From the Health and Genetics Committee

Longevity Studies in Golden Retrievers

For many of us, the ultimate goal of canine health research is to let our Golden Retrievers live healthier, happier and longer lives. Recent publications suggest that goal may be achievable but that we aren't there yet. One very exciting recent study indicated that two haplotypes (groups of alleles inherited together) in the 5'UTR (untranslated region) of the ERBB4 gene were significantly associated with shorter or longer lifespan in Golden Retrievers (Rebhun et al, 2024). The findings were well publicized and generated considerable excitement (Quinton, 2023). This Health and Genetics Committee article responds to those asking if we should test for those haplotypes and if there are other genes that may be involved in healthy aging and longevity in Goldens. Some important information on exciting advances in canine health genomics and longevity studies are included below. In terms of potential testing, both the authors of the study and the GRCA Health and Genetics Committee believe that it is currently too early to use the findings from longevity studies for breeding decisions.

This is Matilda, a Golden Retriever owned by Chris Miele, President of the Golden Retriever Foundation. She is pictured here on her 14th birthday. In the future, we hope more Goldens live to celebrate their 14th birthday.

Advances in canine health genomics

Before talking about the new study itself, it is important to look at the breakneck pace of genetic discovery in canine and human health. The technology is rapidly changing and new technology often drives new discovery. A little more than a decade ago, whole exome sequencing (WES) was the state-of-the-art for discovering the genetic basis of inherited disease. WES looks at all of the exons, the protein-coding portion of the genome, and is still an important research tool. However, a new technique, whole genome sequencing (WGS) examines the whole genome, including DNA regions that are protein-coding and those that are not. In humans, clinical use of WGS can sometimes identify the cause of a genetic disease when all previous testing did not (Wojcik et al, 2024). Indeed, some of the DNA variants associated with inherited disease are in untranslated regions (UTRs) of DNA – regions that are not protein coding. These UTRs of DNA were once thought to be junk but actually can play an important role in regulating gene expression. The DNA region identified in the recent Golden Retriever longevity study is in one of those UTRs of DNA. Genome-Wide Association Studies (GWAS) are studies that use WGS to identify DNA variants causing disease. The study that revealed the association between variants of the ERBB4 gene and longevity began with GWAS.

Findings from the 2024 Golden Retriever longevity study

This research first used GWAS to compare a small number of Golden Retrievers who died before they were 12 years old with Golden Retrievers more than 14 years old. A region on chromosome 37 was associated with lifespan but that region contained 9276 DNA variants so follow-up investigation was needed, and this was done using two different populations of Goldens. Follow up investigation within that region identified three haplotypes in the 5'UTR of the ERBB4 gene. Haplotypes 1 and 3 – in various combinations, and with certain differences between males and females – were associated with longer or shorter lifespan. However, these associations are not necessarily causal.

Other factors potentially implicated in Golden Retriever longevity

Longevity is not due to a single gene. Instead, many factors influence canine longevity. A study on lifespan and calculated coefficient of inbreeding (COI) from 9791 Golden Retrievers, indicated that outbred Golden Retrievers (calculated COI <2%) tended to live longer than inbred Golden Retriever based upon data from k9data.com. Size is important also. Small dogs tend to live longer than big dogs (Doherty et al, 2020; Fleming et al, 2022; Urfer et al, 2020; Yordy et al, 2020). Similarly, shorter Goldens may live longer than taller Goldens (Glickman et al, 1999). A major DNA variant associated with size in dogs produces antisense RNA that affects the expression of insulin-like growth factor 1 (IGF1) (Plassais et al, 2022). As with the DNA haplotypes in the Golden Retriever longevity study, the size-associated DNA variant is an untranslated region of DNA. In addition, other genes associated with size and with cancer susceptibility have been implicated in canine longevity (Doherty et al, 2020), and in fact, large dogs get nearly 3.7 times more cancer

than toy and small dogs (Schwartz et al, 2022). Variants associated with longevity can also vary in different breeds (Korec et al, 2024 and Korec et al, 2025). In humans, at least 16 genes influence lifespan (Park et al, 2025).

This is Jessie, also known as Bravhart KC Run For The Border MH QA2 WCX OS, who is GRLS hero 1370, pictured just before his 13th birthday

Potential future directions for the 2024 longevity study

The recommendation is that more studies are needed. The study specifically notes that "additional validation studies are needed before these data should be applied clinically or in breeding programs." In addition, the study notes that no one knows the function of the 5'UTR of ERBB4. Because it is located in an untranslated region, by definition, it is not translated into a protein. However, it could be involved in processes affecting ERBB4 levels or something else. Importantly, based upon studies in humans, canine ERBB4 likely functions as either a tumor suppressor (suppresses cancer) or an oncogene (enhances cancer) depending upon other factors (Lucas et al, 2022). In terms of validation, the study notes that ongoing prospective studies such as the Golden Retriever Lifetime Study (GRLS) are ideal for validation. GRLS also has medical, dietary, vaccination, environmental, and postmortem data and these factors may also affect longevity. All of this indicates the need for more research. For now, researchers are studying the function of the variants of ERBB4 in dogs. With time, these and similar studies may help us understand factors that enable longer healthier lives for Golden Retrievers.

Considerations for the future

Today, dog breeders often use selected DNA tests to make wise breeding decisions. Many of the most useful DNA tests involve autosomal recessive genetic mutations that can cause disease. The tests can be used to prevent breeding of two carriers of the same mutation to each other – in that way, puppies do not get the disease caused by that mutation and carriers can be used in breeding programs. Used in that way as a management tool, DNA testing reduces the risk of those diseases and helps maintain genetic diversity. Unlike mutations that cause disease, the ERBB4 variants identified in the longevity study appear to be associated with apparently healthy Golden Retrievers. In the study, the variants cause a statistically significant effect on longevity – they do not determine the lifespan of individual dogs. We do not know how common these variants are in other breeds, if the effect on longevity is different in other breeds, if the environment influences the effect of these variants, what caused the deaths of Golden Retrievers with any of these variants, or even the function of the 5'UTR of ERBB4. Thus, any testing for these variants would be very different than currents tests for autosomal recessive mutations. In addition, selection of breeding dogs based upon any test needs to maintain genetic diversity or resulting puppies could suffer the effects of excessive inbreeding – loss of genetic diversity could actually decrease lifespan. We need to maintain genetic diversity because that can affect lifespan and health also. The authors of the recent publication (Rebhun et al, 2024) are clear that additional studies are needed before the findings are used in breeding programs. What the study does do is to provide hope that there may come a time when we better understand genetic contributions to longer and healthier lives for the dogs we love. But now is not the time.

Scout (Lakwoia's Awesome Scout) and his sister Molly are shown here a month before their 16th birthday.

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