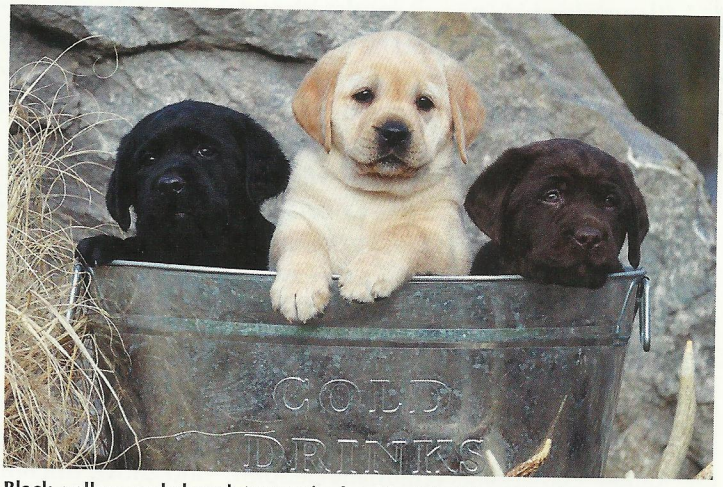
The Great Dilute Debate

by Caroline Coile

When a dog named Silver is as Good as Gold, CD won High in Trial at the Labrador Retriever Club of the Potomac in the spring of 2012, it fueled a controversy that had been simmering for decades. That's because as the name implies, Silver is as Good as Gold is a Lab of a different color – silver, to be exact. And for traditional Lab enthusiasts who contend the breed comes in three, and only three, colors – yellow, black, and chocolate – silver is simply unacceptable.



Black, yellow, and chocolate puppies bred by Wig Wag Labradors. Photo by Sharon Wagner.

Dilute black (charcoal) Labrador. Photo courtesy of Phantom Labradors.

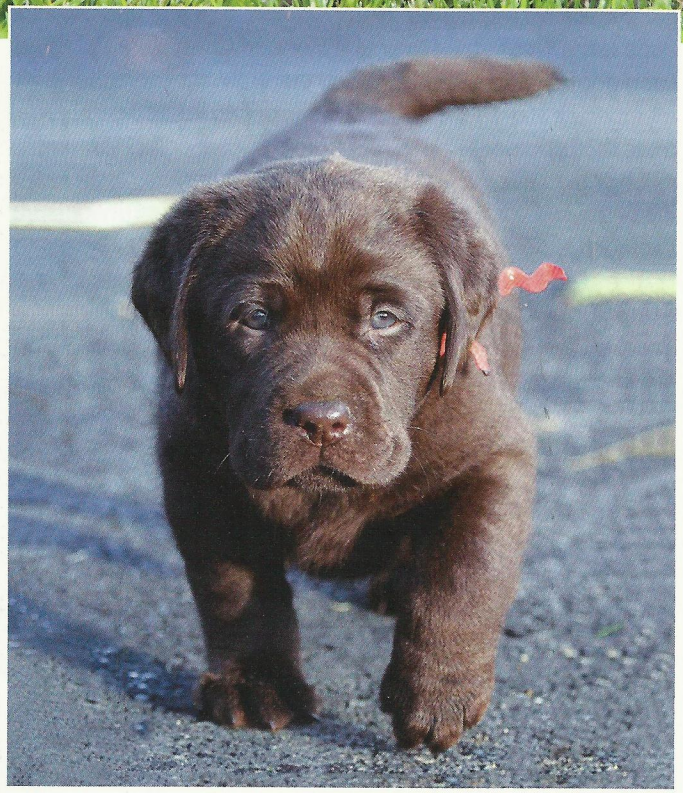
The controversy springs from a 1981 breeding between two chocolate Labradors that produced a surprise: a silver puppy. Repeat breedings produced additional silver puppies. The breeder, Dean Crist of Crist Culo Labradors, interbred these puppies to produce additional silvers. Crist contended that the coloration was the result of a recessive gene that had always been in the Labrador gene pool; critics suspected a cross to another breed.

Silvers, or *dilutes*, come from the combination of two recessive genes not usually found in Labs: the "d" gene. A dog needs two copies of this gene for the dog's color to be affected, either changing it to a shade of gray or silver. The important thing to remember is that both parents must carry at least one copy of the "d" gene to produce a puppy with two copies. That means that puppies from a first-generation cross between a traditional Lab and a Weimaraner, for example, would carry only one copy of the "d" gene and so would not be dilute. Only by crossing the puppies amongst themselves could "dd" (dilute) puppies be produced. In other words, if breed crossing had occurred, it would take at least two generations to produce a silver Lab.

Off-Color History

The rootstock of the Labrador breed were black and, occasionally, chocolate. The first officially recorded chocolates were born in 1892. The first officially recorded yellows were born in 1899. Yellows were initially disliked by most breeders but gradually became accepted. Chocolates came into their own in the latter part of the 1900s but not without contro-

Dilute chocolate (silver) Labrador puppy. Genetic coat color profile: Eebbdd. Photo by Carleton Pope.



Chocolate seven-week old male bred by Wig Wag Labradors. Photo by Sharon Wagner.

versy. Although some breeders suspected they arose from crosses to pointers, more believed this was unlikely because liver was mentioned as a color in the 19th century, and because several closely related retrievers also came in liver.

No reports exist of silver Labradors recorded in the official stud book from 1878 until the 1980s. It's possible silver dogs were culled, or simply not reported, but it's noteworthy that other color oddities, including brindle, black and tan, and chocolate and tan, made their way into the studbook. So why weren't silvers noted?

Sharon Wagner, of Wig Wag Labradors in Litchfield, New Hampshire, believes they weren't noted because they didn't exist. "No dilute dogs have ever been produced or recorded in other countries aside from those imported from the U.S. No dilute dogs were ever recorded in the early stud books in the UK. To suggest that all were culled and none were even noted is very unlikely," she says. "To suggest that the dilute coat color could have lain dormant for a hundred early years of the breed [1880-1980] is just not statistically possible. The Labrador is the most popular dog in Europe, and the lines that they breed today go back to the same lines as our show dogs here in the U.S."

Carleton Pope, of Starstruck Labradors in Calgary, Alberta, Canada, believes another force was in play. He points out evidence that early records of UK Labs with non-Lab ancestors were altered, changing the color descriptors to B, Y, or C, or deleted: "The same thing happened in the U.S. If 'grey' colors were listed, then due to studbook cleansing, it is now nearly impossible to prove or disprove unless someone can acquire a studbook printed prior to the cleansing."

A curious comment appears on page 116 in the 1988 book *Advanced Labrador Breeding* by Labrador retriever authority Mary Roslin-Williams: "There is another colour which I had heard of but never seen and that was a rumour of a bluish or silver Labrador in the old days, with a dark stripe or stripes

Labrador Colors Decoded

Traditional Labrador retriever coat colors are determined by genes at two locations: "B" and "E."

B: The "B" locus determines if the coat appears black or chocolate. The dominant allele, "B," codes for black; the recessive allele, "b," codes for chocolate. A dog must have two copies of the "b" allele to be chocolate.

E: The "E" locus determines if eumelanin (black, brown, or gray colors) versus phaeomelanain (red, gold, or yellow colors) will be produced in the hair. The dominant allele, "E," allows eumelanin to be expressed; all black and chocolate Labradors have at least one "E" allele. The recessive allele, "e," does not allow eumelanin to form; dogs with two copies of "e" will be "yellow" Labs no matter what alleles are at the "B" locus.

D: The "D" locus is at the center of the silver controversy. It determines whether colors are fully saturated or diluted. The dominant allele, "D," allows full saturation, such as black and chocolate. The recessive allele, "d," causes black to be diluted to gray and chocolate to be diluted to mousey silver.

Various Combinations...

B- D- E- = black

bb D- E- = chocolate

B- D- ee = yellow

bb D- ee = yellow

B- dd E- = charcoal

bb dd E- = silver

bb dd ee = yellow with gray nose and pads ("champagne yellow")

down the back. Funnily enough a litter of these turned up recently from perfectly reputable breeding and in the hands of a good breeder who knew that no misalliance had taken place...." She goes on to say: "I haven't seen these puppies when adult to know what shade of black they became, whether dull lead as I would expect or a true black."

Silver proponents believe this passage is evidence of a charcoal Labrador, and that the gene was in the population in the "old days" – which for Roslin-Williams must have meant the 1920s or earlier. However, Roslin-Williams never reports seeing a silver Labrador first-hand, and the one puppy from the silver litter she saw as an adult she reports grew into a true black.

"Williams' notes could easily be interpreted as describing a gray soft coat that is sometimes seen on correct black dogs," explains Wagner. "Sometimes blacks are born with a grayish puppy coat that looks duller than a typical black puppy. This falls out and is replaced by a correct black coat and has nothing to do with the dilute gene."

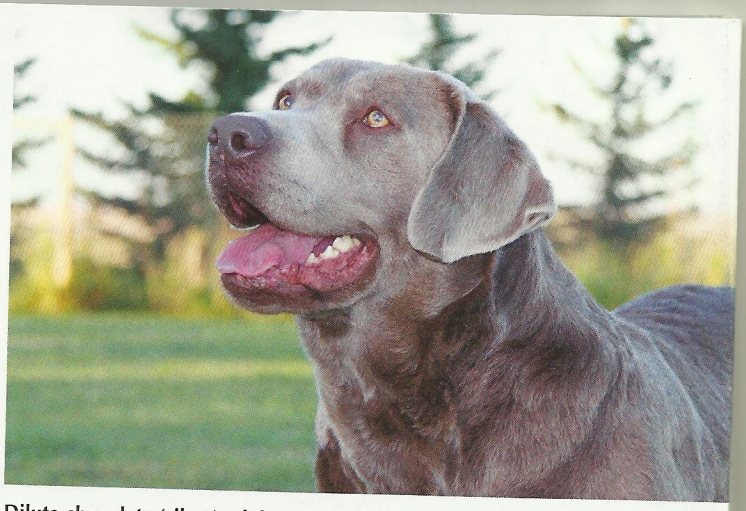
Pope cautions that "puppy coat colors can sometimes play tricks, so it is not conclusive to address what may or may not be seen in a puppy coat. But the dog from the 'old days' that Roslin-Williams refers to would seem to be an adult. To this day, it is possible to find an unusual dilute Labrador with what appears to be the described 'stripes' down the back."

The first documented report of a silver Labrador occurred with the Crist Culo litter in 1981. In the mid 1990s, an unrelated line, Beavercreek, produced a charcoal gray puppy. The two litters that produced dilutes were unrelated at least within the first five generations; however, as with all purebred lines, they eventually share ancestors. According to Wagner, many Culo and Beavercreek dogs share common ancestors produced by a particular kennel that bred not only Labradors but also pointing breeds as far back as the 1920s.

Pope brings up an interesting point, however. If the dilutes descend from a cross to a Weimaraner, it had to occur after 1930, as the first two Weimaraners didn't come to America until 1929. Of course, other breeds, such as the Newfoundland and possibly the Chesapeake Bay retriever, also carry the dilute gene, and these breeds have been crossed with Labs at various times in the breed's early history.

Regardless of which breed was responsible, or when, could the common ancestry behind the Culo and Beavercreek lines account for all present-day dilutes? Maybe. "All dilute dogs appear to share both Beavercreek and Culo lines, which were heavily inbred," says Wagner. "Any pedigree search will show this. Newer common lines of dilutes can also be traced back eventually to these kennels as well. Dilute breeders will weave in and out in order to keep producing the colors."

In the 2000s, several additional lines produced silver puppies. Proponents of dilutes contend that silver puppies may be more common now because chocolates are more common; or that breeders are now more likely to report them. Critics believe that they may be more common simply because breeders wish to cash in on the "rare color" fad, and question whether recent – perhaps purposeful – crosses to other dilute breeds could be responsible.



Dilute chocolate (silver) adult. Eebbdd genotype. Photo by Carleton Pope.

According to dilute breeder Pope, there are about 300 known breeders of dilute Labradors in North America, with the possibility of hundreds more without an online presence. Pope is the president of the newly formed Council for Purebred Labrador Retrievers (CPLR), which currently has more than 150 members. It states its mission is to "preserve, improve and promote the Labrador retriever, regardless of coat color." Among its objectives is to "refute the unfounded claims of crossbreeding with fact-based information that substantiates purity of Labrador retrievers that possess the MLPH [dilute] gene."

Standard Colors

The AKC registered the first Labrador retriever (black) in 1917, the first yellow Labrador in 1919, and the first chocolate in 1932. From 1916 through the 1950s, the standard in both the United States and United Kingdom described the color as "generally black.... Other whole colors are permissible." Proponents of dilutes question why, if there were only two or possibly three colors known in 1916, didn't the standard simply name them? They contend that this is evidence that more than three colors were around and accepted.

In 1957, the AKC standard was changed to describe the color as either black, yellow, or chocolate, as follows: "Blacks are all black...; Yellows may range in color from fox-red to light cream...; Chocolates can vary in shade from light sedge to dark chocolate...." Proponents of dilute Labradors contend that dilute dogs represent a light sedge version of chocolate, and so meet the standard.

By the mid 1980s, the AKC added the option of "other" to AKC registration applications, which already had options for black, yellow, and chocolate. Most owners registered their silver Labs as "other" and wrote in "silver." That option was later removed so that the current options are only black, yellow, and chocolate.

In 1994, the AKC standard modified the definition of chocolate to shades from "light to dark chocolate." Silver proponents again contend that light chocolate describes the silver shade. The standard was also modified to state that any color besides black, yellow, or chocolate is a disqualification. A disqualification means the dog cannot compete in conformation classes, but can be registered and can compete in

all other events. In 1997, representatives from the AKC and its parent club, the Labrador Retriever Club (LRC) examined the situation with silver Labs and determine they should be registered as chocolate.

More recently, the AKC issued the following statement: "There is no genetic basis for the silver gene in Labradors. The silver color is a disqualification under the Standard for the breed. The LRC does not recognize, accept, or condone the sale or advertising of any Labrador as a silver Labrador. The Club opposes the practice of registering silver as chocolate."

According to the CPLR president Pope, some members of the LRC have suggested identifying Labradors from dilute bloodlines by adding a special character onto their registration numbers. Pope and the CPLR object to this, saying: "Such a policy produces the potential for an endless list of breed qualifying DNA tests ranging from physical conformation characteristics to genetic diseases. We are willing to accept either no change to the status quo, or preferably, the registration of dilute Labradors as charcoal (dilute black), silver (dilute chocolate), and champagne (dilute yellow)."

Pope adds, "If breeders or the breed club wish to distinguish certain Labradors with special characters, they should first focus on dogs known to produce or exhibit debilitating and life-threatening heritable diseases – not on dogs known to produce or exhibit certain coat colors."

Wagner doesn't agree, pointing out that while a few breeds use letters on their AKC registrations to identify disqualified colors, no breed uses any such means to identify carriers of colors or genetic conditions. "Dilute Labradors are a disqualification," she says. "A dog carrying yellow or a dog carrying PRA [progressive retinal atrophy] is *not* a disqualification."

Back to the Genes

The three traditional Labrador colors are produced by variation at two loci that control (1) whether a dog is black or chocolate; and (2) whether a dog is yellow regardless of whether it would otherwise be black or chocolate.

Genes at an additional locus, the "d" locus, are responsible for determining if the dog has fully saturated color or diluted color. The Labrador retriever has traditionally been assumed to have no variation at this locus; that is, all dogs are homozygous (two copies of the same allele) for the dominant "D" allele for full saturation. Silver dogs, however, are homozygous for the recessive "d" allele; the condition causes black dogs to be diluted to charcoal; chocolate dogs to be diluted to silver; and yellow dogs to be diluted to a silvery yellow (sometimes called champagne) often with grayish nose leather and paw pads.

The "D" locus is technically the *melanophilin gene* (MLPH). More than one mutation in it has been associated with coat color dilution in dogs. In one study of 20 different breeds, published in 2009 in *Journal of Heredity*, the dilute color was associated with a mutation in exon 1 (a particular sequence of DNA) of MLPH. But dilution in some other breeds is associated with a mutation in exon 2. This includes Labrador retrievers, according to coat color geneticist Sheila Schmutz, Ph.D., of the University of Saskatchewan in Saskatoon.

So are Dilutes Purebred?

Current DNA tests cannot be used to determine if the dilute Labradors are purebred or if they've been recently mixed with any other breed. Some claims exist that a DNA study proved the silver Labs were purebred, but no such study has been conducted. The unpublished work they cite was not examining the question of purity because current DNA analyses can't determine breed purity past a generation or two. The AKC DNA certification only confirms that a dog's parents are as stated; beyond that, it cannot address crossbreeding.

Wagner says dilutes are purebred just like any other Labrador, but explains there's a difference. "Other breeds were used to create the Labrador back when it originated and as late as the '40s and '50s in Europe to introduce desired characteristics. This, of course, does not make my Labradors 'mixed.' The introduction of the dilute gene is far enough back that for many generations the dogs bred have been AKC registered Labradors. There is no reason to believe otherwise. However, the population of dilute Labradors is small and specific..., in other words, dilute Labradors do *not* appear in all Labrador lines and pedigrees. There is a gene pool with common ancestors here in the U.S. that have produced dilute Labradors. They came from U.S. field lines only. They are not derived from European lines or show lines from any country including the U.S. Also, there is no evidence that suggests they were present at the origins of the breed. Actually, all evidence strongly suggests otherwise. Somewhere along the way, once the breed was brought here to the U.S. and field lines were separated from show, the dilute genes were introduced."

Dilute yellow (champagne) adult with conformation show points. eeBBdd genotype. Photo by Carleton Pope

Health, MLPH, and CDA

Dogs with dilute coloration caused by mutations at the MLPH locus sometimes, but not always, suffer from *color dilution alopecia* (CDA). In CDA, the hair becomes brittle and breaks off at the root. The dog loses hair, and the coat is patchy. It's unknown why some "dd" dilute dogs get CDA and others don't, or why some dilute breeds are more affected than others. CDA does occur in silver Labradors with enough frequency to be reported in some veterinary texts. Owners of such dogs are understandably distressed that the dog they chose for its silver coat is instead missing parts of its coat.

Pope warns that the greater concern is the "many more prevalent and damaging heritable diseases that definitely affect all colors of Labradors. There are no shortage of these very prevalent diseases, and many can be reduced or eliminated through testing and selective breeding – such as elbow dysplasia, hip dysplasia, heritable eye disease, and simple recessive genetic disorders such as progressive retinal atrophy, exercise induced collapse, centronuclear myopathy, degenerative myelopathy, and retinal dysplasia associated with