

# Breeding & Genetics Summary

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Established in 1966, the Guiding Eyes for the Blind Canine Development Center in Patterson, New York, is where Guiding Eyes dogs are “purposefully bred” for the superior health and the temperament needed for guide work. About half of all weaned puppies will go on to become guide dogs and members of the Guiding Eyes breeding program or serve in other careers such as service dogs and detection dogs.

Guiding Eyes is an international leader in breeding and genetics. Our breeding program is built upon best-in-class analysis of genetic data from every step of a dog’s life. From our Reproduction & Cryogenics lab where pups are conceived to the final years of a working, retired, or released dog’s life, Guiding Eyes chronicles millions of data points along the way. Why? Because while Mother Nature often knows best, science can often help us know better. With the right information, we can make better breeding decisions to keep our colony growing and healthy for years to come.

## Data-Driven Genetic Decisions: Estimated Breeding Values

Selective breeding is the process of deciding which dogs become breeders, who mates with whom and when a dog is retired. Most health and behavior traits are controlled by many genes, each having a small effect, and without data guiding our decisions, chance plays the greatest role in the quality of health and behavior. There are two ways to selectively breed: 1) phenotype selection, the most widely used, requires creating puppies and waiting to see how they turn out; and 2) estimated breeding values (EBVs), the best improvement.

Estimated breeding values (EBVs) are calculations built on data on dogs and *all* their relatives, which allow Guiding Eyes to identify the best dogs to join the breeding colony. EBVs are genetic merit scores produced from careful calculations on various traits (allergies, hip quality, elbow quality). These EBV scores are then combined into an overall weighted genetic score. EBVs help identify which dogs have the highest likelihood of transmitting the most desirable genes, *before* the dogs are bred, versus breeding the dogs and seeing what they produce (the process used in phenotype selection).

By using selective breeding, Guiding Eyes can breed the genetically superior individuals, so that each generation of our dogs is an improvement on the previous generation in terms of health and temperament. In fact, since the implementation of extensive data collection and Guiding Eyes’ genetics work since 1989, we have seen 90% reduction in hip dysplasia, 92% reduction in elbow dysplasia and 75% reduction in skin allergies and ear infections. Most of this improvement occurred since 2003 when we began use of EBVs.

The data and EBVs also inform which broods and studs are paired together to produce a litter with the lowest level of inbreeding and carefully select non-related dogs to maintain a healthy level of genetic diversity. Additionally, we can fine tune our mating selections by using “Negative Assortative Mating” where mates are chosen to compensate for each other’s weaknesses.



## Inside the Reproduction & Cryogenics Laboratory

Technology plays a major role in making this step in the process a success. A cutting-edge Computer Assisted Semen Analyzer allows thorough examination of semen quality to ensure that our breeding males are reproductively sound and is even able to pick up on aspects impacting fertility that are invisible through normal microscopy. An in-house progesterone analyzer provides immediate measures of breeding readiness and whelp timing for female dogs based on quantitative progesterone levels.

Additionally, Guiding Eyes was the first school in North America with the ability to perform camera-guided trans-cervical insemination. (We even train schools around the world in these state-of-the-art techniques.) Coupled with an in-house ability to freeze semen, we can maintain genetic diversity by sharing semen with other guide dog organizations worldwide and importing semen from other colonies. This also allows some male dogs to have dual careers, both as guide dogs and breeders, by utilizing their stored frozen semen.

## Practical Guidelines: Applying These Principles

Building a bridge to better puppies is achievable for any organization, of any size, by applying three key imperatives: 1) collect data, 2) collaborate, and 3) direct genetic change. Let's break them down point by point.

- 1) **Collect data:** The foundation of any healthy breeding program is consistent, usable data. Organizations should store data on *all* dogs in their universe (not just breeding dogs). Data guides decisions on which traits to focus on improving and measure progress. These data are useful for analysis because they are stored electronically using consistent scoring and measures throughout Guiding Eyes staff and departments.
- 2) **Collaborate:** While data within one organization is useful, data shared across many is exponentially more powerful. Guiding Eyes has supported global efforts to help organizations collect the same data and combine it into one database, the International Working Dog Registry. We have shared our own knowledge and semen from our best studs to help organizations on all continent improve their dogs.
- 3) **Direct genetic change:** With combined data, all organizations have the potential to use EBVs to direct the genetic improvement of their dogs with each generation, and to choose the next generation quickly and more accurately. Keeping the genetically best replacement breeders from the most recent generation and limiting the number of progeny of any one individual reduces undesirable inbreeding, while systematically improving the health and behavior of dogs.

This ongoing work systematically improves new litters with each generation and enables the Guiding Eyes puppies enter the world with a "paw" up. Once they begin their early development through our renowned Successive Training & Enrichment Program (STEP), they are already well on their way toward a successful working career.

