The Irish Wolfhound Longevity study

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Purpose
The Irish Wolfhound Longevity Study (IWLS) is a population study, aiming at creating substantial basic research for a wide array of further in-depth studies, which in sum will help establish the current status of the Irish wolfhound as a breed worldwide. It is within the framework of the study to uncover patterns through statistical analysis of the gathered data.
Based on our findings, it is our aim that The Irish Wolfhound Longevity study, among other things, will be able to provide strategies for the future of breeding pedigree Irish wolfhounds and possibly pedigree dogs in general, where the next best thing to '*survival of the fittest'* will be a '*selection of the fittest'*.

Background:
Unless we are dealing with a geographically isolated population of dogs, a purebred population of domesticated dogs can usually be defined as the result of a closed, pedigree recorded, and selective breeding program, which is frequently based on limited founding stock.
Like many of today's purebred dogs, the Irish wolfhound has only been bred within closed registries for approximately a century and a half; since the founding of the World's first Kennel Club in England in 1873, the American Kennel Club in 1884 and subsequent pedigree issuing kennel clubs around Europe during the last quarter of the 19th century.
Domestic dogs were bred quite differently 150 years ago, prior to the centralization of registrations and formal breed standards. Each owner controlled his/her own breeding program; breeding dogs to suit specific personal needs and desires. It is possible that dogs were bred as specific phenotypes, rather than a closed population. What we would consider out-crossings today, were applied to keep a line going with infusion of new blood, or as enhancers of type, speed, substance and other desired characteristics.
Phyllis Gardener (6 October 1890 – 16 February 1939) was a writer, artist, and noted breeder of Irish Wolfhounds. In her 1931 publication, "The Irish wolfhound".
She portrays a vivid picture of how dog breeding was practiced before and during her time:

"Before complaining of the diversity of type in the old days, we should consider that not all of our ancestors had quite the same ideas about purity of breed in dogs as modern fanciers. Communication being much more difficult, breeders of large breed dogs looking for fresh blood to keep their strains going were pleased enough to get any dog that possessed the qualities they required, irrespective of whether such dogs closely resembled their own strains, and till quite recently complete standardization, except in the case of certain local strains, must have been the exception rather than the rule." (Gardener: p. 65)

When efforts were done to 'recover' the Irish wolfhound during the last quarter of the 19th century, it was not farfetched to continue using certain strands Deerhounds, that originated from wolfhound stock and which had been infused with wolfhound blood for certuries. To reinstate size and substance in the dogs, outcrosses were also done to Borzoi, a 'Tibetan wolf dog', a 'Cuban bloodhound' (which resembled the modern Irish wolfhound), a Pyrenean and a significant number of Great Danes. It must be pointed out that the practice of 'out-crossing' was not just a one way

traffic: The piebald or spotted Irish Greyhound (wolfhound) was used to improve size and agility in the Harlequin Great Dane. A wide genetic web was woven between numerous breeds at that time. We only have records of outcrosses to specific dogs of various other breed types from around 1860 till the 1920ies. Even after the registries closed, there was sporadic out-crossing going on, sometimes secretly, according to Gardner. p.p. 134 – 154.

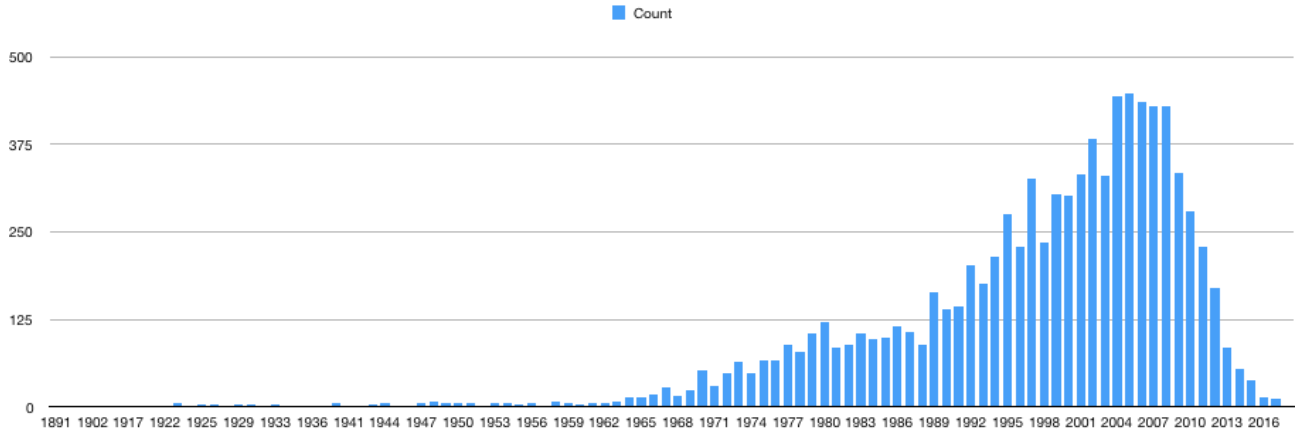
Breeding practices for domestic animals changed drastically during the Victorian era. In a 1998 lecture held at the European Federation of Irish Wolfhounds, entitled 'What Can Population Genetics do for The Irish Wolfhound', Dr. Hellmuth Wachtel Says:

"It was in the England of Queen Victoria that the basis of pedigree breeding and dog showing was laid. It is an English invention and became the most successful animal breeding system worldwide, a refinement of the domestication process. A pedigree guarantees (more or less) an animal's pure descent and allows to precisely plan matings and breeding development. It reflected the ideas of the Victorian era of pure nobility and aristocracy. Purebred animals were – and are – regarded as the aristocracy of a domesticated species (Wachtel 98 p. 2)

The general rule was to breed in, and avoid dilution. The practice worked to establish a consistent phenotype, as a visual identification or 'trademark' of 'purity' and 'aristocracy'.
It is plausible that the invention of the assembly line during the Industrial Revolution also added inspiration to the new approach to breeding, where one could consistently produce a distinct phenotype. Practices of close inbreeding or line breeding became the rule of thumb if one wanted to cement a specific type, which bred true consistently.
After a century and a half with such breeding practices, it is, however, no secret, that a large number of present day dog breeds have reached critical points, where the results of human selection processes, have inadvertently caused various breed specific health challenges. Perhaps it is time to rethink certain aspects of breeding practices. The IWLS will explore, if applying a wider selection criterion for breeding stock, which includes health span and lifespan, will in fact work as an infusion of health, robustness and reduced puppy mortality.

Methodology:
Data for the Irish Wolfhound Longevity study has been collected through personal correspondence with breeders and owners, and from various Irish wolfhound club publications and websites around the World. To exploit as many avenues of data collection as possible; two separate Facebook pages were created; *The Irish wolfhound Veterans page* and *The Irish wolfhound Memorial page,* which have provided information on sex, lifespan, cause of death and parentage on close to 1000 Irish wolfhounds in the dataset. Some kennels have shared their private kennel notes in full with us, which is extremely valuable for the study.
We keep the IWLS database as an open 'work in progress'. Dogs in the database stem from the time of centralized registration in kennel clubs, however information on lifespan is sparse all the way up until around late 1980's /early 1990's and the volume of data increases significantly the closer we get to the present. A study published in 1956 entitled: LONGEVITY AND MORTALITY OF IRISH WOLFHOUNDS by A. Comfort, which provides a 'historical' baseline for comparison to the data in the IWLS.
The study is based on the detailed notes on a kennel population of 189 Irish wolfhounds born in the years from 1927- 1949. (p.28-31)

Graph shows dogs by date of birth:



It is conceivable that our data has a slight veteran bias, compared to the actual population of Irish wolfhounds worldwide. Since we are dealing with owner reported data, we believe that there is a greater desire to share information on dogs, which have lived into their veteran ages, rather than those which didn´t make good ages. However, within the data are several identifiable populations, which are believed to reflect a closer picture of the general state of the breed. These results can be used separately for relevant calculations.
The choice of working with owner reported data; warranted quantitative data: The initial goal was to collect information on approximately 6.000 dogs or more to balance out possible sporadic inaccuracies in the data collected.
Several recent independent studies done on Irish Wolfhounds in various countries along with a study from 1955 by A.COMFORT *Department of Zoology, University College London* seem to come to the conclusion that median lifespan of the Irish wolfhound is somewhere between 6 and 6½ years. A recent calculation done on the combined data mass in the Irish Wolfhound Database https://iwdb.org/ and the Irish wolfhound Longevity Study (approximately 160.000 IWs) concludes that the mean average lifespan for the Iris wolfhound Worldwide is between 7 and 7½ years.

Collaborating partner:
The Irish Wolfhound Longevity study is working in close collaboration with a pedigree database for Irish wolfhounds: The Irish Wolfhound Database IWDB https://iwdb.org/
IWDB's aims at collecting data to document heredity of the breed in its entirety (or as close to this as possible), and subsequently give breeders, owners, fanciers and researchers access to pedigrees, which are a valuable part of breeding choices. A number of owners and breeders are also submitting additional data on health and lifespan, which can be accessed by the users of the database. The IWDB is a dynamic entity, with an ever growing volume of data and new functions.
http://info.iwdb.org/ provides instructions on how to use the database and which functions are available to the users. Since its launch in March 2016, IWDB has had more than 177.000 visits, where each visitor has viewed an average of 6 pages. There are approximately 40.000 pedigrees viewed every month, which shows a significant interest from the IW community. The database currently holds pedigree data of close to 160,000 Irish Wolfhounds.

Hypothesis
Findings in various human population studies, combined with our preliminary data on 9,356 Irish wolfhounds, strongly indicate that the potential for longevity contains inherited components.
Most dog owners generally wish for their companion animals to live long lives, however, longevity in itself usually has no significance within the realm of biology: We base our study on the

assumption, that the greatest drive in all life forms, is the competition for the right to reproduce; a process which requires all encompassing vitality and strength. There are countless examples from a variety of species, where parental life is sacrificed in the name of reproduction, thus demonstrating how strong this drive can be. As a rule, life is not necessarily sacrificed in the competition for the right to reproduce among canids, however, the reproduction process requires good health, vitality and stamina if left without human interference.
It is our hypothesis, that the potential for longevity is a "by-product" of good health, vitality and stamina. In other words, by selecting breeding stock from long-lived families, theoretically one should reap a series of health benefits in addition to longevity.

Preliminary findings
From the trial calculations done on our preliminary data of 9,356 dogs we see indications that:

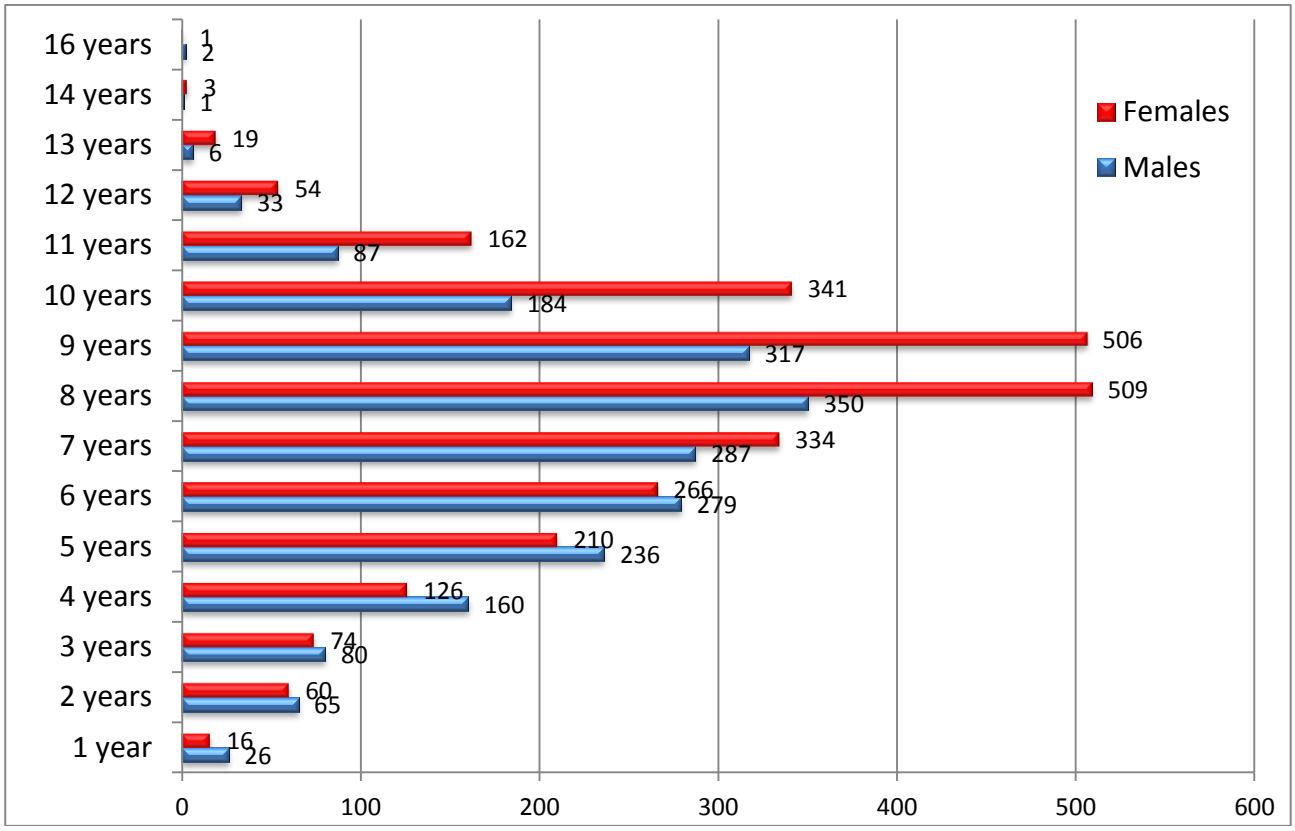
- There is a strong element of heritability in the potential for longevity. (See graph below) This is supported by a number of human population studies. See: Angela R Brooks-Wilson –Genetics of healthy Aging and Longevity

- The majority of veteran dogs (8 years or above) have at least one veteran parent.

- There is a strong indication that the potential for longevity increases gradually according to the number of long lived dogs present in a 5 generation pedigree.

- In the group of dogs surviving 8 years and above, the sex ratio shows more than 40% more bitches than male dogs, a gap which grows proportionally with an increase of age. Bitches in the dataset have a lifespan that is close to 8 months longer than males on average.

Gender & lifespan graph calculations based on 4.794 dogs

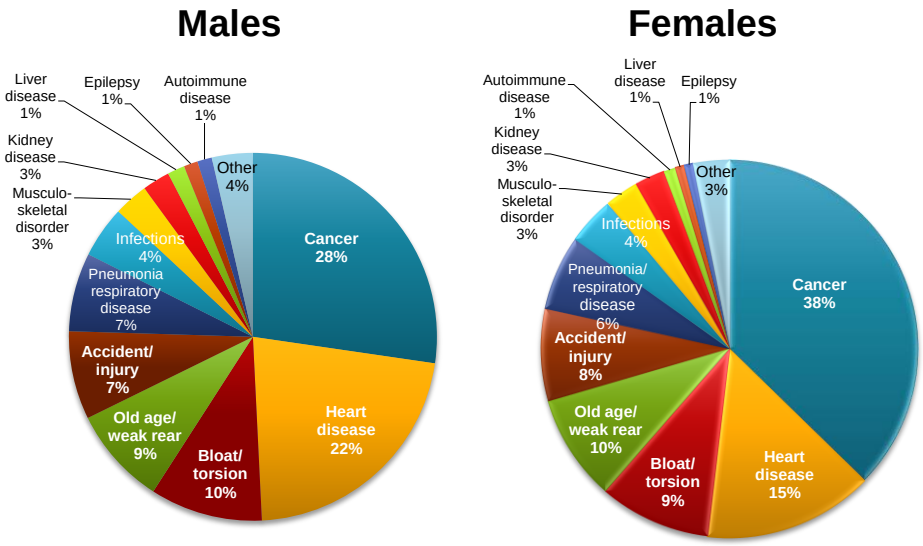


In order to understand the expression of common diseases such as cancer and heart disease, we divide the dogs in two groups:

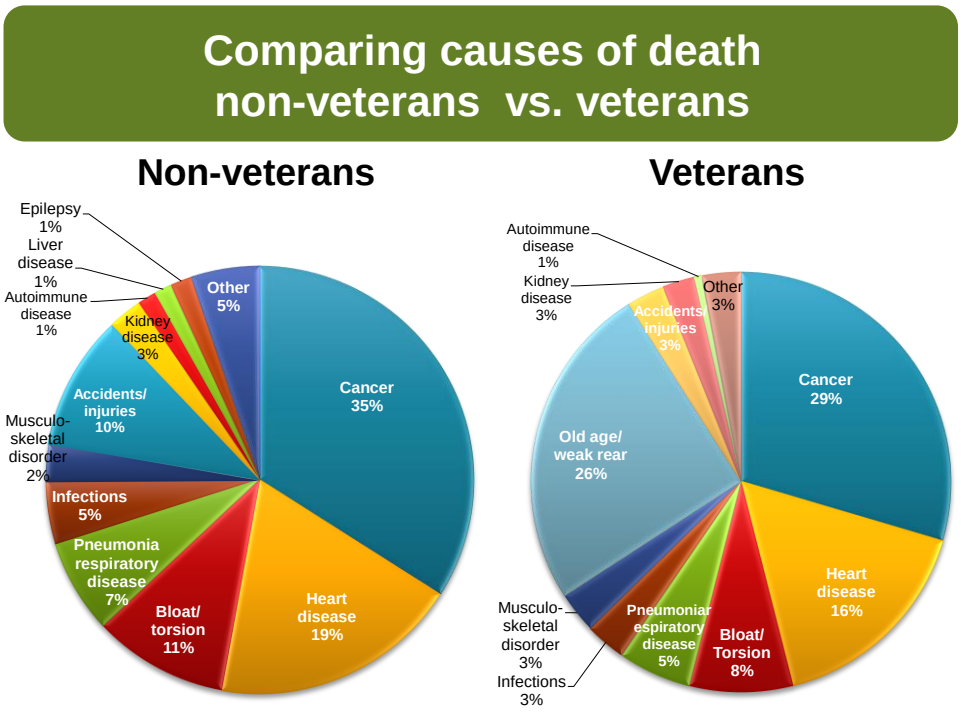
1) dogs which have died under the age of 8 years and

2) dogs which have died at the ages 8 years and above, show that in the first group 39% died from cancer (all forms) and 19% died from cardiovascular disease (all forms). In the second group, we found that 31% of the dogs died of cancer (all forms) while the cause of death in 20% of the dogs was due to be cardiovascular disease (all forms). The relatively small variance in the percentual distribution of causes of death in the two groups may indicate that, disease control could be exercised more effectively, if we aim at a postponement of the time of onset, rather than aiming at a total elimination of diseases such as cancer and cardiovascular disease. This will allow breeders to aim at robustness and longevity instead of trying to breed out the major causes of death in the breed, which seem to be impossible.

Comparing causes of death males vs. females



- Even kennels, which have bred more than an average amount of veterans, have not eliminated diseases such as cancer or heart disease from their stock. However, compared to the breed average, the time of expression frequently occurs much later, usually in the senescence of life, hinting that not all diseases can be completely eliminated through selective breeding; but can be ‘pushed into postponement’ in their time of expression – hopefully into the senescence of the dogs life.



The two charts comparing causes of death as reported by the owners reveal that there is very little difference in causes of death, aside from the obvious age related conditions. This could indicate that we are failing in our attempt to eradicate various diseases by eliminating animals in which they are expressed. It is possible that we should look closer at the time of expression instead; in other words, there is a huge difference between getting osteosarcoma or heart disease at the age of 2½ years compared to getting it in the senescence of life, which for an Irish wolfhound would mean at 8 years or more.

Longevity and healthy ageing has been studied quite extensively in human populations. It appears that there are some ethnic variants, in the identified genes associated with longevity. However some more recent studies have shown that:

"……centenarians (persons living above100 years ed.) *do not carry a smaller numbers of risk alleles for common complex diseases than average people.*

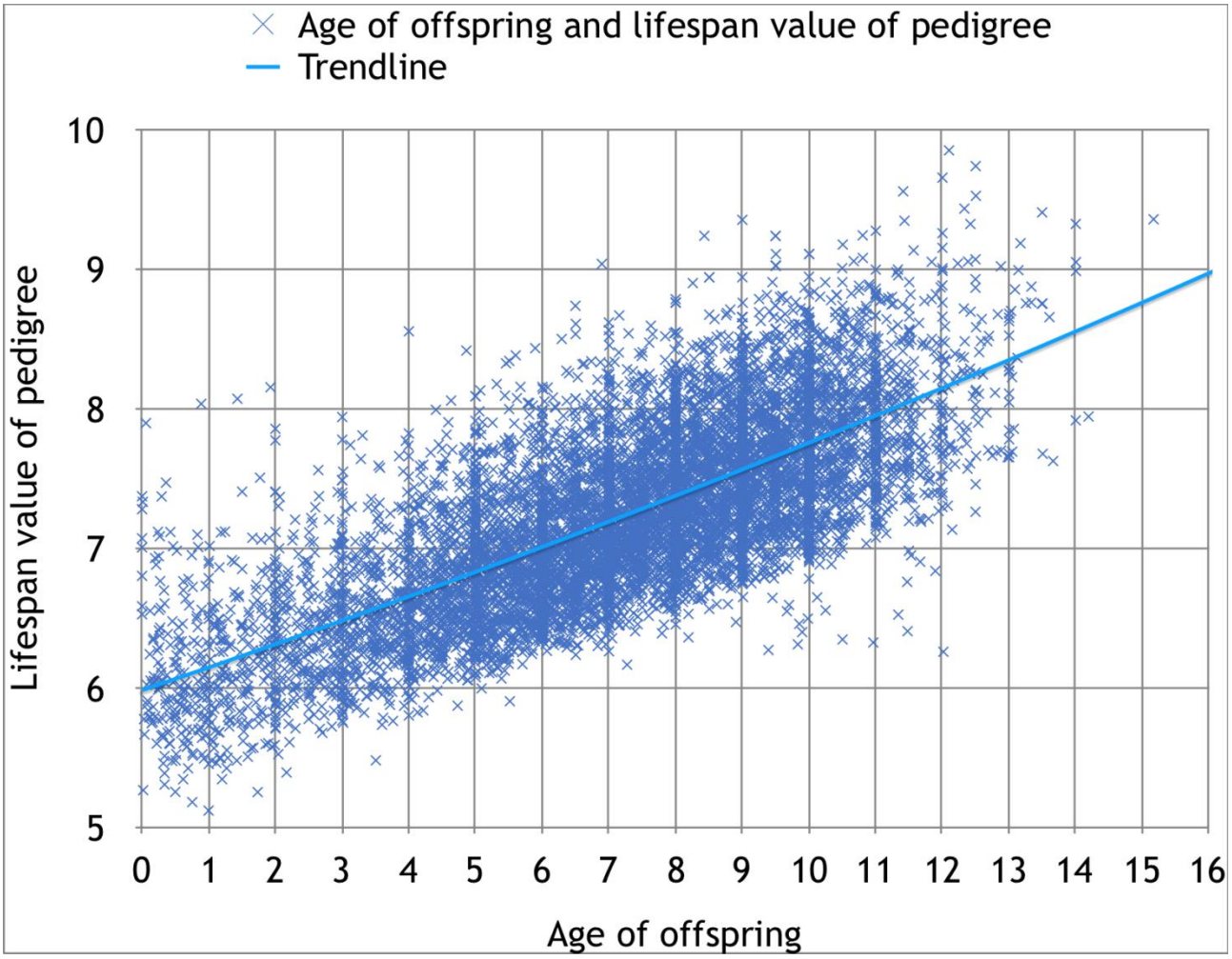
……They looked at 30 SNPs (SNP = single nucleotide polymorphism ed.) *known to be associated with CVD* (cardio vascular disease ed.), *cancer or type 2 diabetes (T2D). The cases and controls each carried an average of 27 disease risk alleles. The distribution of risk alleles was the same in elderly and young subject. Beekman et al. note that "GWAS-identified* (GWAS = Genome-wide association scans) *disease risk alleles do not compromise human longevity" and suggest that lack of rare disease factors, or the presence of protective factors, is at work in the long-lived individuals. It is important to note, however, that CVD, cancer, and T2D are diseases that have very clear lifestyle components and part of the effect could be due to lifestyle differences.* (Brooks-Wilson, p.8, 2013)

Looking the comparative charts on causes of death in veterans as well as non veteran Irish wolfhounds, in the light of the findings in the human longevity studies, one could speculate if future screening for various disease risk alleles would have any positive impact on health and lifespan in wolfhound population at all. Perhaps one could apply a more positive selection process of inclusion of individuals which have protective good alleles which prevent common diseases from coming to expression, rather than excluding the bearers of risk alleles for a long line of common diseases. Brooks-Wilson continues:

These important and perhaps surprising results show that extreme longevity, and the long-term good health that often accompanies it, is not incompatible with the presence of many disease risk alleles. At least the common SNPs associated with common complex diseases, it is not the absence of 'bad' alleles, but more likely the presence of 'good' alleles that influences longevity, though effects of 'good' environmental factor may also contribute (ibid:p.8.)

We have tried a practical approach to selection, by using frozen semen from exceptionally long lived males, which for a wolfhound is from age 9 years and up. Because harvesting eggs or embryos is not commonly practiced in dogs, but the use of frozen semen is gaining popularity among breeders, this was the method of choice for selecting long lived individuals.
Age at of death in adults has a heritability of about 25% according to Murabito et. al. 2012 (in Brooks-Wilson)
She continues:
"Importantly, the heritability of longevity increases with greater age. The heritability of living to at least 100 has been estimated at 0.33 in women and 0.48 in men (Sebastiani and Perls 2012). Male and female siblings of US centenarians were 17-fold and eightfold more likely (compared with US Social Security data) to reach the age of 100, respectively (Perls et al. 2002). The increase in heritability of longevity at greater age is consistent between several studies."(Ibid)

The graph is based on known lifespan of 8.632 Irish Wolfhounds.



The calculations show, how longevity in a pedigree affects the longevity of offspring. The trend line shows the correlation between lifespan value in pedigree and experienced longevity in progeny. Each dog has a little X, plotting its age at time of death on the horizontal axes and the lifespan value of its ancestors on the vertical axes.
The lifespan-value of ancestors (the vertical scale) is a weighted calculation of direct ancestor lifespan in the last five generations. We are still working on improving the algorithms used for this crucial calculation.
The emerging pattern of plots, clearly shows, that the higher the age of ancestors, the greater the chance of the resulting progeny reaching similar ages. In other words there is a significant inherited component in the potential for longevity.

The aim is providing applicable tools for the calculations of inherent robustness and longevity in planned litters,which may prove a useful element in breeding robust, healthy and long-lived pedigree dogs.

Conclusions

We find that good pedigree data is vital to understanding the queries of longevity. From our data and breeding experimentation in practice, we see strong indicators, that longevity is merely a byproduct of an inherent overall health and robustness. In selecting for long lived individuals, we are using the lifespan as an identifiable marker for a wide spectrum of health benefits.

When researching individual pedigrees in the selection process it is important to understand that, looking mainly at parents may lead to arbitrary results, while analysis of pedigree data including longevity data may give us better accuracy in estimating the potential for longevity in breeding. The Irish Wolfhound Longevity study and the Irish Wolfhound Database intend to offer an online trial pedigree analysis, which IWDB users can access and incorporate into future breeding choices.

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