

Norwich Terriers, 8-14

Title: Color Me Beautiful

The coat color of Norwich Terriers would seem to be fairly straightforward with the two main color groups being *red* and *black/tan*, but that is not the case. Since my first litter, I've been fascinated with the genetics and complexity of color. My first pup was a pale creamy shade, followed by two that were comparatively very dark. I thought I had a red pup and 2 black/tans (the common NT colors). As it turned out, I had a rare "pinkie" and 2 regular reds.

Genes control both color and distribution of pigment, and there are many possibilities allowed by the breed standard which says, "All shades of red, wheaten, black and tan or grizzle. White marks are not desirable." While the genetic basis of color is beyond the scope of this column, a basic understanding of the biology of color formation is helpful. Cells in the skin produce a substance called melanin which gives color to hair, skin, and the iris of the eye. There are two forms of melanin which give coat pigment: eumelanin and pheomelanin, and each has a "default" color which can be modified by various genes. For eumelanin, black is the default. Diluted colors are simply shades of these colors caused by genes that restrict eumelanin production (for example, changing black to blue or grey). The second form of melanin is pheomelanin (red or tan). But, unlike eumelanin this pigment doesn't appear in distinct colors. Rather it occurs in shades covering a range from off-white to dark Irish Setter red. The various loci also determine distribution of eumelanin and pheomelanin which affects intensity (such as greying over time, white spotting, etc.).

A dog has at least two alleles from each locus (in coat color these include A, B, D, E, S, and others). If the alleles are the same, then the dog is homozygous for the trait; and if the alleles are different, then heterozygous and usually the dominant allele is expressed. Every dog carries several coat color genes and it is the interplay of the genes on all color loci that give the complete coat picture. It is relatively new knowledge that some genes are expressed only in next generations and always silent in a parent.

Red is the dominant color of Norwich (classified as Ay sables). In fact, these terriers were developed specifically to be small red ratters. In the early years, red was the "correct" color, and until the 60's the black saddled type was a bit controversial. Marjorie Bunting (Ragus Kennel, UK) wrote about black and tans in 1964 describing the recessive nature of the genes involved – largely guesswork at that time, but fairly accurate. It seems rare these days to find a really dark red; lighter reds are more typical. Unlike reds, wheatens are born light in color, and they may have a hint of a dark mask or a black overlay on the coat (eumelanin) and paler than normal pheomelanin. All shades of grizzle are fine per our standard.

Black/tans have a saddle pattern, caused by an allele at A locus, but, we've seen black/wheatens too, perhaps a variation where the red is a pale wheaten. In 2000, Ruth Corkhill (Redash Norwich, UK), noted that it is quite rare for black/tans to keep their black saddle for life; rather most become red grizzle with age although they retain the black undercoat. In fact, the grizzle saddle is dominant to black, although you might not think so from ringside!

A blue/tan saddle pattern is another variation. Renée Willes (Cobby Norwich, Sweden) mentioned that this is a very unusual color with the nose being bluish and lighter eye color. This would be caused by restricted production of eumelanin. Puppies look like true blues (dd), ending up as blue saddle dogs that look like pale fading black/tans. There is some disagreement about whether blue/tan is a shade of black/tan and acceptable or not. Of course, the eye and nose color

would be considerations in the evaluation of the overall dog. While there is some mention of dd blues in other breeds having skin problems or color dilution alopecia (CDA), Norwich are less prone because dd is expressed as a mask (as a result of the interplay with other color genes) and always results in a saddle pattern in our breed, whereas CDA typically affects the neck, abdomen and inner thighs.

Getting back to my first pup, the pinkie (ee recessive yellow). Having never seen a newborn Norwich, I didn't recognize the most obvious signs. Not only is the coat pale, these pups are born with pink paw pads and nose (which darken after a couple of days); they do not have any black hair in the coat. This color has existed for a long time and was the color of many influential UK sires. They sometimes have names that provide a clue such as the word pink or gold (e.g., Eng. Ch. Ragus Golden Chip). While some early breeders did not think pinkies should be bred to each other, there are no known health issues linked to the E locus. Every dog carries genetic material in the E locus; and other loci carry genetic material too that will be expressed in the next generation of a pinkie parent.

To add to the complexity of color, we often see banding. A single strain of hair will have different shades as it grows, usually with darker pigmented tips. This happens when cells produce eumelanin (black) and then switch and produce pheomelanin (red). While various shades of red, wheaten, grizzle and black/tan are acceptable NT colors, white is not desirable. Fortunately, white markings are minimal in Norwich—likely the S allele with a modifier prevents white pigment from extending over the body.

Norwich Terriers should not be judged on the basis of color preference. That is not in accordance with our breed standard. While dark reds and jet black saddle type are often seen in the show ring, both are actually less common. There is no reason for chalks and dyes. Norwich Terriers should be appreciated for their variety of acceptable and beautiful colors. For those interested, commercially available coat color tests are available for Norwich by VetGen (www.vetgen.com/canine-coat-color.html).

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