Scientific Summaries and Breeder Commentaries

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Heritability of Litter Size in Labrador Retrievers and German Shepherds-
This 2006 article in the Journal of Veterinary Behavior estimated the
heritability of litter size and survivability of pups to be moderately high. The
heritability range was between 0.19 and 0.31 for these kinds of
reproductive traits. This study was conducted by the Seeing Eye, Inc of
Morristown, NJ.

Success Rates of Purpose Bred Training for Guide Dogs/Breed Suitability
(Journal of Veterinary Behavior, 2006)

Interesting data in the article on the success rates of purpose bred dogs to
complete training. Dogs are sent to volunteer puppy raisers for their first
year for socialization and basic obedience training. Most return (90-95%)
for to the Seeing Eye for actual training at 14 to 18 months of age. Those
that are rejected leave for various health and behavior related reasons.
During the first month after return to the training facility, health and
suitability evaluations eliminate another 5 to 10% of the dogs, then the
formal 4 month training process begins. Ultimately, 59% of LabX golden
crosses complete training, 54% of Goldens, 51% of Labs, and 46% of
German Shepherds complete training. This success rate of purpose bred
dogs is substantially higher than dogs used from the general population,
but is low enough that behavioral and genetic selection techniques are a
major area of research. Overall, 53% of dogs that entered training (which
was 85 to 90% of the total population bred by the Seeing Eye) were
successful as guide dogs.

Methods for Breed Associations (Genetics and the Social Behavior of Dogs, Scott and Fuller, 1965)

"The breed associations were founded in order to overcome the limitations
imposed upon the individual breeders, and it is possible for them to
accomplish much more through long continued selection programs. In the
future, the breed associations can accomplish more than they have in the
past by modifying their objectives and making use of newer genetic

theories and techniques. First of all it should be realized that a breed is a population of individuals showing a limited but still important degree of genetic variability. If selection is confined to one narrowly defined type, the result will almost inevitably be the accidental selection of various undesirable characteristics. Breed standards should include regulations relating to health, behavior, vigor, and fertility as well as body form. These can perhaps best be accomplished by introducing tests of performance and emotional reactions as well as appearance. Obedience trials and field trials are a valuable step in this direction.

The desirability of multiple standards makes the practice of breeding a champion to a large number of females within a breed a questionable one. Almost every animal carries some sort of injurious recessive genes, and this practice insures that they will be spread throughout the whole breed, with resulting disappointment as the descendants of these champions are eventually bred together and the recessive traits begin to show up in large numbers. The breed objectives should not be the development of a single, fixed type----something only possible by strict inbreeding----but rather for the development of a population varying within desirable limits and with which new and more valuable combinations of genes will always be possible." See the associated articles on "Population Genetics" and "Breeding for Performance".

Genetic Selection Against Hip Dysplasia

--- *The effectiveness of genetic selection against hip dysplasia is discussed by the following three articles:*

Article one, by the OFA demonstrates a reduction in HD in submitted radiographs, but the abstract does not address the fact the many dysplastic radiographs are not submitted for OFA evaluation.

Article two, from Finland also questions the effectiveness of genetic selection against HD, in a system independent of OFA.

Article three, also by the OFA shows the prevalence of HD is similar in purebred and mix breed populations. This implies that the years of breeder selection against HD has not significantly improved the rate of HD in purebred dogs. The overall dysplasia rate for purebred and mixbreed dogs

was around 19%. Note that there is conflicting scientific data on this topic and ideal solutions do not exist at this point. I would encourage that this data not be over interpreted and would strongly encourage continued selection against dysplastic dogs. However, this implies that there are very significant factors leading to dysplasia that are NOT genetic. See the above article on overfeeding and longevity and dysplasia rates.

Trends in hip dysplasia control: analysis of radiographs submitted to the Orthopedic Foundation for Animals, 1974 to 1984. Corley EA, Hogan PM. J Am Vet Med Assoc. 1985 Oct 15;187(8):805-9.

From 1974 through 1984, the Orthopedic Foundation for Animals evaluated 143,218 radiographic submissions representing 151 breeds of dogs. All breeds from which there were 35 or more evaluations had some frequency of dysplasia. Seventy breeds, each with over 100 submissions, were tabulated and ranked according to frequency of hip dysplasia. Frequency of dysplasia varied from 0.6% in the Borzoi to 46.9% in the Saint Bernard. These data were compared with data obtained earlier (1966 to 1973) on evaluations in 38 breeds for changes in frequency. There was significant (P less than 0.05) reduction in frequency of dysplasia in 27 breeds, a significant (P less than 0.05) increase in frequency in only 1 breed (German Shorthaired Pointer), and no significant change in frequency in 10 breeds. The median significant decrease was 22.4%, and the range was from 3.1% in the Chesapeake Bay Retriever to 48.7% in the Keeshond. The reduction in frequency of hip dysplasia demonstrated the value of a control program. There were 5 breeds with a significant (P less than 0.05) decrease in frequency of dysplasia that had over 5,000 evaluations from 1974 to 1984. The decreases in frequency were independent of changes in American Kennel Club registrations for these breeds (a dramatic decline in registrations for the German Shepherd Dog and Old English Sheepdog, and a dramatic increase for the Rottweiler, Golden Retriever, and Labrador Retriever). Frequency regressed linearly in the German Shepherd Dog and Old English Sheepdog, but regressed nonlinearly in the other 3 breeds. The percentage reduction in frequency from the base frequency (1966 to 1973) for these breeds was 17.5% for the German Shepherd Dog, 23.1% for the Old English Sheepdog, 9.1% for the Rottweiler, 10.1% for the Golden Retriever, and 6.8% for the Labrador Retriever.

Finnish Study on Hip Dysplasia with Data from pre 1988

Disease frequency. A clear between-breed variation of dysplasia frequency was observed: from 2% (Smooth Collie) to 80% (Long-haired Saint Bernhard). In every breed, annual variations of frequency were noticed. Only in nine of the 22 breeds included in this study, were significant changes in hip dysplasia frequency detected. However in four breeds the disease frequency increased, and only in five breeds was a decrease noted. In other breeds the observed changes were so slight that they were thought to be caused by random variation. The frequency of severe HD in each breed followed very closely each breed's overall changes in HD frequency.

Economic effectiveness. As already discussed, numerous calculation models can be created for economic estimation. However, no benefit/cost -ratio over 1 could be shown for any breed or calculation model that were used. In some breeds dysplasia frequency had also increased during the study period, so in these breeds the benefit/cost -ratio was found to be negative. The best benefit/cost ratio (0.82) was achieved in the Nova Scotia Duck Tolling Retriever when calculation Model no 1 was used. This calculation model was the one which assumed the cost of hip dysplasia to be the highest. All calculation models have numerous sources of bias: especially the cost of treating hip dysplasia is very difficult to estimate.

Heritability in German Shepherds. When the hip dysplasia scores from A to E were coded as numbers from 1 to 5, respectively, the mean value of the subjectively recorded hip dysplasia score was 2.42 with a standard deviation of 1.20. This corresponds average hip scorings between B (normal hips with slight changes) to C (mild dysplasia). The coefficient of the variation was 49.9%. The heritability estimates for hip dysplasia were moderate, varying from 0.31 to 0.35.

Environmental factors affecting hip dysplasia in German Shepherds. Environmental effects: birth year and month, panelist screening, age of the dog, as well as the effect of the genetic group of offspring from imported versus non-imported sires had significant effects on hip dysplasia. The litter and the breeder had only very small effects.

Phenotypic and genetic change and breeding values in German

Shepherds. No phenotypic progress could be shown, the disease prevalence had, instead, increased. As expected, also no clear genetic improvement could be shown in either males or females according to breeding value averages per year of births. Also, breeding values of parent animals were very similar to those of the whole population, which gives reason to suspect the effectiveness of selection.

Prevalence of canine hip dysplasia in a veterinary teaching hospital population.

Rettenmaier JL, Keller GG, Lattimer JC, Corley EA, Ellersieck MR. Veterinary Services, Columbia, MO 65201, USA. *Vet Radiol Ultrasound. 2002 Jul-Aug;43(4):313-8.*

The purpose of this study was to determine the prevalence of canine HD in a population in which there was minimal or no prior screening of radiographs for the disorder. Patient information was obtained from the radiographic database at the University of Missouri-Columbia Veterinary Teaching Hospital during the five-year period of 1991-1995. The coxofemoral joints on ventrodorsal radiographs of the pelvis were independently evaluated by three veterinary radiologists. A consensus evaluation of normal, borderline, or dysplastic was compiled. There were 2885 dogs identified representing 116 breeds and the mixbreds. There were 2236 purebred dogs (1071 males and 1165 females) and the prevalence of HD was 19.7%. There were 649 mixbred dogs (340 males and 309 females) and the prevalence of HD was 17.7%. There was no significant difference in the prevalence of HD between sexes or between purebred and mixbred dogs (P = 0.16; P = 0.29). Degenerative joint disease (DJD) was the most common radiographic manifestation of HD and there appeared to be a threshold at 12 months of age after which the presence of DJD was the primary diagnostic criteria.