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The Problem With Breeding

SO why are there so many canine misfits around these days? If dogs domesticated themselves, if they have evolved their way into a cozy place in human society by instinctively ingratiating themselves, if they have learned behaviors that elicit a friendly response and play on our preprogrammed sympathies, then why are the veterinary journals full of case reports like this one?

> An 18-month-old male Irish Setter was owned by a young childless couple. The husband was often threatened by the dog and had been bitten several times. The dog would growl whenever the husband entered the room. This usually occured if the wife and the dog were in the room before the husband entered. The dog would willingly go for walks with the husband, but only the wife could be in the kitchen when the dog was eating. The dog was most likely to attack the man when he tried to enter his bedroom if the wife was already there.

It is impossible to say for sure if such problems are getting worse, though there is no doubt that aggression in dogs is a widespread phenomenon. In Baltimore, a city of 80,000 to 100,000 dogs, there were 7,000 attacks on people in one year, according to a classic 1973 study. According to the Centers for Disease Control and Prevention, each year in the United States 800,000 people are injured seriously enough by dogs to require medical attention, 6,000 are hospitalized by dog attacks, and about fifteen, mostly children, are killed.

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Aggression is of course part of the dog psyche; young dogs, particularly males, do frequently test the dominance status of higher-ranking males. Some other specific behavioral problems reflect innate propensities that have simply become incompatible with modern urban life. For example, traditional sled-dog breeds show up disproportionately among dogs that experience what the veterinary behaviorist Katherine Houpt, of Cornell, terms "barrier frustration": they like to run and don't like being kept in a confined space -- and respond by chewing or other destructive behavior.

And of course some dog behavioral problems are owner problems. Because dogs are so good at picking up on social signals, our psychological failings readily affect the way our pets act. A survey of cocker-spaniel owners in Britain found that less-assertive owners had more-aggressive dogs. There has been a distinct upsurge in the "yuppie-puppy syndrome," as young working couples buy dogs and leave them alone at home all day to ruin the house -- and then spoil them out of guilt for neglecting them. There is also a marked tendency, noted by dog breeders and veterinarians alike, for expectations and realities to clash, because members of an increasingly urban society do not always know what they are getting themselves into when they bring a high-energy herding or hunting dog into their lives.

But there are several reasons to think that canine aggression and other behavioral problems as they exist today are not a "normal" part of the evolved relationship. Nor are they merely the result of individual owners' personality traits. Over the course of 100,000 years there should have been a considerable amount of selection (even if it was largely unwitting) against aggressive dogs. And most people who seek help for behavioral problems with their dogs, Houpt says, have "done all the right things." Feral dogs, significantly, are not very aggressive. Studies of urban dogs found that strays were only a third as likely as owned dogs to exhibit aggression toward people when approached. Most wolves are not really aggressive either. There is only one "alpha," or dominant, male in a pack. Most wolves, and most dogs, are not alpha in the natural

scheme of things.

Many people explain the persistence of canine aggression by pointing to deliberate efforts within certain human subcultures to breed aggressive dogs as status symbols or for protection. But even this cannot completely explain what is going on. Notoriously aggressive breeds like Dobermans and German shepherds do show up on lists of problem dogs; but according to Houpt's research, so do springer spaniels and cocker spaniels -- and aggression among these, which hardly rank as notoriously aggressive breeds, may be a phenomenon of the past several decades. Among owners of springer spaniels the phenomenon is widely recognized; they call it "springer rage," only slightly tongue-in-cheek. According to a survey by Houpt, 27 percent of springer spaniels had bitten a person -- at least twice the average rate for dogs.

Such streaks of aggression may seem odd, and they are odd. They seem to be traceable quite directly to the way dogs have been bred for the past century. By now nearly everyone has heard about the evils of inbreeding in dogs, and hip dysplasia and other hereditary diseases are forever being cited by animal-rights activists in their campaigns against pet ownership in general and dog breeders in particular. Such defects are often presented as the inevitable consequence of any attempt by humankind to manipulate or direct the evolution of a species toward characteristics it happens to fancy.

But genetic markers imply that up until a century or so ago people did successfully develop many highly distinctive varieties of dogs -- everything from lap dogs to attack dogs, bird dogs to sled dogs -- without a loss of overall genetic diversity, and without a rise in physical or behavioral abnormalities. The evidence also suggests that the problems that have arisen are less a direct consequence of deliberate breeding practice -- as is usually alleged -- than a largely avoidable side effect of it.

Historically, dogs were mostly categorized by general type. There were sheep dogs, foxhounds, spaniels, pointers, retrievers. But pointers were just pointers -- they weren't German short-haired pointers or Vizslas or Weimaraners. As Wayne's genetic data show, interbreeding and a flow of genes on a worldwide scale was continuing even as this segregation into types was taking place. The types were distinct in both physical appearance and behavior; they clearly had been selected with specific human aims in mind. But the crucial point is that these dogs were defined by form and function rather than by parentage. They were

what livestock breeders would today call "open" or "grade" breeds.

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Beginning around 1870, however, with the establishment of kennel clubs in Britain and the United States, closed breeding books were introduced in the name of developing and maintaining "purebred" animals. A dog could be registered as a Vizsla only if both of its parents were registered as Vizslas. There was more than a little racist thinking behind all of this; writings about animal breeding from the late 1800s and early 1900s are full of exhortations to eliminate "weaklings" and to invigorate the race by maintaining the "purity" of its "blood lines." Look up any bibliography of dog books and the name Leon Fradley Whitney is sure to appear. Whitney was the author of many standard works, including *The Complete Book of Dog Care* (still in print), *This Is the Cocker Spaniel*, *Bloodhounds and How to Train Them*, and *How to Breed Dogs*. What you won't find in a dog bibliography is some other Whitney works, including *The Case for Sterilization*, a paean to eugenics published in 1934. It was such a definitive treatment that the author received a letter of appreciation from no less an authority on the subject than Adolf Hitler. (Whitney in turn publicly hailed Hitler's "great statesmanship" in ordering the sterilization of the feeble-minded and the insane. In an unpublished autobiography written four decades later Whitney still defended his stance, maintaining that "no ruler ever before had had the courage or the knowledge to put sterilization to work." He allowed, however, that in the 1930s he had not been aware "what a vile human being" Hitler was.)

Today, when an unscientific embrace of "biodiversity" is almost as common as the unscientific embrace of "racial purity" was a century ago, inbreeding is often portrayed as an unmitigated evil. But that is almost as much an oversimplification as the uncritical embrace of purity for purity's sake was. Inbreeding has in fact been a vital technique in the development of virtually every strain of plant and animal useful to agriculture, and it is the only way to rapidly develop a line that will consistently produce certain desirable characteristics. This is at heart a consequence of the biological fact that chromosomes come in pairs; one is inherited from each parent. Closely related individuals -- brothers and sisters, parents and offspring -- are more likely to carry the same genes. So a mating between two closely related individuals increases the likelihood that the offspring will wind up with the same gene for a given trait on both chromosomes -- a state called homozygosity. An organism that is heterozygous for a given trait -- that is, has different versions of the gene on

each chromosome -- may look the same as one that is homozygous, but it will not pass that trait to its offspring as consistently. In the classic human example, both a homozygous individual and a heterozygous one can have brown eyes, though the latter has one gene for brown eyes and one for blue eyes. Brown is "dominant" in this case. But the "recessive" (blue) genes carried by two heterozygous individuals may combine in reproduction to produce offspring who are homozygous for the recessive trait and who will thus be different in appearance -- a person with two blue genes has blue eyes. With a homozygous mating, though, what you see is what you get. No matter which of each parent's pair of chromosomes gets passed on to the offspring, the result is the same. In other words, homozygotes breed "true to type" for the traits they have been selected for.

But since closely related individuals have a lot of other genes in common too, inbreeding also increases the chances that any genes for undesirable recessive traits carried at other sites on the genome will combine to produce trouble. Inbred faults in domestic animals tend to be recessive because genetic diseases caused by dominant traits are quickly weeded out in a breeding program: eliminate from the breeding population all the animals that manifest such a disease, and you eliminate the genes for that disease from the entire breeding population. (It takes but a single dominant gene to cause a dominant disease, so there are no "silent" carriers of such genes.) But genetic diseases that show up only in an animal homozygous for a recessive trait can be carried silently for generations. Only when two carriers happen to mate will the disease appear.

Genetic data confirm that the past century of dog breeding has produced some extremely inbred animals. Surveys using gene markers show that the chance that two members of a typical human family will have a different combination of genes at a given site is about 71 percent. In crossbred dogs it is 57 percent, in most purebred dogs 22 percent, and in some rare breeds four percent. Even crossbred dogs are more inbred than the most inbred human populations (the Amish, for example, or families in India in which uncle-niece marriages take place).

This degree of uniformity means that when a bad trait does get locked in by chance, it tends to stay as long as breeding is confined within the group. And a raft of genetic diseases have been turning up in a variety of dog breeds. Some of them are truly bizarre: epilepsy in poodles, sudden muscle rigidity in Scottish terriers ("Scottie cramp"), chronic fever in Shar-Peis, tumors in flat-coated retrievers, congestive

heart failure in boxers.

The dog-show world -- the American Kennel Club in particular -- is often blamed for having created these genetic diseases through an obsessive preoccupation with physical appearance in breed definitions. But that criticism misses most of the point. Selecting for one thing (such as looks) doesn't mean you can't also select for other things (such as herding behavior and good health) at the same time. Breeders can narrowly select for traits that suit their fancy and still not unlock recessive diseases or lose desirable behaviors -- *if* they start from a large founding population and make sure that they keep a broad representation of the founders' gene pool in all subsequent generations. Working foxhounds are intensely scrutinized for body conformation at competitions; they are also meticulously selected for their ability to follow a fox's trail and to work together as a pack, and their readiness to speak when they find scent. Border collies are selected for herding ability; they almost all happen to have white collars and white tips on their tails as well.

The real source of genetic trouble in many breeds is not so much that dogs are being bred for looks or to meet other narrow criteria as that the breed has relatively few founders. Many breeds suffer from the "popular sire effect" as well, and here criticism of the breeding world is more justifiable. A stud dog that wins a blue ribbon at a major show may father hundreds of litters, swamping the gene pool with his virtues -- and defects -- and crowding out some other ancestral lines altogether. The problem is worse in breeds that have gone through a genetic bottleneck. A number of breeds that exhibit strange recessive ailments, including Irish wolfhounds, flat-coated retrievers, Portuguese water dogs, and Shar-Peis, almost disappeared at some point during this century and were reconstituted from very small populations.

Streaks of aggressiveness in a breed like the springer spaniel could likewise be the result of recessive traits being inadvertently locked in to a closed population with a relatively small founder base. But selection may play a role too, and this is another instance in which the show ring may be to blame. Dogs that carry their heads and tails erect catch the attention of judges, and thus tend to win shows. Those are also the marks of a dominant, hence aggressive, dog. Some show-dog breeders don't actually live with their dogs (the dogs stay in kennels), and so are willing to put up with bad traits in a single-minded pursuit of the perfect coat or the half-pricked ear.

Fixing the Damage

ONE strikingly counterintuitive conclusion of modern genetic studies is that the worst way to correct these mistakes of the past is to weed the carriers of genetic diseases out of the breeding population. The central fallacy of the racist view of eugenics was embodied in the claim that purity is genetically invigorating. In fact just the opposite is true -- genetic diversity is invigorating (thus "hybrid vigor," well known to agricultural breeders), because it helps to ensure that breeding for homozygosity in desirable traits doesn't at the same time breed for homozygosity in undesirable traits at other sites on the genome. Even disease carriers have a valuable contribution to make in preserving heterozygosity: a dog that carries an epilepsy gene, for example, could also very well carry a gene that protects against cancer. That is a point that Deborah Lynch, of the AKC Canine Health Foundation (which spends about $1 million annually on academic research into canine diseases, about half of that in genetics), emphasizes.

The key is not to cull the carriers (that is, animals that possess just one defective gene and so don't exhibit the ailment) but, rather, never to breed two carriers. "The first thing a novice breeder will do is say, 'Oh, my gosh, there's a problem in my line, I'm going to get rid of everything and start over,'" Lynch says. "Well, all you're doing with that is starting over with someone else's problems." The solution is to keep parentage as diverse as possible while correcting the problem -- and correcting it will become easier and easier as more genetic probes for specific canine ailments are developed.

Clearly, dog breeders are becoming far more sophisticated in their understanding of genetics and more forthright in facing up to inbred problems that just a few years ago they tended to disregard. But old habits die hard, and amid the eclat of new genetic research one can occasionally make out strains of Leon F. Whitney's old tune. A number of breeders are seeking genetic probes not to detect disease but rather to measure "genetic purity" -- to test, for example, if a Vizsla really is a Vizsla, or if (horrors) tainted blood has crept in. But breeding for the purity of the breed is like hiring a storyteller not on the basis of how well he tells stories but after looking at how many generations of Irishmen he has in his background. The fact is that any genetic markers that happen to be associated with a given breed are just a matter of chance. Yes, it is possible, owing to the high degree of inbreeding in dogs, to find some (usually junk) DNA that is unique to one

breed. But that is a matter of genetic chance, not genetic necessity, and a breeder who set out to foil the system could easily do so. A dog might be bred deliberately to pass the Vizsla genetic-purity test while looking like a cross between a Pekingese and a coyote. A more sensible strategy would be to breed dogs for chosen characteristics and for the maintenance of genetic diversity. From a scientific point of view, it is perfectly possible to do this while satisfying the desires of dog breeders to maintain distinctive breeds. Zoo keepers go to great lengths to ensure that subsequent generations of the rare species in their care -- considered as a worldwide population -- will reflect the total range of existing genetic diversity within the species. Zoos are continually swapping breeding animals or frozen semen.

Individual dog breeders do not have the same incentive to act in concert; the short-term rewards still go to those who can offer puppies that were sired by a champion dog. In the long run, however, the increased availability of genetic tests will make it obvious which breeders have sacrificed good genes in their quest for puppies with flashy pedigrees. Already there are genetic probes available to detect carriers of cystinuria in Newfoundland dogs; Von Willebrand's disease, a bleeding disorder, in poodles and Manchester terriers; and copper toxicosis in Bedlington terriers. Many breed clubs are requiring, or providing strong incentives for, the use of such tests as they become available.

The sheer diversity of dog breeds, and the fact that up until a hundred years ago -- a blink of an eye in terms of evolutionary time scales -- genes flowed freely throughout the global dog population, together imply that we still have ample genetic reserves that can be drawn on to undo any damage recently done. Taken as a whole, the genetic diversity of the dog remains as great as that of its wild ancestors.

We can take some reassurance, too, from the fact that mutts, owned and unowned, will always be with us. Despite the efforts of neo-eugenicists to ostracize them, mutts constitute a vibrant reservoir of canine genetic diversity. Mutts tend to be healthy dogs, because of hybrid vigor. They also tend to be good dogs. And in a very real sense mutts today embody the evolutionary heritage of the True Dog -- that animal that evolved with us, that adapted to and exploited our society, and did so largely on his own terms. Defiant of human fashion and whim, selected only in accordance with the ancient evolutionary dictate that demands nothing more than an ability to get along with

rather gullible human beings, mutts are really what dogs are about. If worst comes to worst, perhaps they will set us straight, just as their ancestors so ably did -- at least for 99,900 of the past 100,000 years.

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