

Breeding for the New Millennium

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Whether you think the Millennium began in January 2000 or ends in December of this year, it's a good time to take a look at the science of genetics and the breeding and exhibition of dogs to determine where they've been, where they are, where they're going and how each relates to the other.

Fortunately, we don't have to go back a thousand years to recap past history in any of these areas. Genetics didn't even exist before Gregor Mendel grew his pea plants in the mid-19th century. By interesting coincidence, the breeding of dogs and exhibitions featuring dogs had some significant developments at about the same time.

For most of dog's history with man, planned breeding—as opposed to the happenstance random matings that have always and still occur among dogs—was done largely on the basis of performance though societies with a wealthy leisure class sometimes had companion breeds who were probably selected for physical appearance and temperament. Most dogs had to earn their keep, so good hunting dogs would be bred to other good hunting dogs, good herders to good herders, etc. with emphasis put on particular aspects of those traits that were useful to the people in the time and place they were bred. Pedigrees might or might not be kept, depending on the inclinations of the breeder or the culture in which he lived.

In the 19th century, social thinkers strongly promoted theories relating to the importance of ancestry to the quality and character of the individual. "Purity" of blood was considered an asset for both man and beast. In this thinking lay the seeds of our present system of closed breed registries and the prevailing attitude that any mixing of breeds, for whatever purpose, is a threat to the well-being of the parent stock on both sides. "Like begets like" was a breeders' mantra.

The challenge, "My dog's better'n yours!" has no doubt been with us since dog first allied himself with man. Canine competitions both casual and formal have been a feature of a wide variety of human cultures, but prior to the 1850s, these were performance competitions. At this time the exhibition of dogs in conformation shows was established, based on similar pre-existing exhibitions of livestock. The original purpose was to display fine specimens of the various breeds in a venue where other breeders and the general public might view and them. The competitive aspect was considered an enjoyable

secondary benefit.

Over the past 150 years, dog breeders have continued to produce dogs with the intent of "improving the breed," though the definition of what constitutes "improving" is a subject of hot debate. As changes in technology eliminated or at least drastically reduced the "work" available for dogs and the need to produce dogs which could perform that work, most breeders have focused on producing companion and/or conformation show animals, though a significant minority still focus on the functional aspects of various breeds.

Competitive events continue to exist and have probably grown in popularity, at least in Europe, North America and other areas heavily influenced by European or American culture. By far, the greatest area of competition at present, in numbers of dogs entered and, arguably, total money expended is the conformation show. While the rules of competition vary somewhat from one organization to another, all of them are keyed to judging dogs on their appearance and movement (at a trot) with respect to a written standard for each breed. Winning has become very important, with the public exhibition aspects of the events secondary. At many smaller events, attendance by non-exhibitors is entirely coincidental.

While the dog world has been evolving steadily on its 19th century foundations, genetics has exploded. Gregor Mendel's work went largely unrecognized until the turn of the last century. For the next fifty years, what was known about genetics was based largely on observations of what was produced by particular crosses or how a trait was distributed throughout a pedigree. Then, in 1952 Watson and Crick discovered the double-helix structure of DNA. Since then, cascading technological improvements have allowed scientists to delve into the detailed structure of DNA and the chemical processes by which it functions, both for good and for ill.

As genetic knowledge became available to the public, breeders began to apply basic concepts to their efforts. Words like "dominant" and "recessive," and even mouth-twisters like "homozygous" became standard breeder jargon. Those whose breeds could have variations in color or coat type quickly learned how such traits were passed and what kinds of crosses would produce them—or not produce them, if they were undesirable. The old notion "like produces like" was confirmed by genetics. And if it didn't produce like, then there was a recessive that one must breed out of one's line.

To maintain the quality of a line, breeders have for decades bred related dogs to eliminate "bad" recessives and make "good" genes homozygous, on the theory that if all the good genes were concentrated and the bad ones strictly eliminated, the line could only improve. Most breeders are at least vaguely aware of something called "inbreeding

depression" and will seldom or never make matings that would be termed "incestuous" in humans and they will outcross to dogs they consider to be little related to their own every few generations.

The "quality" which most breeders hope to achieve is keyed largely to "breeding to the standard" or success in competitive events, especially conformation shows. Health issues are often not prime selection criteria, beyond screening for a few specific ailments known to occur in a breed. At one time, dogs with marginal health or soundness would be eliminated from the breeding population by nature or their inability to perform. Today, with few opportunities for screening via vigorous and demanding physical activities and with veterinary medical advances which allow dogs which would once have died or been unable to reproduce to become parents, animals of marginal health can become part of the breeding population, sometimes without the breeder even being aware of their shortcomings.

The show culture confers the mantle of greatest success on those who produce the most winning dogs and the dogs which individually win most often. Some breeders allow the gaudy bubble of big wins become the guiding light of their breeding program, beside which all other considerations pale. When such individuals are successful in producing winners, others buy dogs from them. The more successful they are the more will seek out their stock., at which point the various negative traits they may have ignored in their pursuit of show wins can become wide-spread in a breed.

Meanwhile, genetics marches on. We now know that dogs have 80,000 genes or more. We know that many of these genes, perhaps as many as 95%, determine that what we have is a dog, not a zucchini. Of the balance (at least 4000), some determine that our dog is an Australian Shepherd, rather than a Borzoi or a Papillon. The breeder will have little affect on these because they are "fixed" for dogs or for his breed. But that still leaves a few thousand genes to deal with, not a number easy to keep track of.

New discoveries and, more important to dog breeders, new screening tests for genetic diseases are announced with greater and greater frequency. Some breeders blythely await the day when once can screen for "everything" with a simple blood sample and all dogs with defective genes can be eliminated before they are bred. Unfortunately, that day is not here and is not likely to be for a long time. Such DNA tests as are available are often breed-specific and expensive. To make best use of available testing and such new screening tests as are developed, breeders need to educate themselves on the strengths and shortcomings of each test, determine what it costs and analyse how much benefit their dogs and their breeding programs will derive from each test. For instance, if the percentage of false positives or false negatives is high, it is only marginally useful as a

screening tool. If the cost of having the test done is high and the disease is rare in a breed, is it really beneficial if a line has no known history of that disease?

By becoming informed consumers, breeders can make the best use possible of the technological advances that genetic science provides. But while many people do their best to be savvy consumers, our relationship with science tends to be love/hate. We embrace wholeheartedly those scientific discoveries which support our personal view of life and the world, but those which are inconvenient to our belief systems are shunned. This applies to dog breeders no less than to society as a whole. Once, when the author was trying to explain to a breeder how an unwanted color had occurred in a litter, the breeder informed her, "I don't believe in that genetics stuff." While this case is an extreme one, it serves as a caution to be open to the consideration of new information even if it is presently inconvenient or appears to negate a dearly-held Truth.

Like begets like, therefore closed registries and linebreeding should guarantee the continuation of traits we hold dear. Or will they?

In spite of the best efforts of generations of breeders, genetic disease is on the rise in purebred dogs. Not just in one breed, but in most of them. Some of this is attributable to mis-placed priorities, such as the previously mentioned focus on show wins. A significant portion is due to the culture of denial which demands secrecy about such matters and punishes those who speak publicly about diseases that have occurred in their dogs and, especially, what the pedigrees of those dogs were. But at bottom, the problem exists because we cling to a breeding modality based on cherished but outdated notions of how to breed better dogs.

By closing registries we have, in effect, created "islands" for each breed. While new individuals (and their genes) may reach these "islands" via imports or other means, the "new" individuals are often to a greater or lesser degree related to those already in the closed gene pool, particularly if the existing population is long-established. The gene pool is what it is and one has to make the best of it.

But what happens when the "environment" on those single-breed islands dictates that some of the population will not reproduce? The genes those unacceptable individuals have will be lost if few or none of the other members have them. If the dog was not bred because it had a serious disease or gross physical deformity, it is probably best removed from the breeding population. But what if the dog is only related to one with such a disease or deformity, with no certain knowledge as to whether it did or didn't carry the genes for the problem? Or what if it had a strictly cosmetic fault, such as an unwanted color or a less-than-perfect coat type, earset or tail carriage? Elimination of dogs with

minor faults or which are only suspected of carrying faults can also eliminate the positive genes they carry.

Long study of island species has shown that they can flourish, even though they descend from very few founders and are, necessarily, highly inbred. But Mother Nature culls more harshly than any dog breeder. The unfit and even the marginally fit are not likely to survive to breed. And her ideas of "fitness" have much to do with physical health and soundness and only slightly to do with who is best looking. Even so, island species are often devastated by the introduction of genetically more diverse mainland species that either out-compete the island populations, prey heavily upon them, or introduce diseases to which they are resistant but the island creatures are not. The average purebred dog will only occasionally be "out-competed" by a trendy new import and it isn't likely to become a new breed's preferred entrée, but it can be more susceptible to infectious disease.

Study of the genes which govern the immune system of mammals has revealed that genetic diversity is key to species survival. These genes are often quite diverse, having as many as 100 different forms. Any individual dog can have only one or two types of allele for any of these genes, but the species as a whole has many. So, when a new canine plague comes along—as it did with parvovirus in the late 1970s and early 1980s—many dogs will die but most will survive. But our different breeds, on their various purebred islands, may or may not have the genetic machinery needed to cope.

Since the most variability any one dog can have is two alleles, if a breed has only a few founders, went through a genetic bottleneck due to war or some other disaster, or has been highly subject to the use of popular sires, the diversity of immune system genes may be quite limited.

All purebred dogs are, of necessity, to some degree inbred. They all descend from an ancestral population which was probably regional and which exhibited a group of traits which people found useful or attractive. How inbred they are depends on a variety of factors: How many founders there were, the history of the breed's population (bottlenecks, geographic isolation), and who got bred to whom as well as who got to breed more than someone else. The trick to maintaining overall breed health is to hang onto as much genetic diversity as is possible within the existing population. But our breeding practices almost guarantee that with each generation more genes will be lost.

Many breeders do not realize how inbred their dogs actually are. When degrees of relationship are considered, only three to five generations of pedigree are reviewed. But if the generations just off the pedigree contain the same names over and over, a "loosely-

line bred" dog may have an inbreeding coefficient equivalent to the result of a parent/offspring mating. The use of popular sires exacerbates this situation. When many breeders utilize the same stud, the subsequent generation of dogs will contain many half-siblings. Since popular sires arise in every dog generation, and the popular sires of one generation may be the sons or nephews of those of the previous generation, the level of inbreeding increases.

Some have argued that inbreeding depression—a complex of reproductive woes and susceptibility to diseases—is not a real concern, pointing to laboratory mice as an example. Strains of lab mice are highly inbred, brother to sister for many generations, to render them homozygous virtually all traits. This makes them very useful to researchers because the strengths and weaknesses of each strain are well known and documented so the most useful strain can be selected for a particular line of research.

But dogs are not laboratory mice. No dog breeder would dream of breeding brother/sister for 20 generations or more. And just as well that they do not. When lab mouse strains are developed at least 90% of the lines descending from the original pair will go extinct due to the various effects of inbreeding depression. Even those that survive are not paragons of health and soundness. Some are deliberately maintained due to the presence of a non-lethal defect, others might lack such defects but if cast into the mousy equivalent of the "real world," would soon perish. Without the highly controlled environment of the laboratory, with it's regulated temperature, regular wholesome food, clean water, and—from a mousy standpoint—comfortable quarters, they could not cope.

While our dogs may have the best food and housing we can provide them, they are still much more a part of the "real" world, with it's exposure to inclement weather, microbes and an assortment of other inconveniences, than is any lab mouse. Too much inbreeding puts them at risk of succumbing to those inconveniences.

To maintain our breeds into the next millennium, breeders need to review and revise their priorities.

We can no longer breed for the prime purpose of producing winners in conformation. Physical appearance alone is insufficient to gauge the overall health and soundness of the dog. The physical and mental demands of showing are not sufficient to separate out the marginally fit and the specialized environment of the conformation show will not necessarily select the dog best suited to function outside that arena.

We must put much more emphasis on health, not just the obvious things like hip and eye clearances, but more subtle considerations. Does the dog have stamina? Is it prone to

catch every little bug that comes along? Does it have a queasy digestive system? Is it capable of breeding without veterinary or other human intervention? If it is a bitch, can it whelp, nurse and raise its puppies without extraordinary efforts on the part of the breeder?

Finally, we must strive to maintain whatever genetic diversity remains in our breeds through assortative mating, the mating of individuals who share desirable traits while at the same time sharing as little common ancestry as possible.

If we can do these things, our dogs may survive well into the next millennium. If we do not, they risk extinction.

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