



BY  
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# Everything you need to know about Genetics...

## *You can learn from your Cat!*

### PART THREE

## THE GENETIC UNIQUENESS OF BIRMANS AND HOW THEY GOT THEIR GLOVES!

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The Birman, also called ‘The Sacred Cat of Burma,’ is said to have origins from Burma, the current day Republic of the Union of Myanmar. Although Burma was a British colony during much of the 1800’s up to post- World War II, which is during the time in which many cat breeds were developed, the term “Birman” is derived from the French word for Burma – “Birmanie”<sup>1</sup>.

#### GENETIC &/OR DEVELOPMENTAL ORIGINS

Several genetic studies have indicated cats from the Birman breed, consistently, genetically cluster with cats from Southeast Asia, including, Siamese, Korats, Burmese and random bred cats from the region (**Figure 1**)<sup>2-4</sup>.

The Birman breed history suggests their development was prominent in France with cross – breeding to Persians to obtain the long hair, particularly after the World Wars, which decimated the breed in Europe.

However the genetic crosses were accomplished, the Birman has retained an overall genetic signature from Southeast Asia (**Figure 1**).

Some breeds, with obvious Southeast Asian traits liked the bobbed tail, specifically the Japanese Bobtail, have not retained their genetic Southeast Asian origins<sup>2-5</sup>.

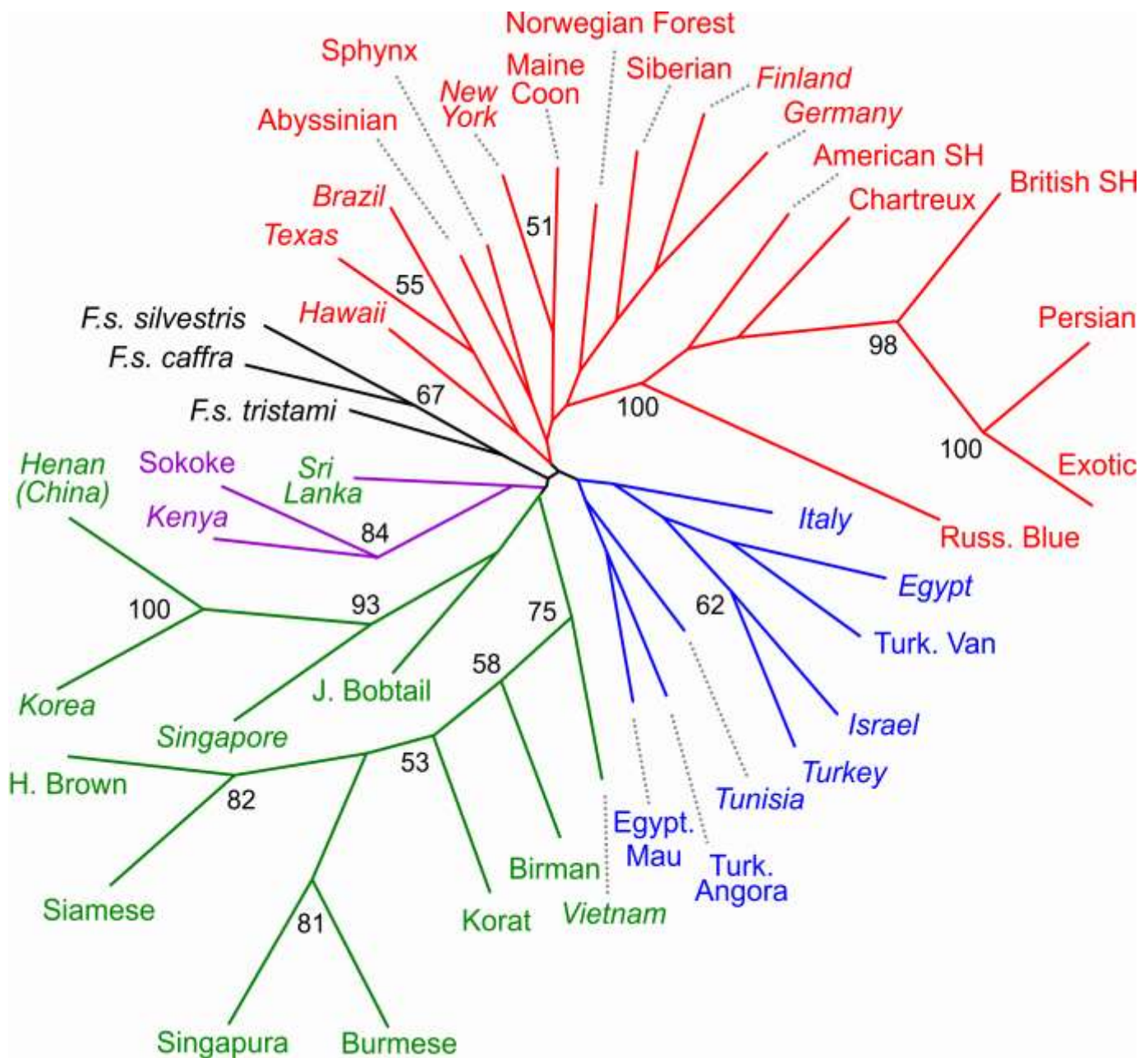
#### COAT LENGTH

For Birman, the Siamese points, are clearly a Southeast Asia trait, however, Birman have the same genetic variant for longhair in the gene *fibroblast growth factor 5 (FGF5)* as Persians, the c.475A>C variant, which is the oldest and most common variant for longhair in all cat breeds<sup>6,7</sup>.

Other long-haired breeds, such as Ragdolls, Maine Coons and Norwegian Forest cats have the common variant, but also, each of these breeds have different longhair variants that many have been part of their early breed development.

Thus, although the Birman has an influence of a Near eastern trait, the longhair variant in Persians, their overall genetic make-up is mostly Southeast Asian.

The breed history also suggests the Birman breed had to be re-developed from only a few cats that survived the World Wars. Genetic studies also support this history as the Birman has low genetic diversity, only the well-established breeds of Burmese, Singapura and Havana Brown have lower genetic diversity.



**Figure 1. Genetic groupings of cat breeds.** Breeds from the Southeastern Asian group together as do Mediterranean and Western European breeds. A number on the line gives some indication of the strength of the grouping. If no number is present, the support for the group is weak, such as with Japanese Bobtail with Southeast Asian cats. Birmans group without Southeast Asian breeds.

## LINKAGE DISEQUILIBRIUM

Birmans also have extended “linkage disequilibrium” – more so than any other cat breed<sup>4,8</sup>. Linkage disequilibrium implies large sections of the Birman genome are the same across the different individuals of the breed, implying, development of the breed is recent (in evolutionary times), or founder effects have been strong, or population bottlenecks have been severe, and or selection for specific traits has been intense.

Since, all Birmans must have points<sup>9,10</sup>, longhair<sup>6,7</sup> and gloves<sup>11</sup> – these are three traits that are under strong selection in the breed and together with the breed history, helped to explain the extended linkage disequilibrium in the breed.

Besides the long hair and the points, what makes a Birman a Birman is their white feet – their gloves. The white feet pattern was first suggested as an autosomal recessive

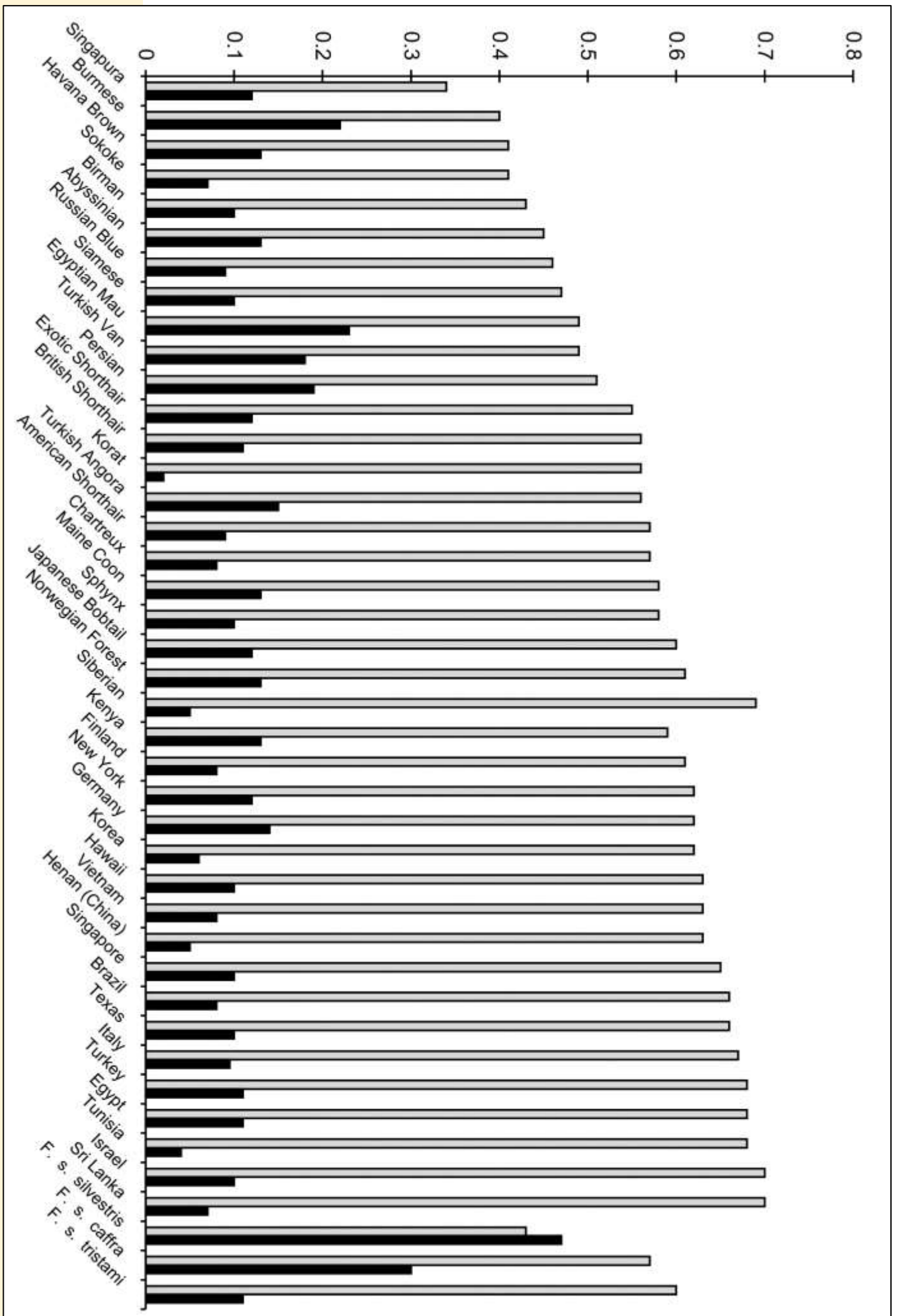


FIGURE 2.

## THE GENETIC UNIQUENESS OF BIRMANS AND HOW THEY GOT THEIR GLOVES!

**Figure 2. Cat breed genetic diversity.** The white bars represent genetic diversity, the dark bars, inbreeding coefficient. A low white bar and a high black bar are indications of poor genetic health. The wild felid species, *Felis silvestris silvestris*, *caffra* and *tristrami*, had only a few specimens for comparison.

trait in 1991<sup>12</sup>. More recently, genetic analyses of a gene called *KIT* (a.k.a. *KIT Proto-Oncogene*, *Receptor Tyrosine Kinase* or *V-Kit Hardy-Zuckerman 4 Feline Sarcoma Viral Oncogene*) has suggested two side-by-side amino acid changes in the protein are responsible for the gloves in Birman, as an autosomal recessive allele<sup>11</sup>

Several other species (horse, cattle, dog) have *KIT* mutations that influence white spotting as well<sup>13-15</sup>. Most all Birman are “fixed” or homozygous for this variant, which is very rare to absent in other cat breeds.

Even the Ragdolls do not commonly have this DNA variation and this DNA variation does not predict mittens in Ragdolls. Thus, the Ragdoll breed did not “steal” the glove mutation from Birman to produce their mittened varieties.

Since the variant is recessive, and because the variant may have been in the random bred population of cats from whence Birman originated, the DNA variant can be found, but rarely, in other breeds and cat populations.

However, the *KIT* variant, c.1035\_1036delinsCA, is defining for the Birman breed<sup>11</sup>. Individuals of the breed that are not homozygous for the mutation are usually shown to have recent outcrossing in their ancestry.

### BLOOD TYPE ISSUES

Interestingly, the B blood type is more common, but still rare, in different parts of the world, such as Turkey, California, and Australia and more common in British - derived breeds, such as British Shorthairs, Devon and Cornish rex<sup>16-18</sup>. Positive selection for the B blood type in itself is unlikely within a cat breeding program.

Cats have naturally occurring antibodies (alloantibodies). In type B cats, the anti-A antibodies are strong agglutinins and hemolysins that lead to the destruction of red blood cells. In contrast, anti-B antibodies in type A cats are weaker agglutinins and hemolysins, leading to less severe destruction of the red blood cells.

When breeding cats, neonatal isoerythrolysis can occur in kittens bearing the A or AB blood group antigen from a mating of B queens to an A or AB tom. Thus, Birman breeders must be vigilant of their cats’ blood groups and prevent breedings that lead to neonatal isoerythrolysis and be prepared to intervene with the kitten’s ingestion of colostrum within the first few days of life.

### SUMMARY

Overall, Birman have interesting origins and interesting genetics. Birman breeders are encouraged to share cats from around the world to diversify the breed, perhaps obtain some new imports from Southeast Asia if possible.

The blood type has to be closely managed. The available genetic tests allow Birman breeders to select cats with the long hair variants, gloves, points and blood type to assist the production of health, genetically diverse and beautiful cats.

EDITOR:

This is the third  
in a series  
of articles  
based on  
feline genetics  
by Dr Leslie Lyons  
that will be  
published in  
FELIS HISTORICA  
in the  
ensuing months



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## A BIRMAN BLAST FROM THE PAST!



MRS. WALLER, MRS. HACKMANN, AND MRS. LOHR - WITH THEIR BIRMANS.  
Mrs. Anneliese Hackmann is holding her Int. Ch. Nadine de Khlaramour.



MODERN DAY BIRMAN KITTENS

Photo: Helmi Flick Cat Photography