

GENETICS OF THE BURMESE CAT

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THE first "Burmese" cat (see Figure 10) was a female imported into the United States from Burma by the senior author in the year 1930. Its bodily conformation and behavior were typical for native Malay cat stocks, best represented in America by the Siamese variety. The Burmese was not recognized at once by the fanciers as a new breed, but suffered for some time the censure of being considered by most persons as an "off-colored Siamese." This explanation sounded very plausible to owners of Siamese who knew that usually the body color of the Siamese darkens with age and varies to a certain extent with the seasons of the year. To make matters worse, the first Burmese cat did not breed true, but threw both Burmese and Siamese kittens when mated to its nearest available Malay cat type, the Siamese (see Figure 13D).

Two of the present authors (C. E. K. and V. C. C.) at once recognized the first Burmese cat as belonging to a new "incipient true-breeding variety." On the basis of crosses made by the senior author, and through a paper (by C. E. K. and V. C. C.) in 1934 one of us (V. C. C.) proposed¹ to the Cat Fanciers Association that the Burmese be recognized as a new color variety for show purposes. Agitation was continued until its acceptance in 1936. Burmese are now eligible for registration in the Association Stud Book.

Further crosses by the senior author produced the foundation pedigree of the breed, shown in Figure 11. In this chart it will be noted that, starting with the imported Burmese cat, Wong Mau, containing one gene for Burmese and one gene for Siamese, and by mating this to a Siamese, Tai, it has been possible to establish a Burmese variety that has bred true for three generations.

The official standards² for Burmese call for a Siamese conformation, a choco-

late brown body color with seal points, and topaz eyes. The kinky tail common to so many Malay cats has not been bred out of Burmese stock and is generally present.

It was recognized that Mendelian segregation of two coat colors was taking place in crosses of the imported Burmese to a Siamese male, as will be seen in Figure 13D. The light colored kittens always developed into typical sealpoint Siamese cats with china blue eyes, and the dark kittens all became Burmese cats with topaz colored eyes. There were no intermediate color gradations observed.

From crosses of this sort made by the senior author there resulted 11 Burmese males, 16 Burmese females, 11 Siamese males and 10 Siamese females.

Mr. Mel Friedlander mated a Burmese female with a Siamese male. This cross produced four Siamese and four Burmese.

One of us (V. C. C.) crossed a Burmese female to a Siamese male. There resulted three Siamese and two Burmese. In all, such crosses have produced a total of 34 Burmese : 27 Siamese.

Because these four segregating classes were present in relatively equal numbers, it was suspected that they represented a monofactorial backcross involving one contrasted pair of autosomally borne gene alleles, or that some independent autosomal gene manifest only in the presence of the Siamese pattern, was converting certain genotypically Siamese kittens into Burmese.

It soon became apparent that all genes involved must be autosomal because of the numerical equality of the sexes in both Siamese and Burmese categories. Thus, the possibility of the genetic complication of sex-linkage was readily dismissed.

It had been shown previously by two of the authors (C. E. K. and V. C. C.) that

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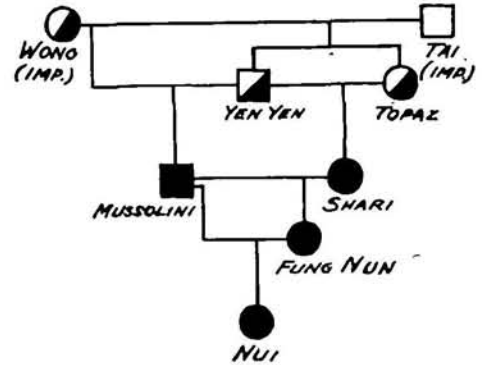
TOPAZ MAU, BURMESE

Figure 10

Daughter of the first Burmese cat, Topaz Mau illustrates the type. Burmese is a dark variant of the Siamese. It is an intermediate allelomorph of the albino series, between silver and Siamese.

the gene producing "Silver" or "smoke" (Figure 13C) in cats is an allele or alternative form of the same gene that produces the Siamese coat pattern. Both silver and Siamese coats are affected by temperature and age, and both types have points darker than the body color. This is more evident in the non-agouti or non-tabby form, namely, smoke.

From the results of these experiments, coupled with the fact that the Burmese also has dark points and that the body coat darkens with age, it appeared that Burmese might well represent a physiological intermediate between silver and Siamese. If a physiologically intermediate stage between these two coat colors, it appeared probable that it might be an allele. The breeding experiments were henceforth conducted to test this hypothesis.



FOUNDATION STOCK OF THE BURMESE VARIETY OF CATS

Figure 11

Squares represent males, and circles females. The solid black symbols indicate pure breeding Burmese. The half shaded symbols indicate Burmese \times Siamese hybrids which carry one gene for Burmese and are intermediate in color. The unshaded symbols indicate the pure Siamese. The production of a pure breeding Burmese breed was very easy because of the intermediate coloring of the Burmese \times Siamese hybrids. (See Figure 12.)

If Burmese represents an intermediate allele between silver and Siamese, we can make the following predictions:

1. When Burmese is crossed to normal intensity (Figure 13B) all of the offspring will exhibit normal intensity of pigmentation.

2. When pure bred Burmese is mated to Siamese, all the kittens should be Burmese.

3. All Siamese segregates from crosses involving Burmese should breed true for Siamese.

4. When Burmese (whether pure-bred, or hybrid for Siamese) is mated to silver or smoke, the offspring should all be silver or smoke rather than tabby or black, as is the case when animals bearing two Mendelian coat colors due to genes at independent loci are involved.

The stud, Pak Kwai Mau (Siamese segregate of the first Burmese, Wong Mau by a Siamese sire, Tai Mau) has sired more than 500 kittens of Siamese queens. All of these kittens have been Siamese without a suggestion of Burmese. Nor have the authors ever heard of Siamese cats having Burmese ancestry, throwing Burmese unless mated



COLOR VARIATION IN KITTENS

Figure 12

These three grades of pigmentation of the Siamese and Burmese coats are shown in the kittens. Left to right: thoroughbred Siamese, hybrid Burmese \times Siamese, and purebred Burmese. The heterozygote carrying both the Burmese and Siamese alleles is intermediate in color.

with Burmese. These facts are in line with prediction No. 3.

Burmese has been outcrossed to cats of normal coat color intensity. All the kittens so produced were of normal intensity. This confirms prediction No. 1.

It was learned that where there was opportunity for the Burmese gene to enter a cross from both parents, there might be in addition to Siamese kittens, two shades of Burmese kittens (Figure 12). The lighter of the two shades developed into the coat color of Wong Mau. The darker shade developed into a darker body color.

It is well known that in rabbits, rats and mice an animal showing a member of the albino series of allelic coat colors

will be lighter when hybrid for a lower allele than if purebred for the given first allele. Aware that we were probably dealing with alleles of the albino series in the cat, we suspected that these two types of Burmese represented animals purebred for the Burmese gene (darker) and hybrid for the Siamese gene (lighter), respectively. A cross of dark Burmese to Siamese yielded only Burmese kittens, in keeping with prediction No. 2.

Where two Burmese, each hybrid for Siamese, were mated, the 3:1 ratio was observed. The verification matings by one of us (M.D.) gave 20 Burmese : 5 Siamese. When these 20 Burmese were divided as to color phase there were found 3 dark and 17 light. We actually



ALLELES OF THE ALBINO SERIES

Figure 13

At the present time four alleles of albinism are known. These are shown here. The lightest form is the Siamese (*A*). Next in intensity of pigmentation is the Burmese (*D*), the kittens shown are segregating for Burmese and Siamese pigmentation. The smoke or silver pigmentation (*C*) is intermediate between Burmese and the full tabby or black pigmentation (*B*) shown here in a Persian kitten. A color intermediate between Burmese and Siamese has also been reported, and complete pink-eyed albinism would also be expected to be a member of this series.

expect twice as many light as dark for a Mendelian explanation.

Prediction No. 4 was the most difficult of all to test, because so many matings between Burmese and Smoke failed to produce offspring, to such an extent that it was suspected that some sort of physiological block prevented inter-fertility between these two varieties. But the persistence of one of us (M.D.) eventually resulted in a fruitful mating. A Smoke-Persian female (see Figure 13C) was mated to a Burmese (hybrid for Siamese). Five kittens resulted, all smokes. This confirmed our final prediction, No. 4.

Conclusion

Thus, we may conclude from the results of all our genetic tests that:

1. The Burmese is a distinct, new coat-color variety of the domestic cat, having a sound genetic basis, in that dark Burmese will breed true.

2. The Burmese coat color is based upon the possession of a pair of Burmese genes (dark color phase) or of a single Burmese gene and its Siamese gene allele (light phase).

3. Burmese and Siamese genes are sharply contrasted in their effects, there being no intermediate grades of coat color observed, and Mendelian ratios being found in both F_2 and backcross matings.

4. The Burmese gene represents a fourth identified allele in the albino series which, naming the genes in order of diminishing pigmentation produced, are as follows:

1—Normal intensity (Tabby or Black)

- 2—Silver (Smoke)
- 3—Burmese
- 4—Siamese

Postscript

A color variation darker than ordinary Siamese was discovered by Lelia Volk of Honolulu to be segregating in her Siamese strain. This was examined by one of us (C.E.K.) and found to be intermediate in color between Burmese and Siamese, and hence we suspect the Hawaiian variation to represent a fifth allele in the albino series. It is so near Siamese in color, however, that it will probably not be perpetuated as a distinct variety and hence the possibility will probably not be had of checking its genetic relationships. At least one inter-

mediate allele between the one producing an intensity similar to that of Burmese and the one producing Himalayan is known in rabbits, and a similar gene⁴ (extreme dilute of Detlefsen) is known in mice. These facts seem to make our suspicion of the Honolulu variation representing a fifth albino series allele in cats seem even more plausible.

Literature Cited

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ARE WAR MARRIAGES EUGENIC?

SOME notes based on discussions with college students. The discussions were centered on the hasty marriages of young men who are going away in the armed services.

A—It seems probable that from the eugenic point of view the war marriages are far more satisfactory than average marriages of young people of the same ages. Whether they are socially desirable is another matter to be considered later.

War marriages tend to be eugenic because (1) The young men going into the armed services are selected on the basis of physical and mental tests. While these tests apply only to the individual and do not consider genetics, they certainly in the mass tend to select extra good genetic probabilities. (2) The selected men of the armed service tend to marry women whose physical and mental qualities appear to be very good. We could be more certain on this point if many thousand recent war brides were given the physical and mental tests required of their husbands. Guessing is not science, but it is a safe guess that the vast majority of the war brides would pass the tests that selected their husbands for service. In this connection it is interesting to mention that there are some good reasons for expecting that a smaller percentage of women than of men would have been rejected if the two sexes had been called on the same basis to the selective examinations. (We must keep in mind in these discussions that many defects which affect health and efficiency in the armed services have nothing to do with heredity and eugenics.)

Summary: From the eugenic point of view war marriages look promising. They are as eugenically good as we could make them if the

army medical and mental tests were required for all marriage licenses. We could do better only by requiring genetic examinations for licenses. After the war we are going to be much more interested in physical and mental examinations as a basis for proposed health improvement campaigns. Perhaps indirectly this will encourage interest in the eugenic movement.

B—The students in these discussions were more interested in the social aspects of war marriages. It was agreed that from the social point of view the hastily planned marriages (not the long engagements) were problems. That proved so in many such marriages in 1917-19. Hasty war marriages are probably greater risks than hasty marriages in normal times. The reason may be that in wartime the wedding is commonly followed by long separation without the opportunity for post-nuptial adjustments that so often make hasty marriages successful when the newly-weds live and work and play together after the wedding.

Summary: In the cases of preceding close acquaintance, especially engagements, immediate marriages when the men were leaving for war in 1917-19 were commonly socially successful. Hasty marriages based on short acquaintance and wartime emotions were so often social failures that they should not be recommended under present conditions. Most participants in the discussions were inclined to admit that it is now impossible to plan post-war economic matters affecting families from war marriages or any others. Hence economic arguments have little weight with the young folks concerned.

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