

# A NOTE ON THE ORIGIN OF PIEBALD SPOTTING IN DOGS

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SEVERAL varieties of dogs such as foxhounds, beagles, Boston terriers, St. Bernards, and collies, are characterized by the possession of a piebald coat pattern. In this pattern, large and relatively regular, and definitely localized white spots occur on a colored ground. The extreme form of such spotting is seen in bull terriers. Here the entire skin and coat is commonly unpigmented, the eyes alone being colored. The appearance of exceptional individuals, however, in which small red or yellowish spots are found on the head, near the eyes or ears, shows that the pattern is really one of greatly reduced spotting and not of true albinism.

On the other extreme of the spotted series one finds, among breeds normally solid colored, certain animals in which one or more of the feet may be white, or which may possess a white spot or blaze on the chest. Data on Great Danes, collected from the American Kennel Club Stud Books indicate that such spots are hereditary and are due to a factor which is hypostatic to solid colored coat. (Little and Jones,<sup>1</sup> 1919.)

Such animals, which show a slight degree of white spotting, have, by some been considered as being forms from which, by rigid selection, spotted breeds have been developed. That this is also the case in rodents has been stated by Castle<sup>2</sup> (1916, page 125) as follows: ". . . Rarely does it (the degree of spotting) go beyond these slight and inconspicuous markings. But under artificial selection in captivity it is possible rapidly to increase the extent of the white areas in the coat, which then takes on striking and often rather

definite outlines, as in Dutch marked rabbits, English rabbits, hooded rats, and black-eyed white mice. . . . The production of white-spotted races from small beginnings observed in wild stocks has been accomplished in the laboratory by Castle and Phillips in the case of *Peromyscus*, and by Little in the case of the house mouse (unpublished data)."

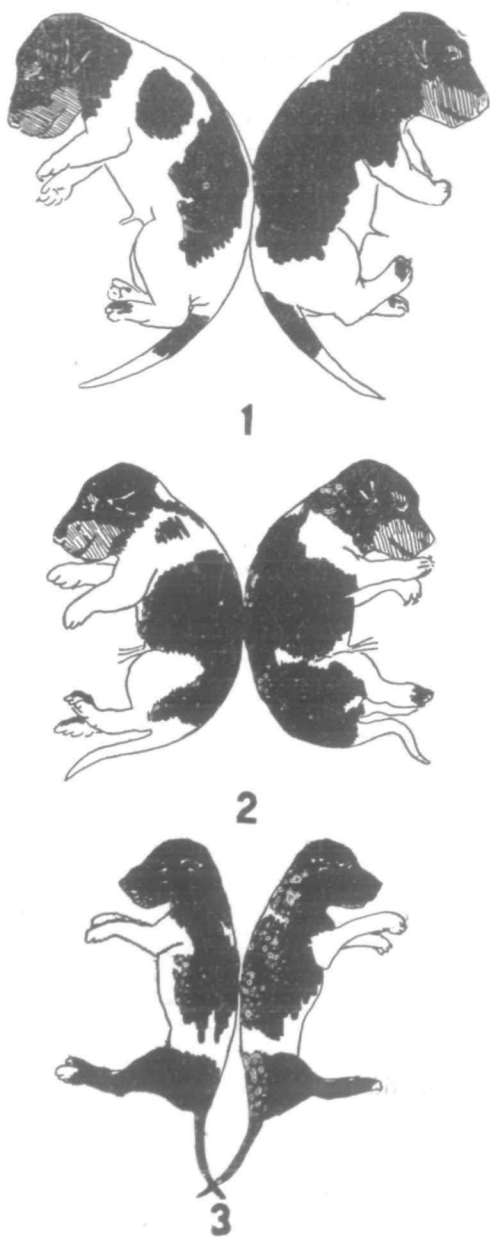
Inasmuch as the inference from the above is that the writer, among others, has by selection developed from a wild race of rodents with a small amount of spotting, a race of heavily spotted animals, it should be stated that progress from the original degree of spotting observed, in the wild mouse used, was made *only after a cross with a tame race and that following the cross progress was so rapid that the introduction of modifying factors by the unspotted race used undoubtedly had occurred.*

## EVIDENCE THAT SPOTTING IN DOGS MAY OCCUR BY MUTATION

By this I do not mean to assert that some progress might not be made by selection alone within the race in which the spotting originated, but merely to point out that there is little or no experimental evidence that the "Dutch" or "English" rabbits or black-eyed white mice or hooded rats mentioned by Castle were developed by selection alone, within a wild race, showing a minute degree of spotting. It is possible that this is the case, and will remain so until their origin *de novo* is demonstrated and analyzed; but in the meantime it is interesting to review two cases in dogs which give direct evidence as to the origin of spotted individuals and which suggest that a spotted race

<sup>1</sup> Little, C. C., and Jones, E. E., JOURNAL OF HEREDITY, October, 1919, Vol. x, No 7.

<sup>2</sup> Castle, W. E., "Genetics and Eugenics." Harvard University Press, Cambridge, Mass.



### PIEBALD COAT PATTERNS

Coat patterns, such as these, characterize several varieties of dogs, but similar spotting is occasionally found among breeds that are normally solid colored. Study of these cases indicates that such spotting is hereditary. Nos. 1 and 2 above represent Airedale terriers, and No. 3 a Scottish terrier puppy. (Fig. 3.)

may arise from a self race, by mutation, without passing through a series of minute gradations directed by selection.

The first case to be reviewed is that of a spotted Scottish terrier puppy (Fig. 3, No. 3) born in my father's kennels, January 22, 1909. This puppy, a bitch, was the only individual born in the first litter obtained from two young solid-colored, pedigreed, and registered Scottish terriers, neither of which had been out of the kennels from the time at which they became sexually mature. The spotted puppy in question was born dead, a fact not very surprising in view of the litter being the first produced by the bitch. The two parents are far from closely related as a glance at the pedigree (Table I) will show. If the spotted coat of the exceptional puppy is hypostatic to solid colored coat, it may be considered as introduced by the germ cells of both parents either by parallel mutations occurring in each of them, or by being contributed to each of them by a common ancestor. If the idea of the occurrence of parallel mutations on each side of the pedigree is considered as far fetched, we must look on both sides of its pedigree for an ancestor or ancestors in common. In this connection, Balmacron Prince occurring in the fourth generation on the male side and in the third generation on the female side appears to be the only possibility. If this dog was, in respect to hypostatic piebald spotting,  $DR$  in formula, he might well have introduced this spotting into the cross. The result would have been that, after several generations, the proper  $DR \times DR$  mating would have been made, and an  $RR$  or spotted individual would have resulted.

*The fact of particular interest from the viewpoint of the origin of spotting is that the puppy had white areas of considerable extent and could in no way be considered a product of selection of minute variations possessed by lightly spotted ancestors.*

The second case presents even more interesting features. It deals with the appearance of spotted individuals in two litters of Airedale terriers. The

TABLE I.—Pedigree of Spotted Scottish Terrier Puppy (Fig. 3, No. 3)

(Sire) Newcastle Carom	Clan Bonnacord Jock	Seafield Rascal	Seafield		
		Bonnacord Jewel	Seafield Nora		
	Nosegay Cornflower	Nosegay Crimson Rambler		Camowen Laddie	
				Glenhin Beauty	
(Dam) Newcastle Confidence	Brynhir Barber . . .		Balmacron Thistle	Balmacron Prince	
			Baberton Lass	Balmacron Tib	
	Foula . . . . .	Valdora Gem			Balmacron Prince
					Lauriston Lass
	Morachi . . . . .	Undercliffe Sandy . . . . .		Roxburgh	
				Loyne Ginger	
	Snapshot . . . . .	Snapshot . . . . .		Cairn Dhu	
				Corrie Linnhe	
			Kildee		
			Zelta		
			Balmacron Prince		
			Baberton Beauty		
			Guide		
			Ayrshire Beauty		

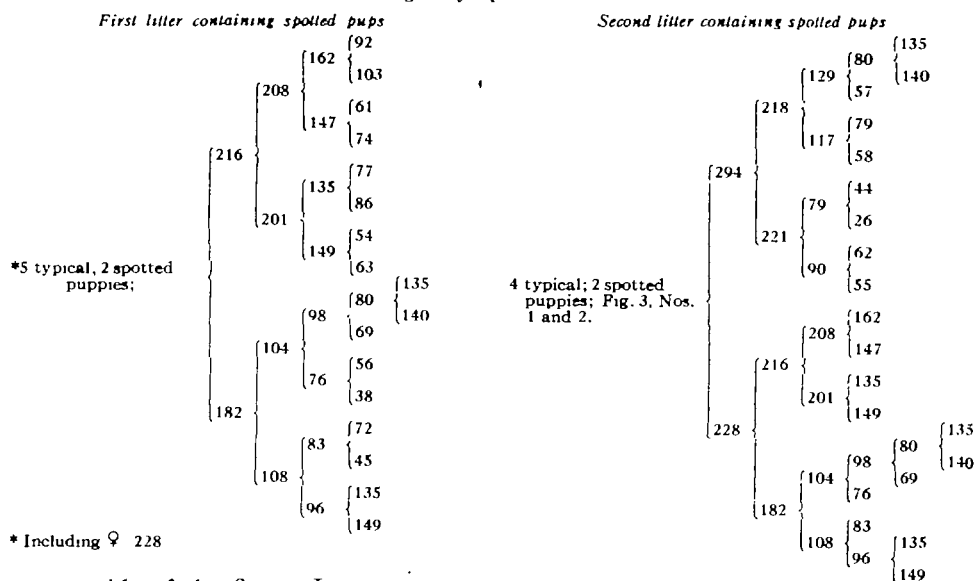
case was reported to me by Mr. Frederic Hood of Watertown, Mass., owner of the Boxwood Kennels. Mr. Hood has been most kind in placing the particulars of the case, as well as two of the puppies themselves, at my disposal. The interest which he has shown might well be taken as a model by all breeders and fanciers, who by adopting a similar attitude might do much to increase opportunities for cooperation with scientific institutions.

The history of this case is briefly as follows: A pedigreed and registered bitch (No. 182), an excellent specimen of the breed, was bred to a typical dog (No. 216), pedigreed, registered, and a bench show-winner. In due time a litter of seven pups, one male and six females, was obtained. Of these two, the male and one female, were heavily spotted with white. They were, according to Mr. Hood's manager, very similar to, though of course not identical with, the two spotted pups figured in Fig. 3, Nos. 1 and 2. The five remaining pups were all normal, and included among their number one which has developed into one of the best American bred Airedale bitches now being shown. This bitch (No. 228)

was bred to a different dog (No. 294) and produced a litter of six puppies, three males and three females, all dead. Two of them, both males, were kindly sent to me in preservative by Mr. Hood and are figured in Fig. 3, Nos. 1 and 2. In conformation and ground color they are typical Airedales, but in size No. 1 is larger and No. 2 a bit smaller than is the average Airedale pup at birth. The other four pups in the litter were entirely typical in color and conformation and were born before the spotted pups which were the last two in the litter. One of the typical pups had, however, a cowl of his own skin which stretched bag-like over his shoulders and head. The head and neck were far from being properly developed. This puppy I did not see, but the description is taken from the personal observation of Mr. E. Warburton, the manager of the Boxwood Kennels, whose accuracy of description need not be doubted.

The pedigrees of the two litters containing spotted pups are given herewith. It will be noticed that ♂ No. 135 occurs in both pedigrees and on both sides of each pedigree. ♀ No. 140 also occurs on both sides of the second pedigree and

Table II.—Pedigree of Spotted Airedale Terriers.



on one side of the first. It seems very likely that if a mutation producing spotted coat color took place in the gametes of any one individual, that ♂ No. 135 or one of its ancestors, was the animal in question.

Examination of Fig. 3, Nos. 1 and 2, shows that the amount of white on the coat of these puppies is considerable and that, like the Scottish terrier puppy

already described, there is no possibility of its having been developed by selection from minute beginnings.

It is hoped that it will be possible to obtain certain of the animals from the spotted Airedale stock for breeding purposes and thus to ascertain more definitely the genetic nature of the variation.

### University Wants Photographs of Twin Calves

The Department of Genetics at the University of Wisconsin is making a study of twins, particularly in cattle, and desires to secure photographs of twin calves. Those of spotted breeds are especially wanted. In this connection, particular interest attaches to the degree of similarity of markings on the duplicated parts of double monsters, such as those with two heads and a single body, or two bodies and a single head. These freaks are often "stuffed" or otherwise preserved, and the college will appreciate receiving any informa-

tion relating to the existence of such specimens in museums or elsewhere, and how photographs or accurate sketches might be obtained. It is believed that a more accurate knowledge of the conditions in such cases will help toward an understanding of the larger problems of inheritance in cattle and other animals. Those who have any information that will assist in the above studies should write to the Department of Genetics, University of Wisconsin, Madison.