

The Science of How Behaviour is Inherited in Aggressive Dogs



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Probably most people recognize that every dog breed results from human manipulation of inherited physical traits. Until recently, most people probably also recognized that much dog behavior is also a result of manipulating inheritance: if you want to do sheep trials, you get a border collie. If you get a beagle, he will likely become instantly deaf to your calls if he picks up a scent to track. But after discussion started about perhaps banning breeds who often attack and kill, defenders of these breeds began to dispute the heritability of any kind of dog behavior.

Conformation

Only when behavioral inheritance is understood, beginning with basic biological concepts, can we have a clear and honest discussion about aggression in domestic dogs. First, we must understand the relationship between “physical conformation” and “behavioral conformation,” which may be seen as opposite sides of the same coin. “Physical conformation” describes how a dog has been bred to become physically shaped specifically for the task we want him to perform. The purpose-bred dog’s body—brain, skeleton, muscles, and metabolism—will be different from those of other dogs. The dog will feel physically comfortable doing the job, whatever it is.

The border collie is physically designed for the stalking stance and for switching easily and often from standing to lying down to standing again. A greyhound enjoys sprinting, with a deep chest that easily provides enough oxygen to the dog’s muscles to fuel a burst of high speed. The same deep chest means the greyhound cannot run marathons because the deep chest prevents a greyhound from losing heat efficiently. The greyhound’s brain has been shaped by selective breeding to steer the legs in a gait that provides maximum speed in a sprint. The unique composition of a husky’s skeleton, muscles and brain enables a husky to pull a sled with a different gait, and to sustain a brisk pace for long distances. The greyhound runs by leaping, the husky by pushing, always with one foot on the ground. Each dog is genetically wired to use the specific body the dog has.



Selecting for Performance

Dog breeders have for centuries selected for particular traits by simply watching how a dog performs. They have bred dogs for specific tasks by removing the dogs who perform less well from their breeding stock. Sometimes they will cross in a dog breed they think will add traits to perform the task better. Breeders select for performance without always knowing exactly which traits they are breeding for. For example, until recently no one realized the husky was being bred for a particular heat economy; they just chose the dogs who kept running the longest. Eventually, successful breeders produce dogs who are physically shaped to do the dog's task better than any other dog, no matter how well the other dog is trained. "Physical conformation" leads to "behavioral conformation." First of all, each dog's brain is genetically predisposed to grow to efficiently direct the body it is born in. Then the dog's brain adapts itself further to the body it is in as it grows in the developing puppy. There is no gene for running or stalking, but there are genes that give a dog four legs and make those legs longer, shorter, more or less flexible, and so forth. It is because of the action of the genes that confer differently shaped bodies and brains that the pointer enjoys pointing, the border collie stalks and stares, the Newfoundland floats in cold water, and so on.



Selecting for aggression

Just as we cannot make a dog into something the dog has no genetic capacity to be, we cannot prevent a dog from being what the dog is genetically predisposed to be. Because inherited postures and behaviors are suitable for the body and brain the dog was born with, they are internally motivated and internally rewarded: they feel good. This means that inherited behavioral traits are practically impossible to extinguish by manipulating external environmental stimuli. In breeding dogs to perform certain tasks or have a certain look, humans often select (sometimes inadvertently) for abnormalities in body and behavior. We do this by looking for mutations and then breeding for them, or by crossing breeds to get combinations of traits. to speed the process up. A clear case of this is the old English bull dog, who can hardly walk, hardly breathe, and cannot be born except by Caesarean section. The bull dog has also been crossed into other breeds by people who wanted to increase aggression in a breed without waiting for mutations to appear. There is such a thing as normal aggression in dogs, as in all animals. Maternal defensiveness, territorial defense, and predatory behavior and depend on different neuronal and hormonal mechanisms, and are all normal coping responses. These dog behaviors have been accepted by humans in the process of domestication, as long as the behaviors can be foreseen.



Serotonergic dysfunction

But abnormal disinhibited behavior is not functional, and it is unpredictable. Although high arousal and sudden attack can be functional in certain environments, this behavior is pathological in a safer environment, where a high level of arousal and aggressiveness are not necessary and only lead to unnecessary attacks and injuries. Research implicates the frontal cortex, subcortical structures, and lowered activity of the serotonergic system in impulsive aggression in both dogs and humans. Impulsive aggressive behavior in dogs seems to have a different biological basis than appropriate aggressive behavior.

Kathelijne Peremans, DVM discovered this by studying two different populations of impulsively aggressive dogs. Each dog had executed one or more attacks without the classical preceding warnings, and the severity of the attacks was out of all proportion to environmental stimuli. Peremans found a significant difference in the frontal and temporal cortices of these dogs, but not in the subcortical areas, compared to normal dogs. Peremans also found significant dysfunctions of the serotonergic systems among these dogs. Serotonergic dysfunction has been widely shown in many different species to be connected to abnormal, impulsive aggression. Peremans studied dogs of various breeds, selected purely on the basis of their behavior. Peremans was not interested in implicating any particular breed, but rather in finding the mechanism behind the behavior in any dog it occurred in. She found that all of the dogs with a history of abnormal impulsive aggression shared the same physical abnormalities in the brain. The gender of the dog made no difference. Neither did whether the dog was castrated or spayed. Peremans left open the possibility that we will later find other physical factors that contribute to abnormal impulsive aggression. For example, the adrenergic system may also play an important role.

Heritability of behavior

Another researcher, Linda Van Den Berg, investigated specifically the heritability of impulsive aggression among golden retriever, a breed rarely involved in fatal and disfiguring attacks. The goal was find out whether impulsive aggressive behavior was inherited in those few golden retrievers who exhibit it, and if so, to isolate the gene responsible for the behavior. Van Den Berg found high heritability of impulsive aggression but did not succeed in isolating the responsible gene(s).

The heritability of abnormal aggression in certain breeds of dogs can no longer be denied. The bodies of these dogs have been selected to execute a killing bite more efficiently than other breeds. These dogs share physical conformation to the task of killing, including exaggerated jaw muscles, heavy necks and shoulders, and body mass that makes defense against an attack much more difficult. Among people who want dogs who can kill, these are the breeds of choice because they are physically more fit for it than other breeds.

Behavioral conformation

But breeders also selected for behavioral conformation. To perform well, a fighting dog had to attack without provocation or warning, and to continue attacking regardless of the response of the other animal. Bull and bear-baiting dogs had to be willing to attack in the absence of the species-specific signs that normally provoke aggression, responding to the mere presence of another animals, and not stopping in response to external stimuli. The Dogues du Bordeaux used to guard extended farmlands in France, the Boerbulls used similarly in South Africa, and the fugitive slave-chasing dogs of Latin America, such as the Dogo Argentino and Fila Brasileiro, all were selected to specifically for a propensity to kill. As they selected for performance, breeders could not know exactly which physical changes they were selecting for. But research now shows that selection for aggressive performance includes consistently selecting for very specific abnormalities in the brain. These abnormalities appear in many breeds of dog as an accident or anomaly, which breeders then attempt to breed out of the dogs. In the case of the aggressive breeds, the opposite occurred. Rather than excluding abnormally aggressive dogs from their breeding stock, breeders focused on creating lineages in which all the dogs would carry the genes causing them to reliably exhibit the desired impulsive aggressive behavior.



“That aggression is not heritable is not tenable”

Now that we know exactly which brain abnormalities the breeders of fighting dogs have been selecting, the assertion that this aggression is not heritable is no longer tenable. It is also not tenable to assert that not all the dogs of these breeds will carry the genes that make them dangerous. These genes may occasionally drop out through random accident, just as golden retriever may acquire the genes to be impulsively aggressive. But the failure to have these genes, in the aggressive breeds, is just that—a failure. It is therefore misleading to assert that the aggressive breeds will only have the selected genes as a matter of accident, or that most of them will be fit to interact safely with other animals and humans.

As in the pointer, the husky, the greyhound, and the border collie, the genes of aggressive breeds have been selected so that certain postures and behaviors just simply feel good. These dogs will seek opportunities to execute the behaviors they have been bred for. Because these behaviors are internally motivated and rewarded, they are not subject to extinction. Learning and socialization do not prevent these dogs’ innate behaviors from appearing.

Adaptive response

Environments such as the fighting pit, confrontations with tethered bulls and bears, and the pursuit of escaping slaves, for which these behaviors were selected as an adaptive response, are so extreme that there is no appropriate context for these behaviors in normal life. Functional in the pit or facing the bull or bear, these behaviors must, in all other contexts, be called pathological. Because the behavior selected for was impulsive aggression, by definition this behavior will always emerge suddenly and unpredictably. Speculating in favor of the aggressive breeds, suppose that human artificial selection will fail as infrequently in the aggressive breeds as it does in the golden retriever. Van Den Berg found impulsive aggression in approximately one out of a hundred golden retrievers. If behavioral selection fails comparably often in fighting breeds, there is only a 1% chance that their keepers will not endanger others in their surroundings.

Can aggression be bred out?

Can impulsive aggressive behavior be bred out of fighting breeds? The fiction that, for example, the American Staffordshire terrier is a different dog from the pit bull, just because the breeding has (also fictionally, by the way) been going on separately for several decades is just that: a fiction. The Russian researcher Dmitry Kontanovich Beljaev reported that he had bred fear out of foxes in only eighteen generations, but impulsive aggression is a more complex response and much more dangerous to live with while you try to breed it out. Further, Belyaev's foxes were bred under laboratory conditions, where there was absolute control over not having the wrong genes creep back in again.

As Belyaev bred his foxes into the petable creatures he wanted, they began to have an increasingly floppy-eared mutt exterior. Belyaev's discoveries suggest that the interface of physical and behavioral conformation mean it is not possible to breed out the impulsive aggressive behavior of fighting dogs while retaining their shape and appearance. Form follows function: one cannot have a dog whose entire body and brain are adapted to executing the killing bite, without having a dog who will execute the killing bite.

