DNA Testing in ISDS Border Collies

Results and statistics (Update 2023)

Abstract

This compilation is an update on the current status of genetic testing in ISDS Border Collies. It includes all test results that had been published on the internet, or been shared with the ABCD studbook committee at the time of October, 2023. [1]

The numbers are solely those of ISDS dogs. It is a sample, albeit a large one.

Publishing of genetic test results is not mandatory in the ISDS, and thus the results might be too positive. Breeders and stud dog owners still tend to be reluctant about publishing perceived detrimental information, and often keep it to themselves.

The good news is, that carrier percentages mostly went down in the last 5 years, which shows the efficacy of voluntary testing. Informed breeders tend to avoid matings that might produce affected. Also, broader testing corrects initial bias and gives more correct results.

[1] The ABCD is the German sheepdog society, it was founded in 1990. Since 2006, the ABCD is associated to the ISDS. I was president at the time and led the negotiations with the ISDS, represented back then by Norman Lorton (CEO) and Jim Easton (Chairman). With the association we brought in 500 new members. Most German breeders of working Border Collies had previously bred in the FCI / German KC. To get these on board, we were and are allowed to have stricter health rules than the ISDS, but obviously must never undercut the ISDS health rules. Same goes for an online resource (database) about working merits and health results, which is commonly called the ABCD online studbook. It is not publicly available but only in the part of the website, reserved for ABCD members. It is an invaluable resource for health records about ISDS dogs. All other databases make no difference between ISDS, FCI unregistered BC or even mongrels that are identified by their owners as BC. Also, they mostly not searchable for a dozen different criteria.

The knowledge that recessive carriers can safely be used, is broadly distributed by now, and the general attitude has changed.

Unfortunately, quite a number of negative results (affected or carrier) are not published, which can leave breeders with affected or carrier offspring. Some carriers are proven by offspring. That means, an untested bitch or sire that had carrier offspring with a clear partner, or one that bred affected offspring, will most likely be a carrier itself.

As long as the tests of parent and offspring are done by an accredited laboratory, and the swabs taken according to the ISDS CEA forms, the results are credible. The only fault might be due to dual mating and thus a different father.

The exceptions of the positive downward trend are the results für Early Onset Adult Deafness (EAOD or EOD), and to a lesser degree Multi Drug Resistance (MDR-1), which was formerly also called Ivermectin sensitivity. The EOD numbers are disquietingly high, and in ISDS registered dogs even unproportionally higher than in the whole breed (all registrations and unregistered BC) tested by MyDogDNA.

More information about the diseases and tests can be found under EOD and MDR-1.

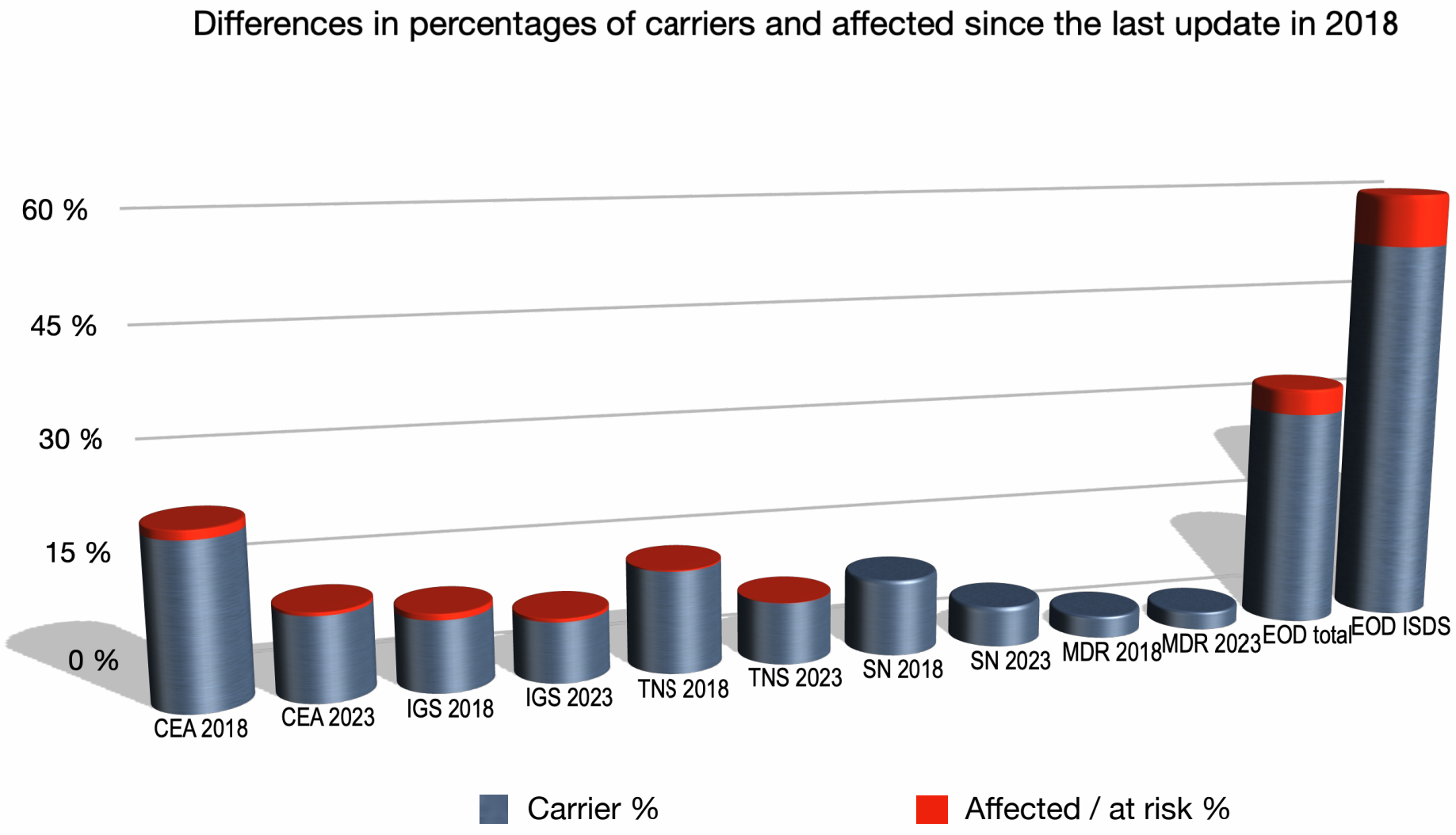
Known test results of ISDS registered dogs in 2023

(last update from 2018 in brackets):

CEA	2,854	(791)	SN	1,432	(281)
IGS	1,836	(697)	MDR	739	
TNS	1776	(530)	EOD	978	

While many ISDS members test their dogs and freely share the information, in comparison to the number of registered dogs, health testing is still the exception, and not the rule.

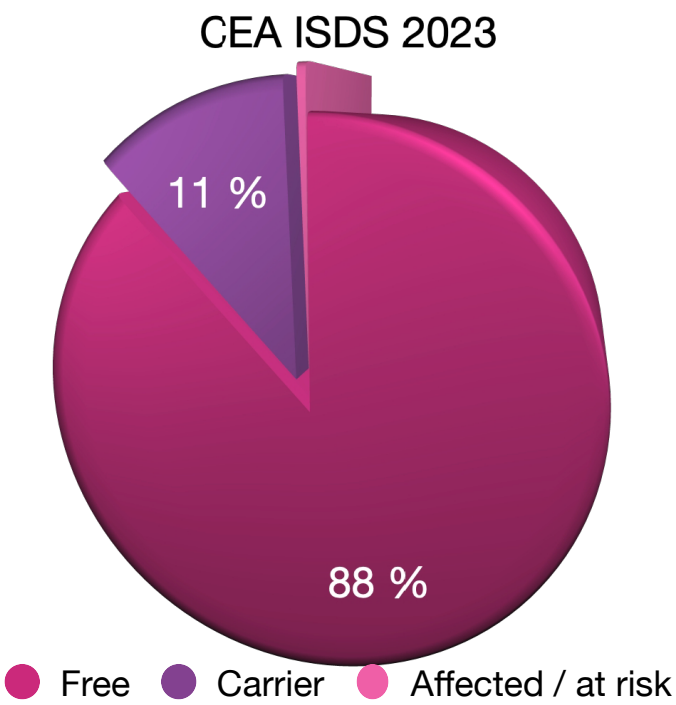
This graph gives a first overview over ISDS dogs' results of the relevant testable diseases. There are more tests f.i. for Ceroid Lipofuscinosis, Goniodysgenesis and Glaucoma or Dental Hypomineralization, but fortunately the known results in ISDS Border Collies have all come back as clear of these diseases.

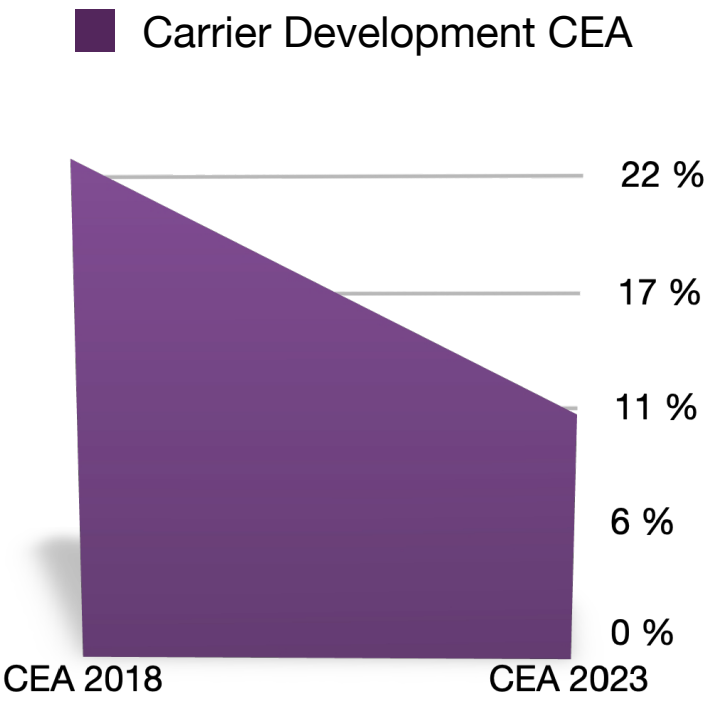

Differences in percentages of carriers and affected since the last update in 2018
60 %
45 %
30 %
15 %
0 %
CEA 2018
CEA 2023
IGS 2018
IGS 2023
TNS 2018
TNS 2023
SN 2018
SN 2023
MDR 2018
MDR 2023
EOD total
EOD ISDS
Carrier %
Affected / at risk %

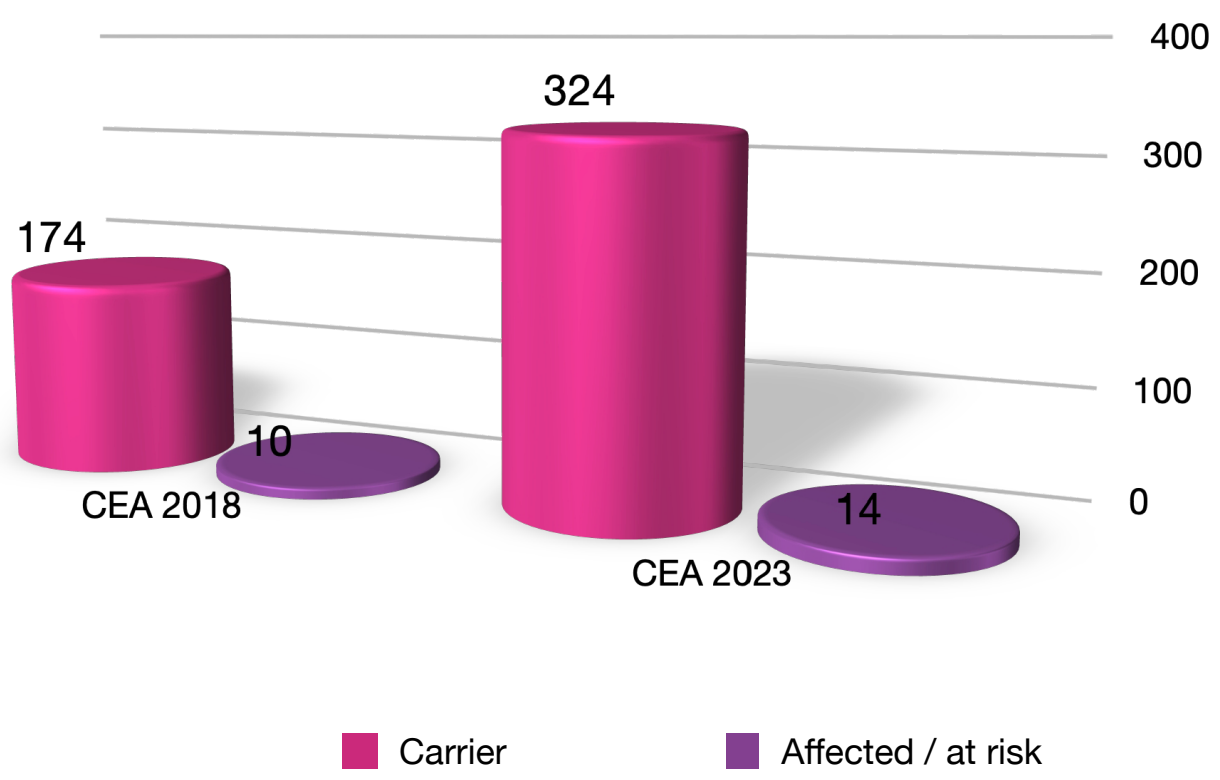
CEA

Collie Eye Anomaly is well known and the society has a successful record of fighting the spread. Even though the known carrier number rose, the number of affected stayed low. The genetic eye scheme is capable of avoiding to breed affected dogs. Still, not all genetically affected dogs are clinically affected.

One of the ISDS accepted gene tests is a marker test.





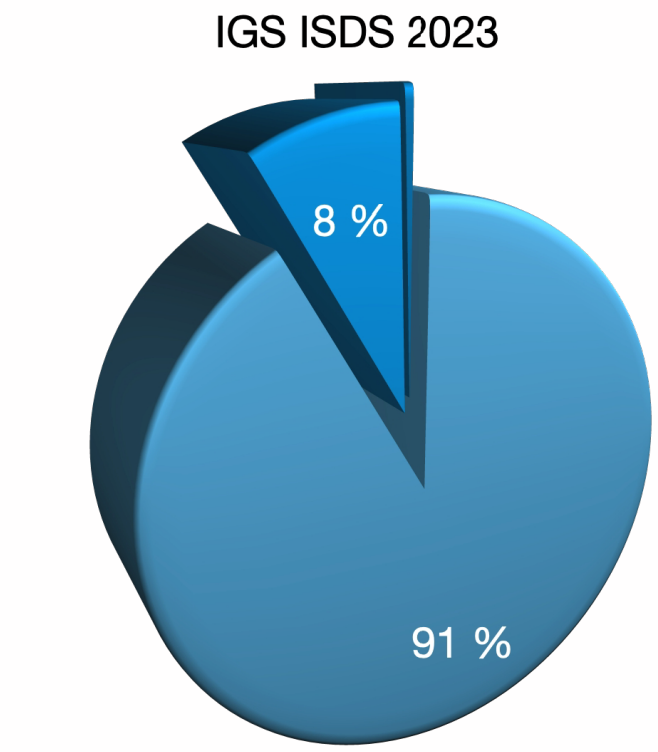


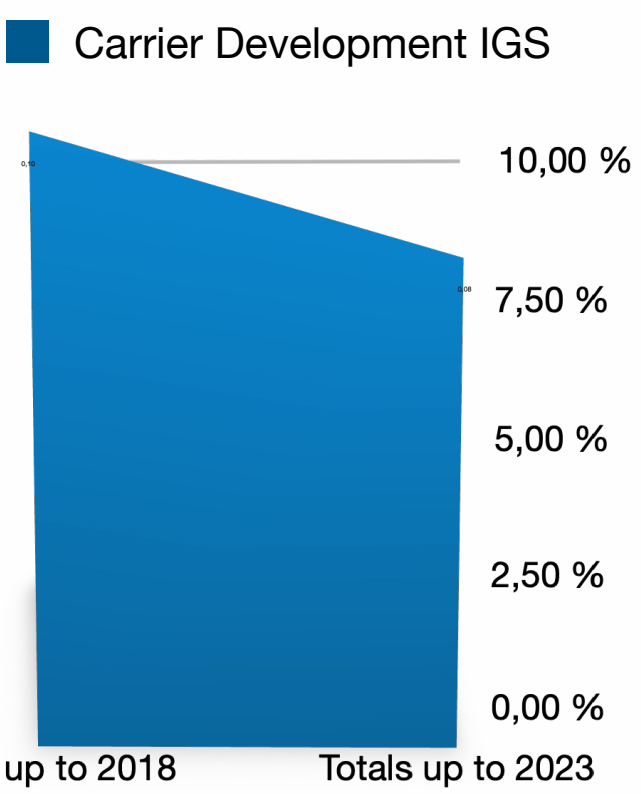
IGS

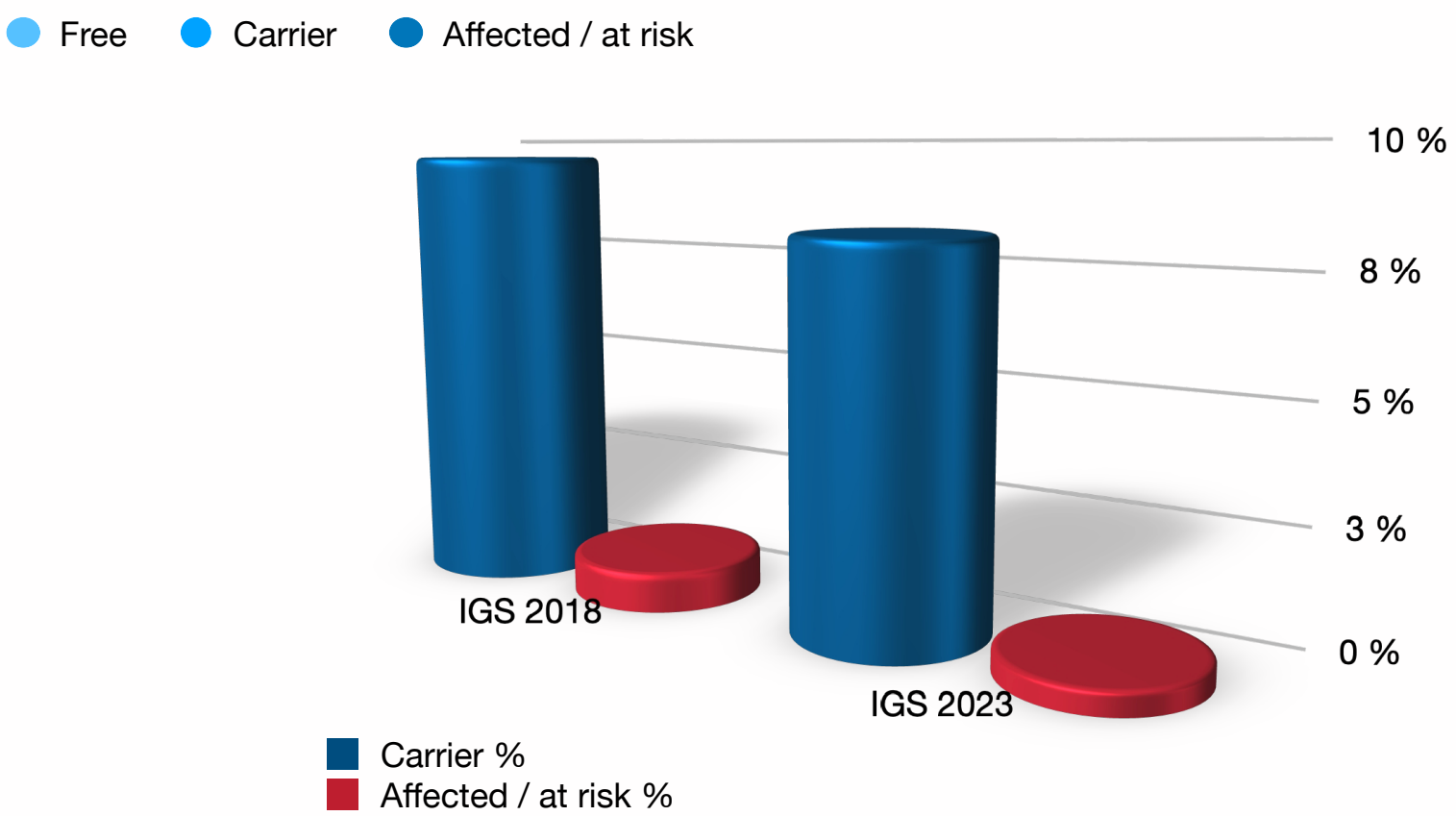
Imerslund-Grasbäck Syndrome (IGS) describes an inability to ingest Vitamin B12 from food. Vit B12 is a large molecule, so the body needs special transport proteins to pump it from the intestine into the blood stream. In dogs with IGS, a single gene mutation has destroyed the blueprint, and consecutively the encoded transport protein is defective.

Symptoms are explained by the lack of Vit B12. Dogs stop to thrive around 6-12 months, they are thin, bad eaters, and can show chronic diarrhea, anemia, and progressive brain damage. Therapy consists of regular injections with Vit B12. It is a cheap and easy therapy, that will roll back all symptoms if started early enough.

1,836 ISDS dogs were tested. The results for 2018 and 2023 are the total results up to these dates.



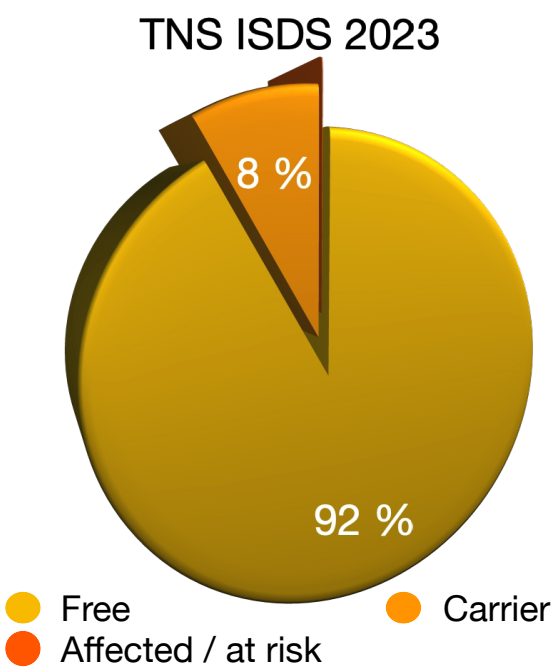


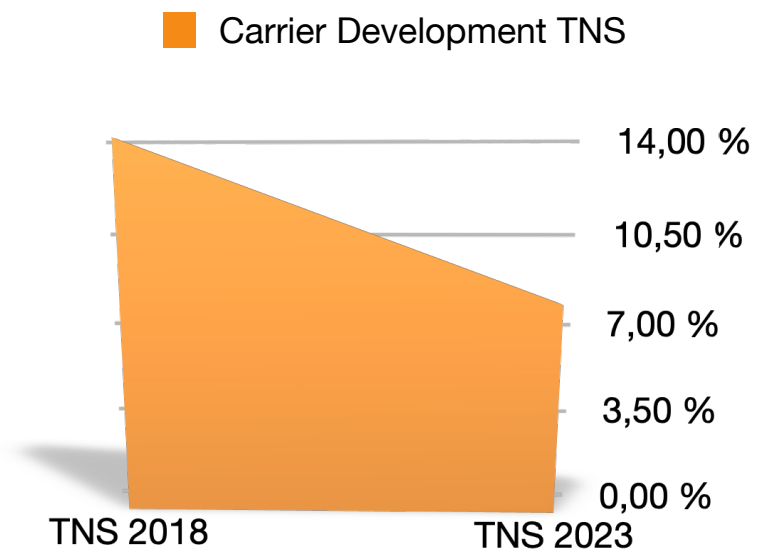


TNS

Trapped Neutrophil Syndrome is a deadly disease, which hits young pups. That is, we don't find any affected dogs in the test results. Pups die early, often without clinical diagnosis and resistant to therapy. Blood tests reveal a lack of white blood cells. With well vaccinated bitches, TNS typically hits pups later, at the time around the first vaccination, because then the maternal antibodies are declining.

1772 ISDS dogs were tested.

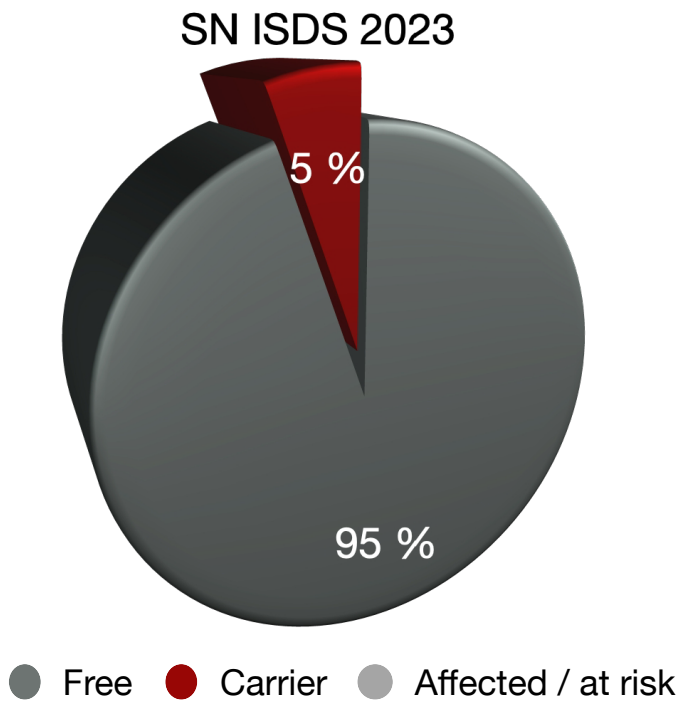


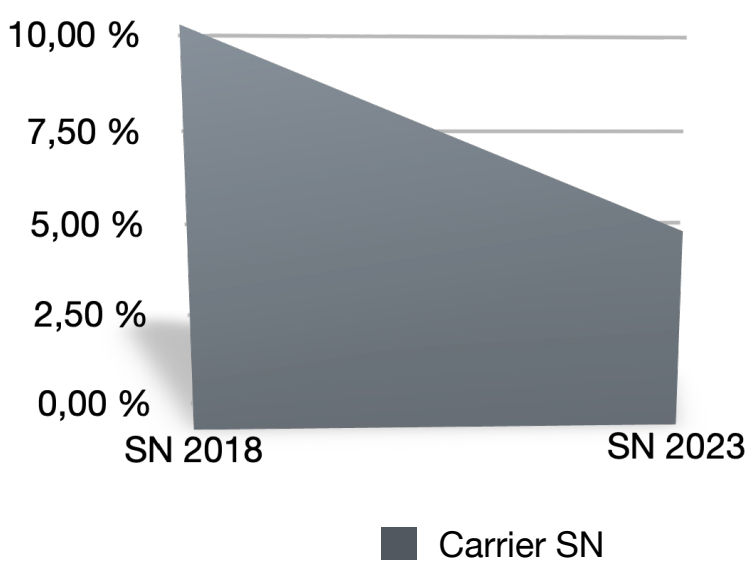


SN

Sensory Neuropathy is a deadly disease of the nerves. Degeneration starts in the hind legs and wanders up. Pups lose sensation in their back legs, start swaying and might mutilate themselves. It is a deadly disease, but affected pups should be euthanized before they suffer gravely.

1,432 ISDS dogs were tested.





MDR-1

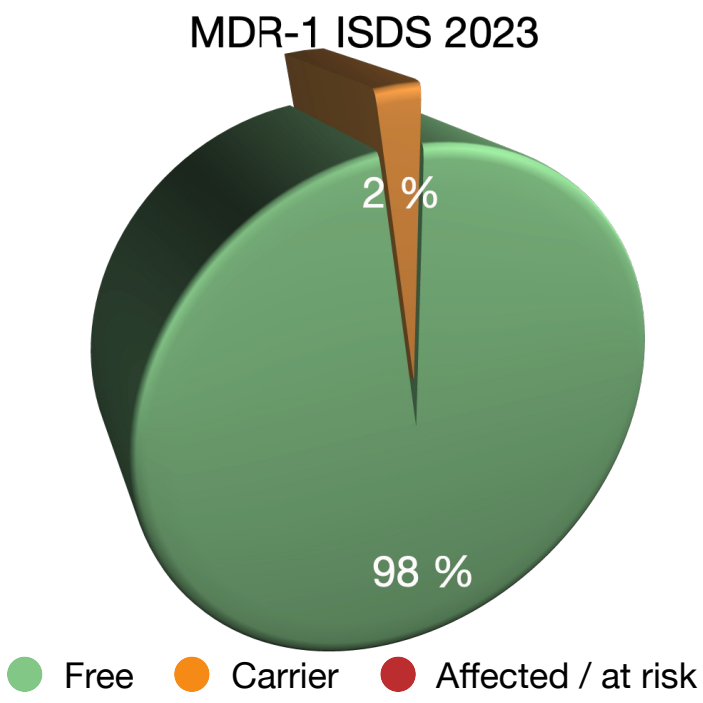
Multi-drug-resistance-1 is characterized by decreased excretion of chemicals and drugs, thus leading to easier intoxication. It is due to a mutated gene which functions as the blueprint for a transport protein. This transport protein acts as a pump in many organs, most importantly between blood and brain.

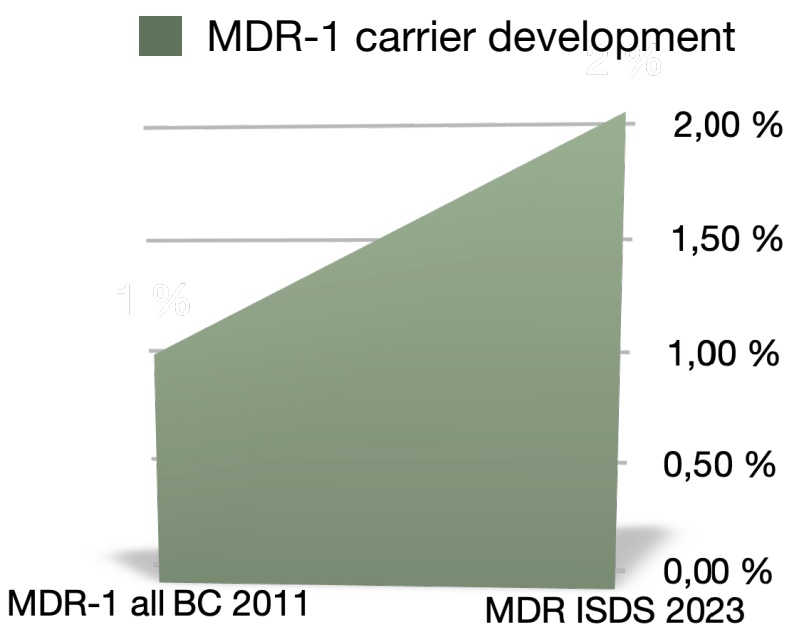
Unlike for instance CEA, the mode of inheritance is not recessive but dominant with incomplete penetrance. While two mutated copies of the gene lead to dangerous intoxications, even one mutated gene can lead to serious side effects from administration of veterinary drugs. The fact that even heterozygous carriers can have problems makes the inheritance dominant. The fact that one defective copy does not lead to nearly as serious problems makes it only incompletely dominant.

Since there is a gene test, it is all about knowing the status of the individual dog before a veterinary anesthesia or other procedures or treatments.

Border Collies consistently used to have very low carrier percentage of under 1%, which now has increased to 2 %. The rise can be seen as statistically not relevant, on the other hand it can be seen as doubling.

Source: https://doi.org/10.1016/j.tvjl.2010.06.012





Early Onset (Adult) Deafness

Early Onset Adult Deafness (EAOD/AOD) or EOD, which is the oldest, but still most widely used abbreviation, describes a premature degenerative process of hearing. Instead of with over 10 years or even later, affected dogs lose their hearing many years earlier. For a working dog that has its eyes on the sheep ,and its ears with his handler, this is a disastrous and career-ending condition.

Affected Border Collies can go deaf as early as with two years of age, but onset can be anything between 2 and 7 years. From one litter of 8 dogs in Germany, 3 went deaf or were half deaf with 3 years. Both parents were tested later for EOD and were found out to be carriers. The affected dogs were BAER-tested and no other reason was found.

History: Even many years ago, North American handlers saw dogs going deaf much too early in life. Pedigree studies strongly hinted at it being an inherited condition. The Health & Education Foundation of the American Border Collie Association was vital in starting research and informing about EOD.

In Europe and the UK, EOD was for a long time considered an American problem, because there didn't seem to be any problems over here. In a health survey of all German ISDS Border Collies in 2013, deafness was not mentioned as a significant problem. Out of 889 dogs, 5 dogs had problems hearing. In 3 that was connected to deafness due to lack of pigment (white head), in one it was acquired (chronic infection), and in one it was early onset deafness without any medical explanation. By now, we have 9 more documented cases of BAER-tested EOD in Germany, and there are probably more of which we do not know.

Genetics: EOD (EOAD or AOD) is a monogenetic condition with variable penetrance. That means, other factors influence the degree of early deafness. The mutation predisposes a dog to lose hearing too early, it is not a given that he does.

Clinical signs: Affected dogs lose their hearing. This can go fast, or it can take time. The process can be very discreet by just losing the hearing of whistles and commands in the distance, but the dogs can also go half deaf or totally deaf in a short time. On the other hand, others might hear the high frequencies of whistles still well, thus camouflaging deficiencies.

The diagnostic method of choice is the so called BAER-test, which measures the neurologic transmission of sound in different frequencies from the ear to the brain. BAER-test results are differing. Some dogs lose the lower frequencies first, others the high frequencies.

Since partly hearing loss in working dogs is often not recognized, but characterized as stubbornness or hardness to handle, it is fair to assume that a lot of the milder cases go undiagnosed.

The gene test: Finnish geneticists of the Helsinki university, led first by Prof. Hannes Lohi and now by Dr. Marjo Hytönen developed a marker test. With extensive genetic scanning of affected Border Collies they identified the genomic region of the suspected gene.

While they could not identify a single responsible gene, they found 4 genes in exactly the same region, which were always also altered in EOD affected dogs, and mirrored the behaviour of the elusive causative gene.

The commercially available test of MyDogDNA (Wisdom) analyzes this set of 4 marker genes. The 4 markers are inherited en bloc. A dog that is labelled „clear“ has none of the 4. A carrier has all 4 as single copy (heterozygous). A dog that is labelled „at risk“has all 4 marker gene in dual copy (homozygous).

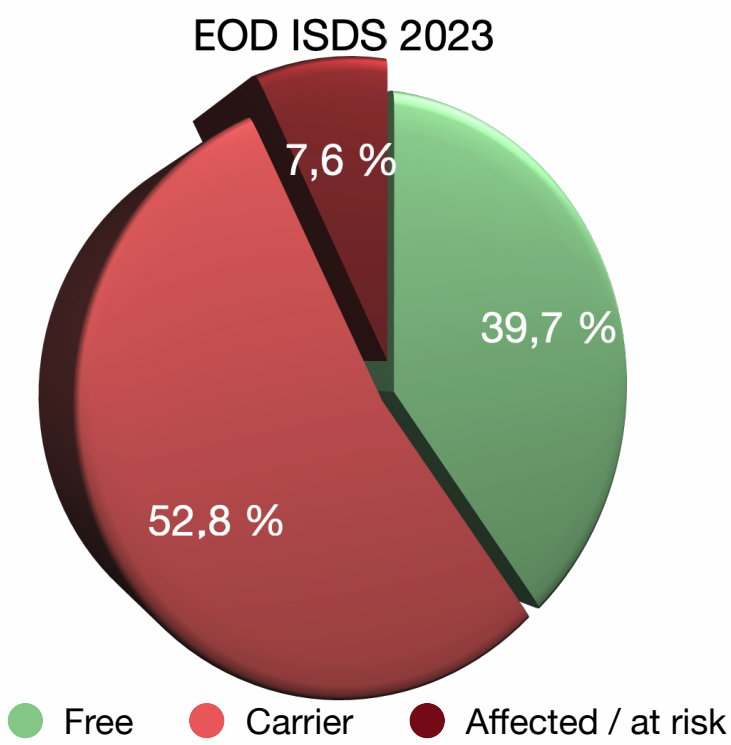
While the test is commercial, the scientists behind it are not. The Helsinki department of veterinary genetics has an excellent reputation and is among the world's leading vet geneticists. This makes its work credible. It is not some backyard lab. Under this link, all ongoing projects can be found. https://www.koirangeenit.fi/english/projects/ongoing-research-projects/

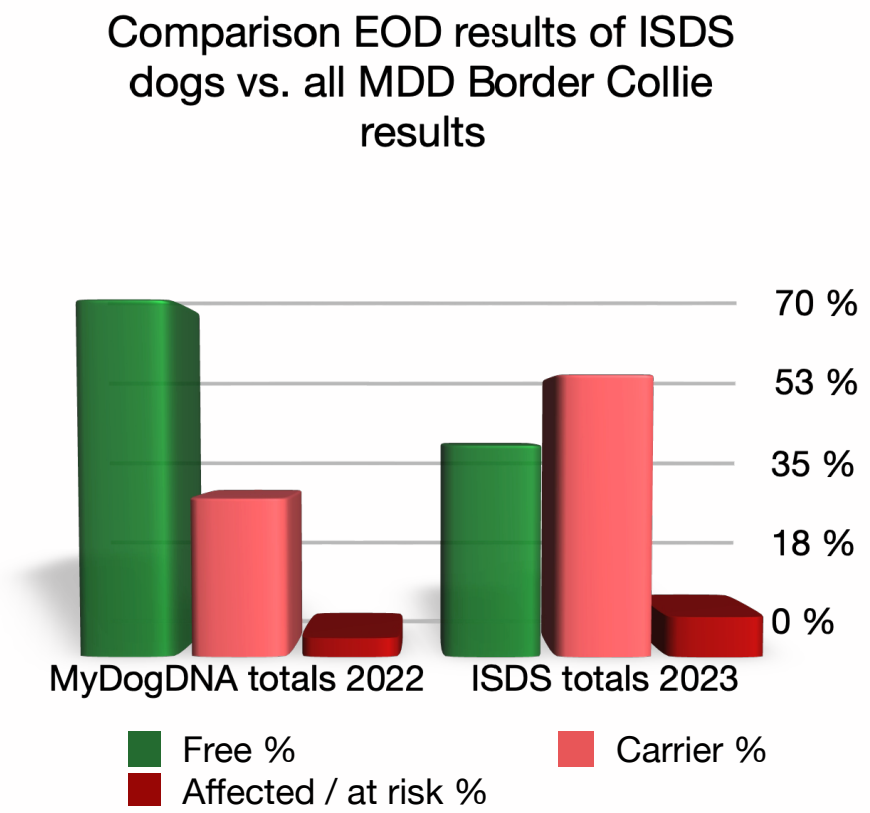
A number of other genetic laboratories use another marker test, which is based on an old publication of 2012. This test has been found to give false positive and false negative results.

Finnish researcher Marjo Hytönen writes: „According to the research, the dog homozygous for the deafness-associated variants is at high risk to develop AOD (remark by the author: the Finnish research group has changed the name and now uses Adult Onset Deafness. It is just another name for what we call EOD). However, additional larger studies are still needed to investigate whether all homozygous dogs develop AOD (EOD) in the critical age and whether all lose their hearing completely or some only partially. In addition, more research needs to be conducted to find out whether the heterozygous (carrier) dogs are at risk to develop AOD (EOD). If your dog has been genetically tested for AOD (EOD) and BAER-tested, we would like you to inform us about the results to aid the research.“

Statistics: The results of the MyDogDNA/Wisdom lab (and its predecessor Genoscoper) until the end of 2022 saw 11.909 Border Collies tested for EOD. Of these, 66,6% were free, 29,8% were carriers and 3,6% were at risk to develop early deafness.

The results of 978 ISDS Border Collies tested until October, 2023 gave shockingly worse results. Only 39,7% dogs were free, 52,8% were carriers, and 7,6% were at risk to develop early deafness.





There are a few explanations for these high numbers. When a test is introduced, the owners of dogs with affected dogs in the family will test first. This is called positive bias.

Nearly 30 stud dogs are suspected to be carriers, because they bred at-risk. 15 are suspected because they bred carriers with a proven free bitch, or were tested as carriers themselves.

What to do?

One possibility is to do nothing until the causative gene has been found. Time and again, a near break-through has been announced, but up to now nothing has been published. The last deadline is end of this year.

Another possibility is to test at least the stud dogs (and brood bitches) with the test we have, to minimize the risk. Deafness or hard hearing is a terrible thing for a working Border Collie in the prime of its life, and for its owner to have a young pensioner dog after years of training, or a lot of money invested.

Of course, there might be the possibility of the test being all wrong. In the light of all the pedigree studies, which prove EOD to be heritable and fit with the gene test results, this seems not the most likely possibility.

The affected dogs we see, and even the dogs we test are just like the small visible part of an iceberg. The much bigger part is hidden from our view.

A somehow realistic view seems to be that the marker test does indeed show an elevated risk for a dog to lose its perfect hearing, only it doesn't tell us when and how bad the hearing loss will be. It is perfectly possible that even a test for the causative gene will not tell us much more, because it looks as if there are other factors involved which cannot be found on this special part of this chromosome.

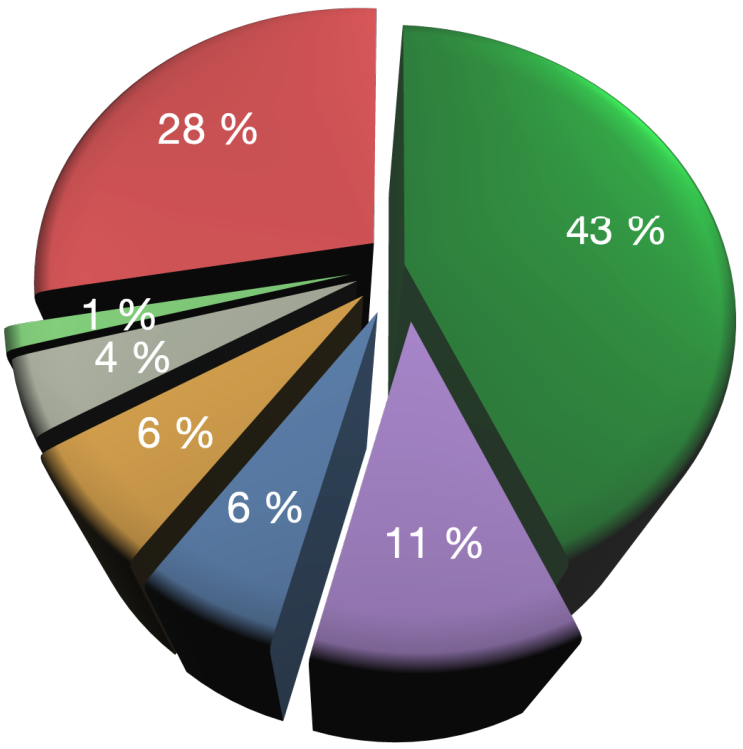
The only really certain thing is that the number of deaf dogs is slowly rising among the published cases.

Distribution of carriers

Until 2023, 310 dogs had been tested against all 6 diseases. 139 of those were carriers for one disease, 34 were carriers for two diseases, 2 were carriers of 3 diseases, and only 135 were completely free of any of the above mentioned mutations.

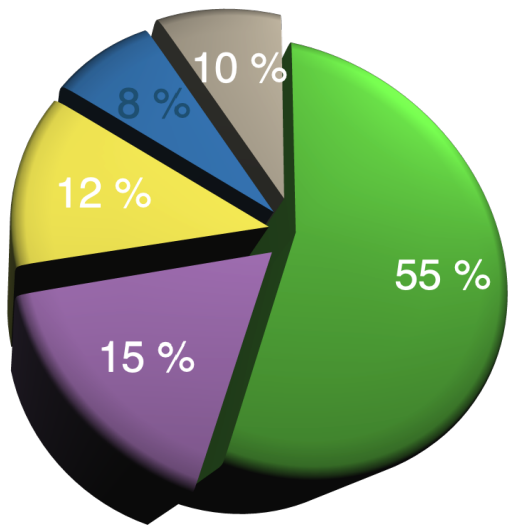
While the carrier percentages of the „classics“ CEA, IGS, TNS and SN dropped in comparison to 2018, the EOD numbers are very prominent.

2023



free of all 6 mutations
carrier CEA
carrier IGS
carrier TNS
carrier SN
carrier MDR
carrier EOD

2018



free of 4 mutations
carrier CEA
carrier TNS
carrier IGS
carrier SN

Author’s remark

This article does not claim to contain all knowledge on the subject. It is an attempt to submit the most recent numbers for carriers and give a distilled overview over the mentioned diseases.

It was written to the best of the author’s knowledge.

Major thanks go to Doris Brand for keeping all data conscientiously up to date and her dedicated work for the breed over the last decades.