

## SEEING RED, REVISITED

Barbara Naviaux

Most cameo breeders are at least aware of the red-tip-cream-tip controversy, and realize the necessity of not showing "spoiled" creams and cream tipped cameos until the standards themselves are changed. The high percentage of dilutes cropping up in one's breeding program can often be devastating, however, especially if one adheres to the "no-show" rule. As an aid towards this end, it is hoped that this article may prove helpful. Intelligent use of the information which follows can result in the production of a minimum of poorly colored individuals. To simplify the material as much as possible, no colors are included except those associated with the red gene. (ie: thus, the exclusion of the black gene needed for a shaded particular)



Ms. Naviaux

With the advent of molecular genetics, and its extreme complexity it is convenient to find that with respect to coat color inheritance in cats, the old tried and true—even archaic—Mendelian genetics is quite functional. So, without having to go into RNA, linkages, crossovers, spontaneous mutations, etc. we can still reliably predict coat color for most matings.

A Mendelian genetic dictionary for the layman, in its minimal form, includes the following terms one must become familiar with:

**GENOTYPE:** The genetic makeup of an individual, not all of which is visible to the eye.

**PHENOTYPE:** The visible exterior that the cat shows, in this case, his actual color.

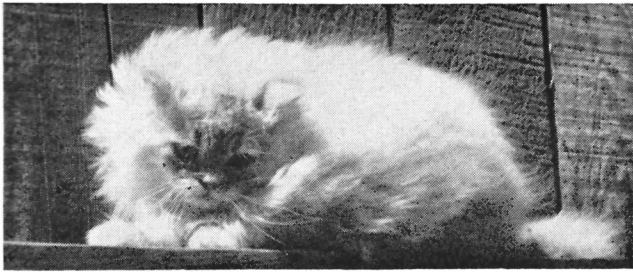
**RECESSIVE CHARACTERISTIC:** The cat must carry only genes for this trait in order to show it phenotypically. It can become obliterated by a dominant gene for the same characteristic.

**DOMINANT CHARACTERISTIC:** The cat will show a dominant characteristic in his phenotype, but can also carry a hidden recessive gene that will only show up if he is mated with a like individual who also carries that same recessive gene.

**INCOMPLETE DOMINANCE:** A gene which works on an increasing scale of intensity, such as the gene for length of tipping.

**HETEROZYGOUS GENOTYPE:** Carrying one gene considered recessive, and one gene considered dominant for a given trait. The cat will always show the dominant gene in his phenotype, never the recessive one. He can however, pass the recessive to his offspring.

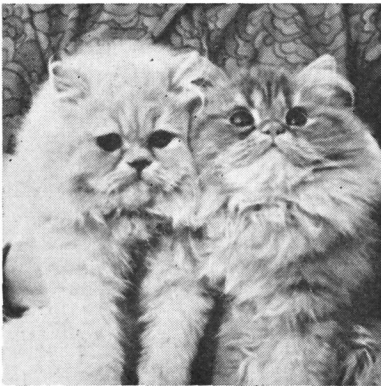
**HOMOZYGOUS GENOTYPE:** Carrying two identical genes for a given trait, either both dominant, or both recessive. In this case, the cat's genotype will always "equal" his phenotype.



Shaded cameo kitten at 2½ months. Note face bars, which are red, but otherwise almost pure white appearance. This kitten matured a very dark shaded cameo (almost smoke) with red tipping and no bars.

given kitten must inherit one gene from his mother, and one gene from his father.

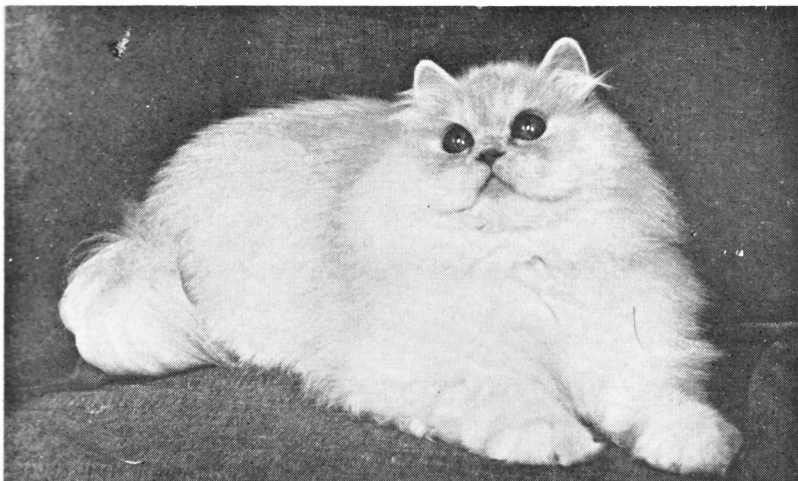
Now, from the Mendelian aspect, we know that two creams bred together always result in ALL cream kittens (cream is recessive to red). And, we also know that two reds bred together **can** produce some creams in addition to the expected reds, if, and only if, each of the parents carries a "hidden" recessive gene for cream. Similarly, in the case of cameos, even though we are also adding additional genetic factors two cameo-tipped cameos will **always** have all cream or cream-tipped kittens. And, two red-tipped cameos **can** have some cream and cream-tipped kittens in addition to the desired red-tipped ones. Thus, it becomes apparent that at least one of the parents involved must be homozygous for red, or there will always be the possibility of having cream-tipped kits. Contrary to popular myth, this can occur just as easily in a one generation cameo as in a ten generation cameo. The perfect solution to this problem would be to somehow guarantee that your cameo stud be homozygous for the red gene. The best bets



Woodland Goldfinger (now a Gr. Ch.), cream male, with his pal Rodabi's Spitfire of Woodland (now deceased) a smoke cameo male. Note the heavy barring on Spitfire, a difficult problem with the smoke cameos. Kittens are 4 months old.

Without going into the sex-linked reality of coat color inheritance in cats, and by simply sticking to the characteristics associated with the red gene, one can think of cats as having two genes for each characteristic. Thus a given kitten must inherit one gene from his mother, and one gene from his father. Now, from the Mendelian aspect, we know that two creams bred together always result in ALL cream kittens (cream is recessive to red). And, we also know that two reds bred together **can** produce some creams in addition to the expected reds, if, and only if, each of the parents carries a "hidden" recessive gene for cream. Similarly, in the case of cameos, even though we are also adding additional genetic factors two cameo-tipped cameos will **always** have all cream or cream-tipped kittens. And, two red-tipped cameos **can** have some cream and cream-tipped kittens in addition to the desired red-tipped ones. Thus, it becomes apparent that at least one of the parents involved must be homozygous for red, or there will always be the possibility of having cream-tipped kits. Contrary to popular myth, this can occur just as easily in a one generation cameo as in a ten generation cameo. The perfect solution to this problem would be to somehow guarantee that your cameo stud be homozygous for the red gene. The best bets are probably the color-bred reds—if you don't mind the bars you'll be trading the cream tipping for. Ideally, however, a red-tipped cameo male, who has proven himself by never producing any cream or cream tipped, blue or blue-tipped individuals, is what the aim should be. If he does not carry a recessive gene for this dilution factor, it will be impossible for him to produce **any** progeny of dilute coloration. (DILUTE: Blue is the dilute of black, cream is the dilute of red and blue-cream is the dilute of tortoiseshell.)

There are three important genes functioning, to greatly simplify things, which determine the coat color of a cameo—Red (color) genes, Shaded (white undercoat) genes, and



Qd. Ch. Rodabi's Playing With Fire, shaded cameo female and dam of Wildfire. Note red tipping over shoulders and back, as well as on face.

length-of-tipping (smoke, shaded or shell) genes. We shall abbreviate these, respectively, R, S, and T. For simplicity, we shall omit all of the other color and pattern genes (tabby, etc.).

Dilutes are recessive to non-dilutes, so cream is recessive to red. The solid "pattern" gene is recessive to the shaded "pattern" gene. The length-of-tipping gene, however, displays incomplete dominance. The greater the length of tipping, the more dominant the gene T becomes. (Smoke cameo is dominant over shell cameo.)

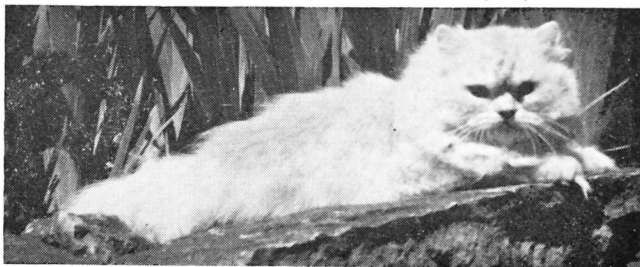
#### INSTANT PHENOTYPE CHART

R = Red            r = cream, red's dilute  
 S = Shaded        s = Solid color (not shaded), "shaded's" recessive form.

T = Tipped heavily (smoke cameo)    Tt = Medium length tipping (shaded cameo),  
 tt = Tipped lightly (shell cameo) (with numerous increments from almost a solid red to almost a solid white—a very difficult gene to get along with!)

As mentioned before, an individual can be thought of as carrying two genes for each of the factors mentioned above—R, S, and T.

Thus, in expressing genotypes, a homozygous red-tipped smoke cameo will have a genotype which we can abbreviate by RRSSTT (red, shaded, with long tipping). Similarly, we can abbrevi-



Ch. Colbyshire's Firebug, shaded cameo female. Note red tipping down entire side and back.

ate a homozygous cream-tipped shell cameo by rrSStt. However, an RrSsTT individual (heterozygous for R and S traits) will still be a red-tipped smoke cameo, and an rrSsTt will be a cream tipped shaded cameo.

One more abbreviation before proceeding to the chart. It is easier, and every bit as accurate, to describe a red-tipped cameo by R-S-; which is, in essence, leaving a blank spot for the second genes. Thus it can be either the dominant gene R or the recessive gene r, in the blank spot after the first R, and the cat's phenotype will still be red-tipped. Similarly, the second gene after the S can either be s or S and he will still show a white undercoat.

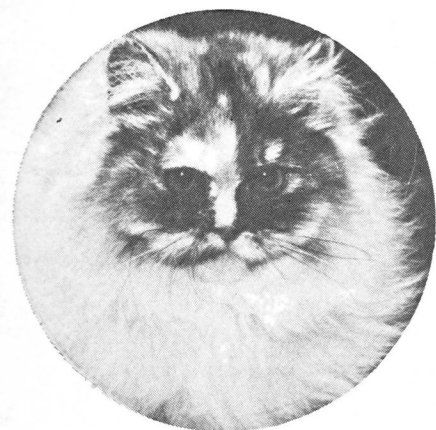
Using the above terminology, it is now possible to make up a chart showing the predicted color kittens one can expect from any given mating of creams, reds, and/or cameos. For simplicity's sake, the gene for length of tipping will be omitted, for it does not directly relate to this particular controversy. The chart is used like a multiplication table, with the resulting kittens being represented inside the squares. Percentages are not included, only the possibilities. Always keep in mind that since the laws of averages do not work out until we have dealt with hundreds of kittens from one particular mating, it is entirely possible to mate a solid red to a red-tipped cameo, and come out with nothing but solid cream kittens!

## COAT COLOR PREDICTION CHART FOR CAMEO BREEDERS — GREATLY SIMPLIFIED

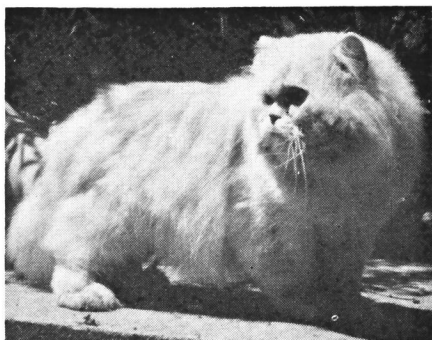
		Sire's Phenotype			
		R-S- (Red-tip cameo)	R-ss (Solid Red)	rrS- (Cream-tip cameo)	rrss (Solid Cream)
Dam's Phenotype	R-S-	R-S- R-ss rrS- rrss	R-S- R-ss rrS- rrss	R-S- R-ss rrS- rrss	RrSs rrss
	R-ss	same as above	R-ss rrss	same as above	RrSs rrss
	rrS-	same as above	R-Ss R-ss rrSs rrss	rrS- rrss	rrSs rrss
	rrss	RrSs rrss	R-ss rrss	rrSs rrss	rrss only

It is obvious by the preceding chart why it is that so many breeders are producing an abundance of cream tipped individuals. The widespread use of creams to upgrade cameo type must be practiced with extreme caution. Astute observations of all progeny, strict culling, and a thorough knowledge of each individual's probable genotype are all mandatory. There is no place in cameo breeding for hit-and-miss matings! Ideally, it is homozygosity for both the red gene and the shading gene which we should all be striving for in our matings. Remember, an RRSS individual, bred to any other individual on the chart, will always result in 100% red-tipped cameo kittens. It is merely the probability of heterozygosity which creates all

of the confusion. The quickest way in which to generate homozygous individuals is by inbreeding. However, bear in mind that inbreeding works for all genes, both desirable and undesirable, so one must be totally cognizant of the possible consequences. So often, the gorgeous red-tipped cameo in a litter may have a foxy nose or a kink tail, while the cream-tipped one out of that same litter may have fantastic type.



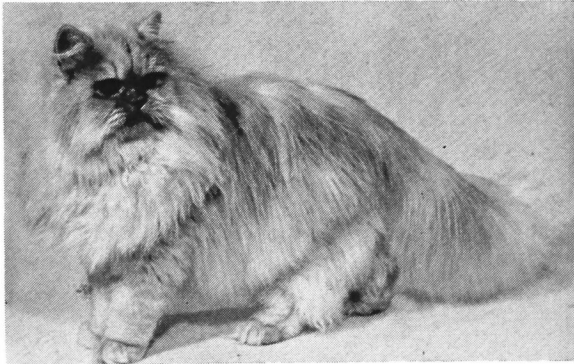
Smoke-tortie female, with the black tipping, blaze, and pure white undercoat and ruff so advantageous for cameo breeding. This non-dilute female, whether bred to cameos or creams, has always produced a high percentage of red tipped progeny.



Gr. Ch. Rodabi's Wildfire of Colbyshire, shaded cameo male at three years, owned by Kitty Colby of Dayton, Ohio. This male has been one of the top winning cameos in the states for over 2 years.

of the confusion.

As a last thought, Rodabi would be most interested in hearing from any cameo breeders who have had kittens which do not "fit" according to the chart. One can see, (in addition to the red-cream dispute) that according to these predictions it is impossible to get any cat with a white undercoat (shaded) unless at least one of his parents is also shaded. And, unfortunately, C.F.A. has many such cats registered, being shown, and even obtaining Championships. By this, is meant, a cameo coming from the mating of two creams, for example. This phenomenon has only one of two explanations—either one of the "cream" parents is actually a cameo, or else the cat itself is actually NOT a cameo. Cogent argument is invited!



Kim Con's High Hope, a Shaded Cameo Female at 1 year. Karen Williams, Breeder-Owner. A real 'Rodabi' type with excellent red tipping.

### BIOGRAPHICAL NOTES

After 15 years of experience as a Veterinary Assistant, Barbara Naviaux returned to college and recently obtained her Bachelor's Degree in Biology, with a specialty in Animal Behavior. Her graduate studies are concentrated more specifically on Feline Behavior, and are planned to also include field studies with some of the large cats in South Africa and South America. With 22 species and subspecies of wild cats on the endangered species list, she hopes to aid in the preservation of at least some of these largely unappreciated animals.

Barbara started the breeding and showing of Persians in 1958. Because of her great interest in feline genetics, she devoted much of her breeding effort toward developing a highly inbred line of red tipped cameos with solid color type. Drastic inbreeding, with the necessary drastic culling, became the basis for the present Rodabi line, which is now best known for cameos, creams and smokes.

Working closely over the years with such intimate friends as Dorie Weston (Walnut Hill), Gayle Wood (Woodland), Vaughn Barber (Les Mew), Dave Bandy (Lowlands) and Kitty Colby (Colbyshire), Barbara has kept records on over 200 litters of persian kittens. These records include complete color descriptions at birth, at 3 months, and finally at maturity. Color pedigrees on all matings are recorded for at least 3 generations, and have been largely the basis for this article, and several others on the general subject of Coat Color Inheritance.

Correspondence is welcomed and should be sent to 937 N. West St., Visalia, CA 93277.

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