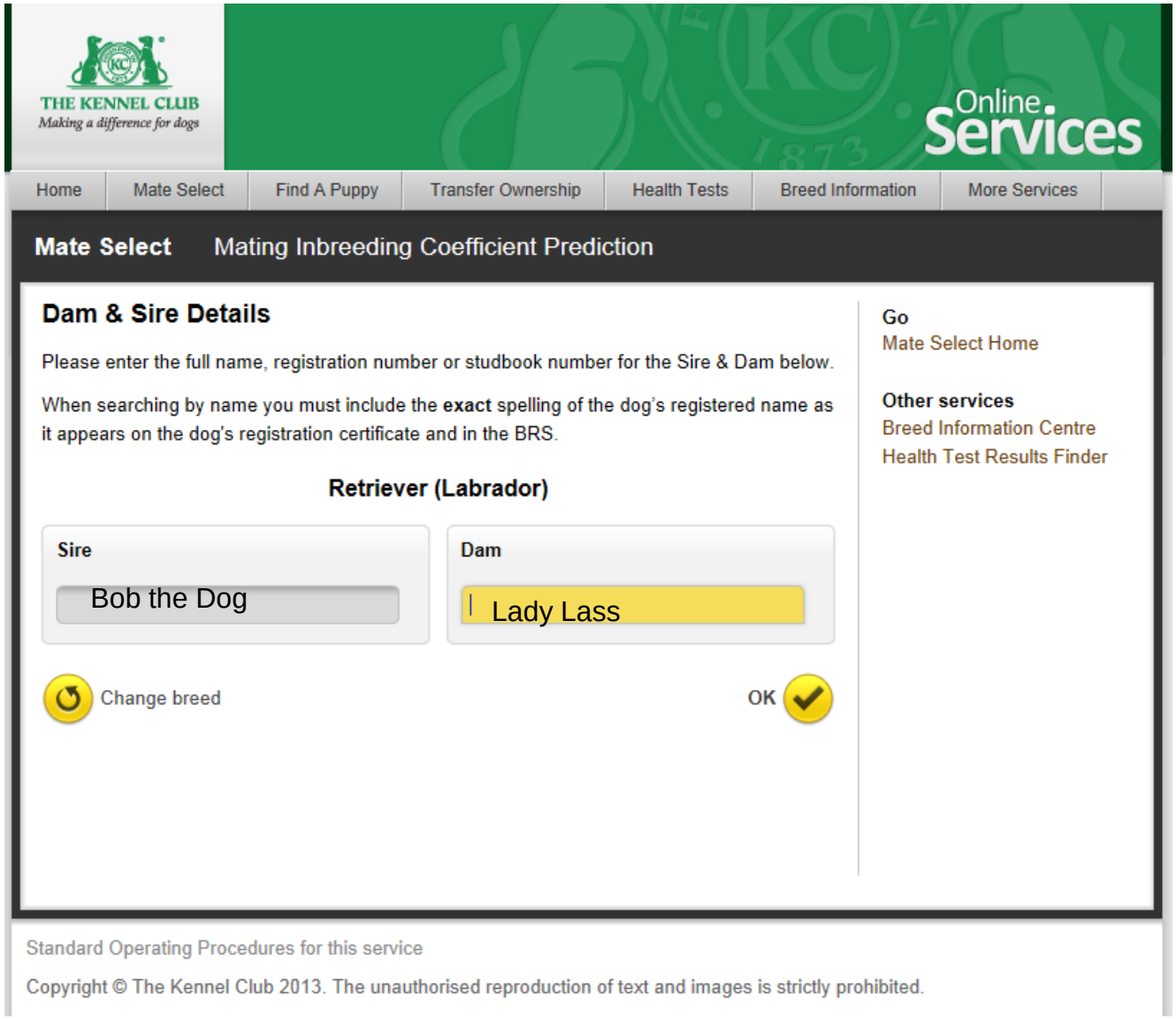
About this calculation

The pedigree data used to calculate this result extended back as far as 19 generations with the first 4 generations being fully complete.

The Mate Select computations are based upon data compiled from pedigree records and data submitted from breeders. As such all information and/or data on the site is provided on an 'as is' basis. Every effort has been made to report information accurately, but the Kennel Club assumes no responsibility for the content or the use or interpretation of the information published.

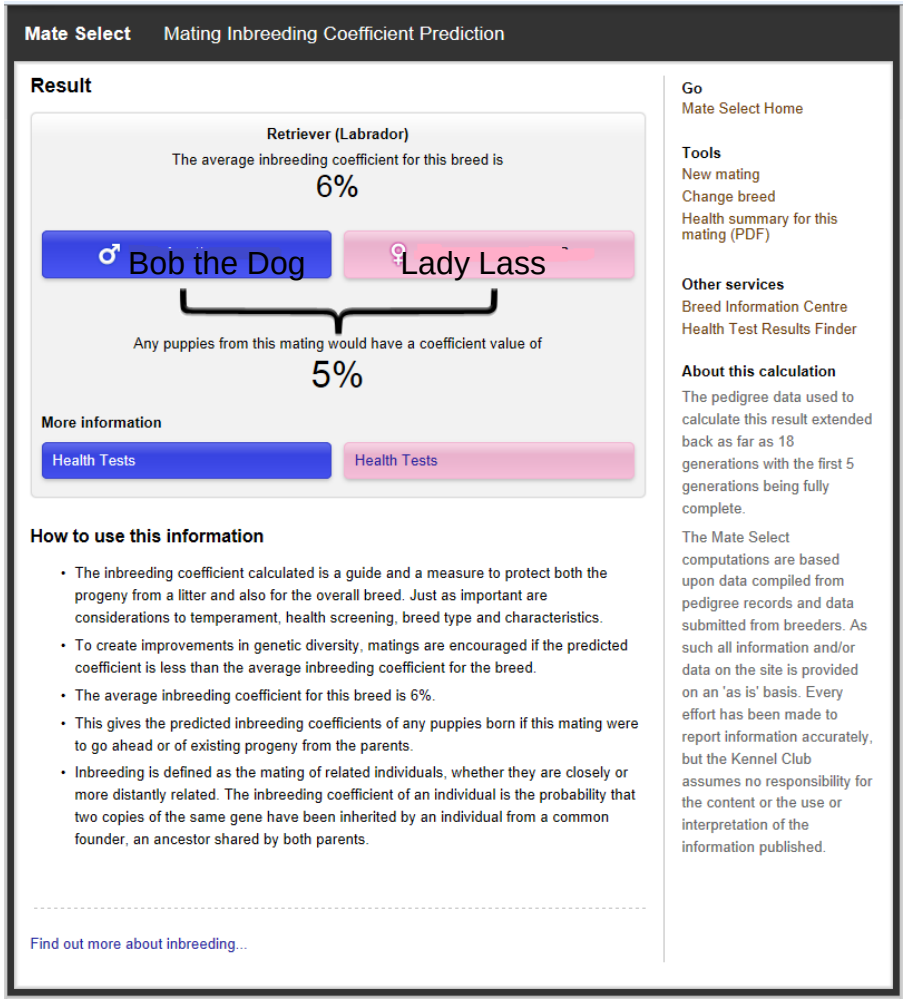
Standard Operating Procedures for this service

Mating Inbreeding Coefficient



Mating Inbreeding Coefficient

- Uses names of dam and sire
- Predicts inbreeding coefficient for resulting puppies
- Breeding for genetic diversity reduces the risk of inherited conditions, and benefits the breed as a whole
- Links to Health Test Results for dam/sire



Individual Inbreeding Coefficient – what would you do?

Mate Select Individual Inbreeding Coefficient

Result

Inbreeding Coefficient

Retriever (Labrador)

Betty

	Breed Average
7.2%	6.4%

More information

Health Tests for this dog

What does this value mean?

- Inbreeding is defined as the mating of related individuals, whether they are closely related or more distantly related. The inbreeding coefficient of an individual is the probability that two copies of the same gene have been inherited from a common founder, that is an ancestor shared by both parents. The lower the inbreeding coefficient, the lower the probability (risk) that this will happen.

An inbreeding coefficient of 12.5% means that there is a 1 in 8 chance that a dog will inherit the same version of gene from the same dog that appears in both the sire's and dam's pedigree. The puppies born to a mother/son, father/daughter or brother/sister mating (which the Kennel Club will no longer accept for registration), would be at least 25%. The inbreeding coefficient of puppies born from a grandfather/granddaughter mating would be at least 12.5%.

Find out more about inbreeding...

Go

Mate Select Home

All results for this session

New Calculation

Change Breed

Other services

Breed Information Centre

Health Test Results Finder

Predict COI of a mating with this dog as the dam

About this calculation

The pedigree data used to calculate this result extended back as far as 18 generations with the first 6 generations being fully complete.

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Choose the right paring!

Home | Mate Select | Find A Puppy | Transfer Ownership | Health Tests | Breed Information | More Services

Mate Select Mating Inbreeding Coefficient Prediction

Result

Retriever (Labrador)

The average inbreeding coefficient for this breed is

6.4%

♂ Bob

Betty

Any puppies from this mating would have a coefficient value of

4.6%

More information

Health Tests

Health Tests

How to use this information

- The inbreeding coefficient calculated is a guide and a measure to protect both the progeny from a litter and also for the overall breed. Just as important are considerations to temperament, health screening, breed type and characteristics.
- To create improvements in genetic diversity, matings are encouraged if the predicted coefficient is less than the average inbreeding coefficient for the breed.
- The average inbreeding coefficient for this breed is 6.4%.
- This gives the predicted inbreeding coefficients of any puppies born if this mating were to go ahead or of existing progeny from the parents.
- Inbreeding is defined as the mating of related individuals, whether they are closely or more distantly related. The inbreeding coefficient of an individual is the probability that two copies of the same gene have been inherited by an individual from a common founder, an ancestor shared by both parents.

Go

Mate Select Home

Tools

All results for this session

New mating

Change breed

Health summary for this mating (PDF)

Other services

Breed Information Centre

Health Test Results Finder

About this calculation

The pedigree data used to calculate this result extended back as far as 18 generations with the first 6 generations being fully complete.

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Get Involved?

Kennel Club support and funding

The collection of scientific data is of the highest importance, helping to:

- Identify the prevalence of canine and breed specific health conditions
- Understand the heritability of specific disorders
- Classify the genetic status of dogs for known conditions
- Provide evidence based advice on how to breed away from particular disorders
- Develop new or more effective treatments for health conditions

To help achieve this, the Kennel Club regularly assists and collaborates with research facilities, Universities, veterinary organisations and charities to further our knowledge of canine health and welfare.

How the Kennel Club helps with your research

The Kennel Club can help researchers in a number of different ways, which can include providing contributions towards funding, assisting with the recruitment of dogs and owners for your study and providing you with data from the Kennel Club database.

International Canine Health Awards

The Kennel Club Charitable Trust International Canine Health Awards, which are the largest veterinary awards in Europe, have been created to recognise innovative researchers, veterinary scientists and students from around the world, who have carried out research that has helped to improve the health and wellbeing of dogs.

The Awards, which are underwritten by a major gift from the Vernon and Shirley Hill Family Foundation, will identify and encourage visionary thinking, ambition and life-changing accomplishments. Those who receive the awards will be passionate about making a difference for dogs. Each award provides a large funding programme to the recipient, which rewards them for their dedication and innovation in the field of canine health and welfare and invests in helping them to continue making a difference for dogs.

The Kennel Club Charitable Trust

This dog charity helps to look after the health and welfare of all dogs and makes a difference by funding a wide variety of work, ranging from supporting research into canine diseases, dog welfare organisations and the promotion of support dogs, all of which give dogs a healthier, happier life.

Founded in 1987, it has donated almost £6 million to support these initiatives through various dog charity grants, and is able to provide its support through the generosity of our donors.

Recruitment and publicising

On your behalf the Kennel Club may be able to promote your study or encourage people to participate in your study via:

- An e-mail sent to all registered owners of a particular breed
- Social media (Facebook and Twitter)
- The "Events, seminars and surveys" section on the Kennel Club website
- The Kennel Scope (a newsletter for veterinary practices)
- A press release
- An e-mail sent to all, or selected Breed Health Co-ordinators, who may in turn be able to publicise your study

Bio-Acquisition Research Collaboration

The Kennel Club has created this facility to help bring researchers and clinicians together with regards to research projects, making it easier to form a collaboration of different ideas and information. It will also act as a central platform for researchers to request samples they need to undertake their current research. If you wish to submit any information regarding sample requirements for a research project, please fill in this form and email it to Bonnie Abhayaratne.

Sample information required:

- What the samples are intended for/what is being investigated
- Breed(s) that you would like samples from
- Health status (for example, samples from healthy dogs and/or samples from dogs with a diagnosed condition)
- Type of sample (for example, blood, cheek swab, tissue)
- Sample preservation method
- Where to send samples and contact information
- Other specific requirements (for example, age/sex, additional clinical information)

Please contact us when you no longer require samples.

Current exchange requests

If you are able to help by contributing samples, or have any queries about the research being undertaken, or would like more information, please contact the researchers directly.

Date Added	Breed/Type	Research	Sample Information	Contact
8th April	Pugs French Bulldogs Bulldogs	**Non-invasive respiratory function assessment in brachycephalic dogs** Aims to characterize respiratory function in brachycephalic dogs and to investigate the genetic and anatomical markers that are related to brachycephalic obstructive airway syndrome. Apart from baseline measurement of each included breeds, we are also studying the respiratory function before and after upper airway corrective surgery	Measurements taken from healthy and diagnosed dogs with brachycephalic obstructive airway syndrome (BOAS) as well as dogs whose BOAS status is currently uncertain (>2 years of age and hasn't undergone any upper airway surgery). Following measurements are taken by the study investigator (appointment required): (1) Respiratory flow trace measurement; (2) DNA sample collections from cheek swabs: (3) head/body dimension measurement	Miss Nai-Chieh Liu Tel: 01223 337621 Queen's Veterinary School Hospital, University of Cambridge (measurements taken at this venue, but investigators can come to you where there is the opportunity to take measurements from many dogs at once) Click here for more information

Meet the Health Team

- Aimée Llewellyn –Manager, genetics
- Dr Tom Lewis – Quantitative Genetics, Mate Select development
- Nick Sutton – Vet communication, health communication, toxicology/poisons, Mate Select, health queries
- Bonnie-Marie Abhayaratne – Breed Health Coordinators, web, Mate Select, health queries
- Bonnie Wiles – Surveys, data, health queries
- Charlotte McNamara – High Profile breeds, Breed Watch

From L-R: Aimee, Nick, Charlotte, Tom, Bonnie-Marie, Bonnie

Partners and Thank-yous

- Dr Cathryn Mellersh and the KCGC at the AHT team, Dr Tom Lewis, Dr Sarah Blott
- Health Team mateselect@thekennelclub.org.uk

THE KENNEL CLUB CANCER CENTRE AT THE ANIMAL HEALTH TRUST

THE KENNEL CLUB GENETICS CENTRE AT THE ANIMAL HEALTH TRUST

MATE SELECT

THE KENNEL CLUB DOG HEALTH

The University of Nottingham UNITED KINGDOM · CHINA · MALAYSIA

THE UNIVERSITY OF EDINBURGH

ROSLIN

canine health schemes