

# Both Ends of the Leash

## Fear in Dogs: Where does it begin?

Patricia B. McConnell

Imagine this: a purse falls off a chair in the vicinity of two seven-month old puppies. Terrified, one of the puppies refuses to go anywhere near it. Her sister takes a look, gives it a quick sniff and then leaps over it and goes on her merry way. Scenarios like this happen every day to Holly and Kit, the Border Collie/Beagle mixed-breed pups adopted by the editors of Bark a few months ago.

Rescued from a shelter in Kentucky early this year, littermates Holly and Kit have been in their new home in northern California for several months now. As far as is known, the pups' first five months of life were less than ideal; they seem to have lived outside on their own and had little contact with people. Not surprisingly, they arrived at their new home timid and shy. Since then, Kit has come out of her shell, romping happily around local off-leash parks with her “big sister,” Lola. Holly is a different story; she is sweet and loving at home, but extremely skittish in other contexts. But even at home, small changes in the environment – like a purse falling from a chair – overwhelm her.

That sisters would behave differently isn't shocking to any of us with siblings or children, or anyone who has watched one puppy battle through life while a littermate calmly accepts whatever comes her way. We all know that sisters and brothers, whether human or canine, are not clones. No matter how similar the upbringing, minor differences in siblings' genetic make-up account for major differences in behavior. But beyond that, what do we know about what influences a dog's approach to life? What's new in our understanding of the ontogeny of fear? In particular, what can make a fearful dog like Holly so different from her more outgoing sister?

**Genetic Blueprints.** The answer begins, of course, in the genetic makeup of each dog, which is unique



to that individual. After all, the point of sexual reproduction – an inefficient and messy process (genetically speaking) – is variation. Each parent contributes one strand of DNA to the double helix that makes up each chromosome, and the strands link up in unique ways each time a new life is created. Thus, every individual is the result of a unique combination of genes. In an environment with a range of conditions – perhaps a drought one year and floods the next – genetic variation ups the odds that some individuals will survive even if others perish, thus ensuring continuation of at least some individuals of their particular species.

This variation isn't news to dog lovers – we are all well acquainted with canine physical variation, from flat-noted Pugs to skinny-muzzled Salukis. This genetically mediated variation is equally true of behavioral predispositions. According to research done over the last 30 years on personality, one of the most heritable behavioral characteristics relates to the behavior of Holly and Kit. What is now called the “shy-bold continuum” has been found to be a relatively stable aspect of personality in rhesus macaques, cattle, people and dogs (to name a few). It appears as though different points on the “shy-bold” spectrum are advantageous at different times. For example, primatologist Steve Suomi has found that in some conditions, shy male rhesus macaques have higher reproductive success than bold ones. The shy males wait longer to leave their natal troops, and thus arrive at a new troop larger and better able to hold their own when challenged by established males. (But sometimes it helps to be brave and bold; what if there are only a few troops in the area and the bold

monkeys become established in them before the shy ones venture forth?)

One can easily imagine how, in some contexts, the progenitors of domestic dogs were best served by boldness (being the first to venture near a human settlement) or by caution and timidity (letting a littermate be the one to go play with that big, fuzzy animal that humans call a *lion*). What is not clear yet is how much of a dog's physical appearance is linked to behavioral tendencies. Holly looks more like a Border Collie than does her sister Kit and, in general, we know that shyness is relatively common in many of the herding breeds. Could there be a link between looks and personality?

There has been shockingly little research on the links between physical appearance and behavioral tendencies, but Swedish ethologist Kenth Svartberg did some interesting work on personality in dogs while at Stockholm University. One of his studies found “large behavioral differences between breeds in the traits [of] playfulness, curiosity/fearlessness (similar to the “shy/bold” continuum mentioned earlier), sociability and aggressiveness.” Clearly, there appear to be strong genetic links between looks and behavior. Does that mean that more of Holly's genes relate to the Border Collie in her? Could be. Of course, we'll never know, but it is certainly possible and biologically logical to predict links between a dog's appearance and her personality even within a litter.

**Starter Houses.** Beyond an understanding of the role of genetics, research is increasingly focused on the effect of in-utero experiences on the development and, ultimately, the health and behavior of an individual. Until recently, our developmental considerations have focused on the influence of genetics and the environment during “early development” – the old nature/nurture argument, as it were. The period we defined as “early development” began at birth and followed an animal through infancy, childhood, adolescence and adulthood. However, new information has alerted us to the important influence of in-utero experiences, an environment we've never before considered as having an affect on an adult animal. Much of the research I'll mention here was done on humans, but there is no biological reason to not generalize it to canids.

In general, the influence of a mother's experience on her fetus is profound: Her sleep pattern teaches the developing child about the cycle of day and night. Her food preferences influence her baby's after birth; if the mother is seriously deprived of food, her infant will be pre-disposed to diabetes and high cholesterol as an adult. Most relevant to a fearful puppy, a mother suffering from extreme anxiety puts her offspring at high risk of being anxious and fearful, even as an adult. Apparently, high levels of the stress hormone cortisol produced by the mother result in fewer cortisol receptor cells in the pup (or child or monkey, etc.). This low number of receptor cells means that the pup's brain is unable to perceive and respond to high levels of cortisol in his own body until the system is overloaded with it. Then the brain goes on red alert, sending the emotions into full panic mode, even in situations that would be only mildly stressful for an average individual.

In addition to the significant influence of a mother on her young, we also know now that the experience of each individual within the uterus is different. Minor differences in nutrients, for example, have long been known to be a factor in major differences in the size and health of animals within a litter. Even genetic clones – identical twins, for example – aren't behaviorally identical. Though they may look alike, they usually have remarkably different personalities. Since they developed with the same set of genes, only in-utero experiences can account for their behavioral differences. Developmental psychologists are learning that for twins, development in the womb is a kind of dance between the two that, by the time they are born, has shaped their personalities.

Another example of the influence of in-utero development is what's called “androgenization.” In this phenomenon, females in a litter are permanently affected by the androgen produced by male puppies surrounding them within the uterine horns. Androgen is the precursor to testosterone, and females who are “bathed” in it, perhaps because of their placement between a large number of males, tend to behave differently than other females once they develop into adults. Androgenized females behave more like males, sometimes have enlarged genitalia and are often more aggressive to same-sex individuals.

And so, even prior to birth, profoundly different experiences could have shaped Holly and Kit. The combination of different genetic blueprints and different experiences inside the womb resulted in two dogs with very different personalities and tolerances. Even though they have grown up together, those beginnings mean that a similar environment will affect them in different ways as they continue to develop. Holly will probably always be more cautious than Kit, because much of who she is was established before she was born. This is not to say that shy little Holly can't become more comfortable at the dog park – or with runaway purses – but it does remind us how and why every dog is a unique creation and special in her own way. And special they are, every one of them.

Good luck, Holly...we're rooting for you!

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