Siamese Breeding Policy

Siamese Joint Advisory Committee

Contents

1. Introduction

This Breeding Policy accompanies and supplements the Siamese Registration Policy and should be read in conjunction with that document.

The aim of this breeding policy is to give advice and guidance to ensure breeders observe what is considered "best practice" in breeding Siamese with the over-riding objective of improving the Siamese cat to meet all aspects of the Siamese Standard of Points

Siamese with their pale bodies, contrasting darker points, and elegant type are one of the most popular and one of the oldest of the pedigree cat breeds.
They should be beautifully balanced with head and ears carried on a slender neck, with a lithe, graceful body, slim legs and feet and a long tapered tail.

2. Origins and History

The exact origins are unknown, but it appears that the semi albino mutation causing Siamese colour restriction occurred in cats in South East Asia. The resulting pale coats probably benefited cats in hot humid climates and so they thrived.

Thailand (Siam) was a prosperous country with a leisured class of people, with time for hobbies, many of whom kept cats as pets.
Aspects of Thai life were recorded in the ancient folding books, the Samut Thai, dating from the 14th to 18th centuries. These consisted of lavishly illustrated poems describing livestock such as bullocks and elephants and the various animals kept as pets. One set of books, the Tamara Maew (Cat Treatises) consists of detailed poems describing cat breeds, including Siamese and Korat.

Siamese cats were first imported to the UK from Thailand (then Siam) at the end of the 19th Century.
They caused great excitement as they were unlike any other cats with their pale bodies and darker points. The date of the first imports is not known but they appeared in cat shows in the 1870s.
Unfortunately many of these cats were very short lived, which means that the number of foundation cats is probably quite small. Breeding was difficult, worms, enteritis and cat flu were major problems. Numbers gradually built up, but there were great difficulties during the Second World War. There were no shows and very little breeding resulting in a big reduction in the gene pool.

Seal Point

Most of the original Siamese were Seal Points. The few Blue & Chocolate Points were considered to be very inferior, many were registered as Seal Points and sold as pets.

Blue Point

There are Blue pointed cats recorded in the very early Siamese. The Siamese Cat Register Vol1 lists Lady Blue Blue of Pegu, imported, blue points, and Rhoda, born 1894.

In Thailand Siamese and Korats lived side by side so it is not surprising that many of the early imports carried blue.

The first show to have Blue Points was the SCC show of 1928 where there were three on exhibition. At the SCC Show of 1935 there were classes for Blue Points, but they were not allowed to compete in the side classes.

In 1936 the GCCF gave Blue Points the breed number 24a and Championship status.

Chocolate Point

In the early 1930s Miss Fitzwilliam was breeding mixed litters of Seal and Chocolate Points, all registered as Seal. She used the prefix Slingsby and the suffix de Listinoise. It is believed that the latter was used for Chocolate Points.

The first class for Chocolate Points was at the SCC show in 1948.

Breed number 24b was granted in 1950. Many cats previously registered as Seals were then re-registered as Chocolates.

Lilac Point

Despite many of the early lines carrying Blue or Chocolate (or in some cases both) there is no evidence of any early Lilacs, presumably because they were considered to be poor colour blues.

In the early 1950s Siamese had a reputation for lack of stamina and were probably fairly inbreed as a result of the war. A Russian Blue was used as an outcross to increase hardiness.

After several generations brothers Laurentide Quicksilver and Laurentide Mercury, both Lilac Points were produced. They are behind most modern Lilacs, and are now in many of the pedigrees of the other colours.

Breed number 24c was granted in 1960

Tabby Point

As the Siamese gene has filtered into the general cat population (through mismatings here and there) there have been random appearances of cats with restricted points and tabby pattern. In the early 1960s breeders decided to develop them into a breed.

They were first known as Shadow Points, then as Lynx Points with breed number 26 (AOV)

Tabby points (except Red, Cream and Tortie) were given breed number 32 and Championship status in 1966

Red, Cream and Tortie Point

Siamese with red points had appeared in the '30s and '40s like Tabby Points, the results of various mismatings. However nothing was done seriously until the late 1940s.
By 1958 sufficient generations of like to like breeding had taken place and a breed number was applied for. The GCCF refused recognition as Siamese and Foreign Shorthair was suggested. Breeders argued that the cats were Siamese in type, eye colour and distribution of colour, and that they were genetically Siamese. In 1958 the GCCF referred them to the Siamese Cat Club who decided "that Red Points had Tabby points and not Self Red Points, and that not enough people were interested to warrant a breed number."
By 1965 the Red Point & Tortie Point Siamese Cat Club and the Tabby Point Clubs had formed & many cats were being bred and registered as Breed 26 AOV
In 1966 Red and Seal Tortie Points were given Championship status and breed numbers 32a (Red) and 32b (Seal Tortie) The other colour Tortie Points, and Cream Points were given breed number 32c (any other dilution Siamese) but not championship status.
The revised standard of points for Tortie Points was approved in 1971. Blue, Chocolate and Lilac Torties were transferred to breed number 32b with Champion Status.
In 1973 Red, Cream and Tortie Tabbies were accepted as breed 32 with Championship status, Cream points were given Championship status in 1977.
In 1979 the Tortie Point breed numbers were split by colour for registration purposes.

At the end of 1993, new varieties of Siamese gained recognition for the first time in twenty years: Caramel, Cinnamon, Fawn and Apricot Pointed Siamese. This time, there was no argument that `these weren't Siamese', and they were given the obvious sensible breed numbers, 24k, 24n, 24r and 32fn respectively

Caramel and Apricot Point
Caramel first appeared as a distinct colour in experimental breeding by Pat Turner from a Chinchilla x Siamese cross (actually, Apricot appeared first). Independently, Caramel was already in the Siamese Gene pool, possibly having been introduced at the beginning of the Tabby Points. Unfortunately Caramel Tabby can be difficult to distinguish from (a poor coloured) Lilac Tabby and so has often gone unrecognised.
The Dilute Modifier gene, which produces Caramel, alters all dilute colours; Blue, Lilac and Fawn.

Though each gives a distinct colour, for historical reasons all three are given just one colour name.
Championship status was given in 2007
Caramel acting on cream produces Apricot, Championship status was given in June 2009.

Cinnamon and Fawn Point
Cinnamon is a warmer, lighter, redder colour that Chocolate, and is produced by a different variant of the Black gene from that which produces chocolate.
The Himalayan gene in guinea pigs produces an effect like the Siamese gene in cats, but when it is combined with a red gene, then an Albino is produced. In the 1960s Maureen Silson (Southview) wanted to see if this was also true in cats. Because Sorrel Abyssinian have a reddish colour, she used a Sorrel Abyssinian with a Seal Point Siamese. This resulted in Chocolate Ticked and Black Ticked offspring. When mated together they produced a kitten of a lovely rich colour paler than the colour of Havanas. She was the first (Oriental) Cinnamon. More Cinnamons were produced and when they were mated to Siamese Cinnamon points, not albinos were produced.
Interest in Cinnamons then rather subsided, to be renewed in the early 1980's. Cinnamon Pointed Siamese were granted Championship status in June 2009

Fawn is the dilute version of Cinnamon, Fawn Points are not yet at Championship status, but the last cat needed for an application for promotion has just qualified. (May 2013)

Type has changed considerably the since the first imports.
Siamese have become more slender, with longer heads and larger ears of a different set.
There is a variation in type at the moment: Some breeders and owners preferring modern extreme type while others like a more moderate cat.

3. Description

The **Standard of Points** describes the ideal cat, but no cat can ever match it completely. They all have unique combinations of good qualities and faults.
It gives the relative importance of the different features of the cat. Judges don't actually look at each aspect in isolation, giving marks to each one and then adding them up. They have to look at the cat as a whole and balance each aspect against the rest.

Type:
The standard calls for a long well proportioned, balanced head. Large ears with good width between, narrowing in straight lines to a fine muzzle, forming a balanced wedge shape with no break or pinch at the whiskers. The ears set should be neither too low nor too upright.

Balanced Head

Ear set too low

Ear set too upright

The head should be, neither round nor pointed, avoiding exaggerated type.

Correct Profile

Uneven Profile

Very Weak Chin
(suggests overshot bite)

Very Strong Chin
(suggests undershot bite)

In profile the nose should be straight, the chin strong and the bite level. The tip of the chin should line up with the tip of the nose in the same vertical line.
The eyes should be oriental in shape, slanting towards the nose, of a brilliant blue, the deeper the better.
The body should be medium in size, lithe and graceful. The legs slim with small, oval feet, the tail long and tapering. The head body, legs, feet and tail should all be in proportion, giving the whole a well balanced appearance
Care must be taken regarding the size of the cat, as small cats can appear to have better type. This is particularly noticeable in small, undernourished kittens.

Coat:
The coat should be very short and fine in texture, glossy and close lying.

Points Colour:
Breeding good points colour can be difficult, perhaps more so in some colours than others. While there has been great improvement in type, colour has taken lower priority and has suffered as a result. . It has been speculated that this may be due to mixing colours particularly warm ones such as chocolate with cold colours such as blue. Unfortunately the gene pool is far too narrow to allow 'pure' colour breeding.

The specialist Siamese breed clubs give the following advice for those wanting to breed good examples of their colours:

The Blue Pointed Siamese Cat Club: recommended matings are blue to blue and blue to lilac.

The Lilac Point Siamese Cat Society: recommended matings are lilac to lilac, or lilac to warm chocolate. Caramel and tabby points should be avoided if at all possible.

Kittens are born white, and gradually develop full colour. This means that young kittens should be much paler than adults of the same colour. As this darkening continues into adulthood, the older cat can become very dark, losing contrast between points and body.

Seal Point (24)

UK ***Grand Champion Moonswift Affaire Ducoeur***

Points - Clearly defined dense warm seal brown, matching in tone on all points and showing clear contrast between points and body colour.
Body - Cream. Even shading, if any, to be of warm fawn colour to tone with the points.
Eyes - Clear, brilliant, deep blue.

Blue Point (24a)

Champion & Grand Premier Genneta Blue Hyacnth

Points - Light blue. All points to be the same colour. The ears should not be darker than the other points**.**
Body - Glacial white shading gradually into blue on back, the same cold tone as the points.
Eyes - Clear, bright, vivid blue.

Chocolate Point (24b)

©Alan Robinson

Points - Milk chocolate; the mask, ears and tail to be the same colour The ears should not be darker than the mask.
Body - Ivory all over. Shading, if any, to tone with the points.
Eyes - Clear, bright, vivid blue.

Lilac Point (24c)

Abicasa The Artful Dodger

Points - Pinkish grey. Blue, chocolate or fawn toned is incorrect.
Body - Magnolia. A cold white coat is incorrect. Shading, if any, to tone with the points.
Eyes - Clear vivid blue, the deeper the better

Cinnamon Point (24k)

Champion Merescliff Roland

Points - Warm cinnamon brown. The legs may be slightly paler than the other points.
Body - Ivory. Shading, if any, to tone with the points.
Eyes - Brilliant intense blue, the deeper the better.

Caramel Point (24n)

Imperial Grand Champion & Premier Abicasa Thegypsybaron

Points - Dark brownish blue (in blue based), brownish grey (in lilac/fawn based), matching on all points although the legs may be slightly paler in tone than the other points.
Body - Off-white. Shading, if any, to tone with the points.
Eyes - Brilliant intense blue, the deeper the better**.**

Fawn Point (24r)

Nightqueen Roulette
©Lisa Jachson Lee

Points - Warm pale rosy mushroom. The legs may be slightly paler than the other points.
Body - Off-white (magnolia). Shading, if any, to tone with the points.
Eyes - Brilliant intense blue, the deeper the better.

Apricot Point (32fn)

©Alan Robinson

Points - Mask, ears and tail, apricot, hot in tone with a slightly darker dusting that develops and becomes more noticeable with maturity. The legs and feet will be slightly paler in colour but definite colour should show at the rear of the hind legs below the hock. Barring and striping on the mask, legs and tail is permissible..
Body - Warm creamy white. Shading, if any, to tone with the points.
Eyes - Brilliant intense blue, the deeper the better.

Tabby Point (32)

Shimileeta Iceman
©Lisa Aggett

Points - The mask, legs and tail should all show clear tabby markings which should be the same colour on all points, although leg markings may be slightly paler in tone.
Body - Pale, showing clear contrast with the points as in the equivalent solid-pointed Siamese. Any shading on the body will show the underlying tabby pattern.
Eyes - Brilliant intense blue, the deeper the better.

Red Point (32a)

Grand Champion Siau Tsi'oe Little Red Dipper
©Lisa Aggett

Points - Mask, ears and tail rich bright reddish gold. The legs and feet will be paler in colour but the bright colour should show at the rear of the hind legs below the hock. Barring and striping on mask, legs and tail is permissible 'freckles' are permitted and should not be penalised.
Body - Warm white. Shading, if any, to tone with the points
Eyes - Brilliant intense blue, the deeper the better.

Tortie Point (32b)

Grand Champion & Premier Mylynn Masumi
©Lisa Aggett

Points - The base colour is patched and/or mingled at random with varying shades of red or cream; any large areas of red, cream or apricot may show some striping.
Presence or absence of a blaze is immaterial.
Body - Pale, showing clear contrast with the points as in the equivalent solid-pointed Siamese.
Eyes - Brilliant intense blue, the deeper the better.

Cream Point (32c)

Imperial Grand Champion & Imperial Grand Premier Firousi Freedspirit

Points -. Mask, ears and tail cool toned cream with a powdery look. A dark but cool toned cream is permissible but a hot cream is incorrect. The legs and feet will be slightly paler in colour but definite colour should show at the rear of the hind legs below the hock. Barring and striping on mask, legs and tail is permissible 'freckles' are permitted and should not be penalised.
Body -. Creamy white. Shading, if any, to tone with the points.
Eyes - Brilliant intense blue, the deeper the better.

Eye Colour:
Although the Standards of Points are slightly different for each variety, effectively eye colour should be the deeper blue the better. Unfortunately, once good eye colour is lost from a line it is very difficult for it to recover.

Temperament:
When pursuing improvements in type or colour, breeders must not overlook the importance of temperament.

Permitted Outcrosses:
It is important that no obstacle be put in the way of attempts to widen the gene pool except where there are cogent reasons not to allow the outcrossing. Thus (these categories may overlap):

- Since type is what distinguishes the Siamese from any other pointed shorthair cat, outcrossing to breeds not of Oriental type is not permitted.
- As Siamese are shorthaired, outcrossing to any longhaired or semi longhaired breed is not permitted.
- In pointed cats, where a parent is silver, it is difficult to detect with certainty which of the offspring is silver, especially if the expression is low-grade. Outcrossing to Smoke and Silver Tabbies is therefore not permitted. (This might be subject to revision if a test for silver is developed)

This has implications for the Siamese registration policy: any breeds not included in the above list should be allowed by the registration policy to be in the pedigree of cats registered on the full and/or supplementary register.

4. Genetic Make Up

An explanation of the genetics may be useful in understanding the make up of the Siamese.

Each cell of a cat's body (with one class of exceptions) contains 19 pairs of chromosomes, each made up of thousands of genes. Each gene has a complicated chemical structure which acts as a template for the construction of components of the body. The exceptional cells are the egg and the sperm, which have only one set of chromosomes - formed by random selection of one from each chromosome pair. On mating the single set in egg and sperm combine to form the normal pairs of chromosomes in the single cell which is the start of an embryo, the sets are replicated as cells divide during the embryo's development. So the offspring has one copy of each gene from each parent.

One of the pairs of chromosomes in the cat, as in most mammals, is unique. In the female, each of the pair is of the normal size, but in the male one of the pair is of the normal size, but one is much smaller. The normal size chromosome is called the X, the small one the Y

Many of the genes have mutated to slightly different forms, selection of these has resulted in the development of different physical characteristics which are the basis of the various breeds. The variant forms of a gene are called alleles. When a particular gene pair consists of different alleles, what usually happens is that the recipe given by just one of the alleles is followed for each cell where the gene is active: this allele is said to be dominant to the other, or the other recessive to it. In this case the effect on the cat is as though the recessive was not present.

So a cat has a set of visible characteristics, but can pass different characteristics to its offspring. It is helpful to know about the ancestors of the cats when trying to predict the result of a mating. For example a black cat with a blue mother will carry dilute and so can produce blue offspring if mated to a blue, or to another carrier. But, though from the ancestry one can determine when a recessive allele may be present, one can't determine that it must be absent. Recessive alleles may be passed through many generations without showing up in the cats' phenotype.

Genes which have known effects are denoted by single letters. The dominant allele is denoted by a capital, recessive alleles by lower case. If there is more than one recessive allele, the lower case letters have identifying superscripts. For example Black [B], Brown (Chocolate) [b], Light Brown (Cinnamon) [b^1]

So which genes are important in Siamese?

Full Colour [C] : Burmese Colour Restriction [c^b] : Siamese Colour Restriction [c^s] : Blue Eyed Albino (Recessive White) [c^a]

A series of recessive semi albino mutations which cause a reduction in the coat and eye colour as well as progressively restricting the colour to the points. c^b is incompletely dominant to c^s, the hybrids, c^bc^s, are Tonkinese which have an intermediate degree of albinism . Both are dominant to c^a.

Siamese Restriction c^s causes the eyes to appear blue and the production of pigment in the hair to become temperature dependant. The pointed pattern occurs because the extremities are cooler than the body. The mutation causes all colours to be paler than in the corresponding self cat.

Colour darkens with age, kittens are born white and gradually develop full colour.

A DNA test for the Siamese gene is available.

Agouti (Tabby) **[A] : Non-Agouti** (Non-Tabby) **[a]**

All cats are basically tabby. But the tabby pattern is concealed in the presence of non-agouti. The background of a tabby pattern is produced by the pigment-generating cells at the roots of hairs switching production of pigment on and off, giving bands of colour in the hair, while in the foreground production is continuous. Non-Agouti stops the switching, so pigment is continuously produced everywhere. You can sometimes see the ghost tabby pattern - often in kittens whose coat later clears. In the paler colours rings on tails are often evident and except in extreme cases not a problem.

A DNA test for Non-Agouti is available

Black [B] : Brown (Chocolate) **[b] : Light Brown** (Cinnamon) **[b^l]**

The alleles of this gene alter the shape of the pigment granules deposited in hairs and in nose and pad leather. Because differently shaped granules reflect light differently, the result is to change the colour. Seal points or blue points can carry either chocolate or cinnamon but not both. Lilac points can also carry cinnamon. However, if a seal carrying cinnamon is mated to a chocolate then chocolate carrying cinnamon will be produced and it would look as if the seal carried chocolate.

DNA tests are available for both Chocolate and Cinnamon.

Dense Colour [D] : Dilution (popularly Blue) **[d]**

Dilution causes the pigment to be spread more thinly in the hair and this weakens the colour. It is independent of the colour genes above, so one can have black+dilution = blue, chocolate+dilution = lilac, cinnamon+dilution = fawn, or orange+dilution = cream. Cream can be blue, lilac or fawn based.

A DNA test is available.

Dilute Modifier (Caramel) **[Dm] : normal [dm]**

As its name suggests, Dilute Modifier is thought to modify the effect of the Dilution gene d. Although it has no known effect where the Dense gene D is present. (i.e. seal, chocolate, cinnamon and red cats) it has been suggested that it could be the cause of a general deterioration of colour.

In dilute cats expressing any of the alleles of Black (i.e. blue, lilac or fawn) it produces caramel. Though each gives a distinct colour, for historical reasons all three are given just one colour name. In dilute cats together with orange, it produces apricot.

While this is the accepted genetic basis for Caramel and Apricot, it remains a hypothesis while no discrete gene has been identified. As there seems to be fewer blue/lilac/cream cats than expected the genetics could be more complicated.

Inhibitor (Silver) **[I] : normal [i]**

The Inhibitor gene suppresses the development of pigment in the hair of the coat, typically producing hairs that are fully coloured only at the tip and have a white base.

The gene has now been identified. There is as yet no test, but it is expected that one will be available shortly. It is dominant, but the expression is variable so that cats possessing the gene may not necessarily be recognised as doing so.

Orange (Red) **[O] : non-orange [o]**

The Orange gene causes the pigment granules to become yellow. This makes the coat, paw pads and nose leather appear red in B series cats, cream in dilute cats and apricot where the DM gene is present. It does not matter which of the B series alleles is present as the appearance is almost indistinguishable. A cat which would be seal without the orange gene is called a seal based red, similarly reds can also be chocolate or cinnamon based, and creams blue, lilac or fawn based.

Orange masks the effect of non-agouti: orange series cats nearly always appear to have tabby markings. (Apparently clear coated reds are either ticked on careful inspection, or have been carefully selected for bad tabby pattern). All orange series with one or more tabby point parents must be registered as tabby point until proven otherwise. This used to mean using a number of test matings, but can now be proved by a DNA test.

Orange is a very unusual gene: its position is on the part of the X chromosome for which there is no counterpart in the Y. So in a male cat only one of the two alleles can be present: the cat is either orange series OY, or not oY. In a female there are three possibilities, the cat can be OO orange series, oo not orange series or Oo which gives rise to the Tortie. A peculiarity of the X chromosome is that only one is active in each cell, but the inactivation of the other happens quite late in the embryo's development, when there already

very many cells, and each cell independently chooses which X to inactivate. In this case some of the pigment-producing cells O is active, in others o, giving the typical mottled appearance of the Tortoiseshell.

Occasionally male Tortoiseshells appear, although they are usually sterile. They always represent a genetic anomaly. The most likely cause is the presence of three rather than two sex chromosomes (XXY Alternatively, there may be two pairs of sex chromosomes (XX and XY) with only one of the pair being present in each cell. The easiest way to understand how this could happen is development from a fusion of two fertilised eggs, but no doubt the truth is rather more complicated.

Piebald White Spotting [S] : Normal [s]

A dominant gene producing white areas, Piebald White Spotting is behind Bicolour in all breeds. Expression is variable, and the homozygous [SS] state produces a larger proportion of white than the heterozygous [Ss] state. While variability of expression could, in principle, give no perceptible white at the low end, and complete white at the high end there is no evidence of this happening

Torties with Piebald White Spotting have their areas of areas of orange and non-orange in patches rather than the usual mingled effect without white.

Piebald White Spotting should not be confused with Brisket Spotting, which gives rise to minor white spots on the underside of the body which are variable in size and irregular in occurrence. The genetics and mode of inheritance of brisket spotting are unclear but are thought to be polygenic.

Brisket Spotting can be masked by Piebald White Spotting.

Dominant White [W] : Normal [w]

A dominant gene which causes a white coat, hiding all other colours and patterns. The gene also causes eye colour to be blue (but with variable expression, so non-blue and odd eyes also occur).

There is an association with deafness, particularly in blue-eyed whites. Deafness can be tested using the BAER test.

In order to reduce the possibility of deafness Foreign Whites have been developed to be White Pointed Siamese so the blue eyes are a consequence of the Siamese gene

Polygenes

These are collections of genes which, although individually insignificant, have considerable effect when combined together. They modify the effect of the major genes and can alter all aspects of the cat.

Type seems to be completely controlled by a very wide range of polygenes.

Points colour is determined by major genes, but the more subtle differences are due to polygenes.

Siamese colour restriction reduces pigment causing the eyes to appear blue, but depth and intensity are polygenic.
Although Siamese are genetically short haired, the action of polygenes can cause subtle differences in texture, density and length.

5. Breeding System

Listed above are the main genes that help define the Siamese cat through the expression of colour and coat, but of course there are a large number of other genes that together create the distinctive physical shape and confirmation which is the essence of Siamese breed type.
In order to ensure the maintenance of the good Siamese breed type already achieved, while allowing scope to further improve aspects of type, coat, and colour, to meet the ideal described in the Standard, breeders need to have a clear, definite and well understood breeding system. This means the development and management of a breeding programme in which certain cats are affirmatively selected to be bred to others, for predetermined reasons. Equally important, it also means that breeders allow no matings until they have given careful consideration to the outcome. In particular three key rules must be followed:

- **Health must be the overriding consideration in any Siamese breeding programme. Cats with serious genetic faults must not be bred from.**

- **The good and bad features of the individual cats should be assessed and weighed against each other before any mating.**

- **When planning a breeding programme, breeders must realise that doubling up on the good traits in a cat also results in doubling up on the defects; the breeding of cats with similar faults should be avoided at all costs otherwise there is a danger of fixation. (i.e. creating a characteristic which cannot subsequently be eliminated).**

Breeders must make themselves aware whether the characteristics they wish to promote or avoid, are due to a dominant gene (which will always be expressed when present) or a recessive gene (only expressed in the homozygous state i.e. where the cat inherits the gene from both parents).
The prime motive is to perpetuate the Siamese as a recognisable breed and to improve the quality of the breed as measured against the Standard
The skill in breeding lies in the choice of the individual cats and the matings to be performed between them.

Selection
A breed is defined by its own distinctive set of characteristics, achieved and further developed by a reduction in genetic diversity This reduction is controlled by selective breeding, where the cat chosen is that which most closely approaches the breeder's idea cat. As selection alone is not very efficient in reducing diversity it is often used in conjunction with inbreeding. Some inbreeding, albeit on at a low level is inevitable in the development of a breed.

Inbreeding

Inbreeding is an inclusive term covering many different breeding combinations and degrees of relationship, including the more distant, less intense. It is consistently more efficient in eliminating heterozygous (varying and diverse) genotypes and increasing homozygous (same) genotype, thereby ensuring a greater likelihood that kittens will closely resemble their parents. Used here, the term does not mean close, purposeful, inbreeding of closely related cats (brother/sister, father daughter), but rather the moderate form that results from the mating of not too distantly, but not directly related cats. Some inbreeding is essential to stabilise conformation around a definite type. Inbreeding is the act of mating individuals of various degrees of kinship, and if continued it produces ever increasing homogeneity in the offspring.

"The more intense the in-breeding, the more careful must be the selection". "Loss of innate genetic variability must not be too great".

Inbreeding should be restricted to experienced breeders with sound knowledge of pedigrees. A complete outcross every few generations is recommended.

Breeders must realise that there has been considerable inbreeding in the past in the development of Siamese. This might not be apparent in 5 generation pedigrees.

The overall approach should be one of balance and moderation in the degree of inbreeding coupled with consistent selective breeding with a clear objective in mind – i.e improvement of key aspect and/or the elimination of weak traits or defective genes.

Breeding systems and practices need to operate so as to ensure the Siamese gene pool contains enough variation to give scope to continue improving the breed and avoid the danger of either fixing type too quickly (before the ideal of the standard is reached) or deleterious genes being expressed and fixed in the breed. Breeders need to use inbreeding to gain sufficient homogeneity to fix recognisable Siamese type but with sufficient variation to both enable improvement, and maintain health and vigour, avoiding fixation of defective genes or unwanted traits (and to ensure the elimination of anomalies).

While it is recognised that breeders do not wish to entrust their valuable breeding lines to individuals who may not operate humane and qualitatively intelligent breeding practice the GCCF would strongly recommend that breeders do not place excessive numbers of healthy good quality cats on the non-active register because they want to operate commercially restrictive practices. This could have serious future consequences in reducing the viable, active gene pool of a breed to an unacceptably low level and potentially promote undesirable practices.

Unavailability of female kittens on the active register discourages potential new breeders.

Inbreeding Depression

A breed, breeding line or individual can suffer from inbreeding depression when inbreeding is taken too far and a loss of genetic variability results. Inbreeding depression can result in a general loss of vigour, even if the animals in question are not suffering from specific recessive genetic diseases. A small gene pool is likley to result in inbreeding depression in a breed. A popular and numerous breed with a small gene pool has a low 'effective population size', regardless of the numerical size of the breed's population. A popular breed with a small effective population size can be compared to an overinflated balloon.

Inbreeding depression can compromise a cat's immune system and make it less able to resist disease. A group of genes called the Major Histocompatability Complex, or MHC plays an important role in the immune system. The way in which the genes in the MHC are inherited means that it is particularly vulnerable to inbreeding depression and a loss of genetic diversity in the MHC can impact on the health of the cat.

Inbreeding depression can manifest in different ways depending on the particular make-up of the gene pool in question. Few cases of inbreeding depression will manifest all of the signs. Although these are problems which can occur in any random-bred cat, a combination of some of these signs could well indicate a problem with inbreeding depression. A breeder who is worried about inbreeding levels in their lines should consider introducing cats from different lines or outcrossing to approved breeds.

Signs of inbreeding depression include slow growth rate, small adult body size, small litter size, reduced fertility, increased kitten mortality, increased prevalence of allergies, reduced ability to fight infections, physical asymmetries, especially facial, an increase in congenital abnormalities, increased prevalence of cancers, increased incidence of genetic disease, and reduced life expectancy.

Anomalies
The problem of the genetic anomaly is something of which all breeders should be aware – this is not to suggest that such anomalies are common but the cat must be expected to have its quota of defects just as are found in other animals.

The golden rule is that health is paramount and must be constantly and consistently monitored; any evidence of weakness or the emergence of lack of vigour must be dealt with immediately through modification of the breeding system.

No cat with any evidence of health problems or lack of vigour should be used for breeding.

No cats showing reproductive problems, or their offspring should be used for breeding for example:

- Queens which have repeatedly failed to conceive, re-absorbed, miscarried or had more than one caesarean,
- Queens which have rejected their kittens, failed to produce milk or produced fading, small, weak or abnormal kittens,
- Studs with low fertility, or siring abnormal kittens with several unrelated queens.

6. List of Genetic Anomalies known in Siamese or Orientals

Amyloidosis
Amyloid is a type of cellular protein, and amyloidosis describes the disease that occurs when this particular protein is deposited within the body organs, mainly in the liver (hepatic) and kidney (renal). Some Siamese and Oriental cats are primarily subject to hepatic amyloidosis, resulting in liver dysfunction and haemorrhage from the liver therefore lines for outcrossing must be carefully selected. Young cats (approx 8 months – 7 years) are most commonly affected. Affected cats are often related, but the mode of inheritance and contribution of environmental factors is unknown. *

Bites
Incorrect bites are an issue in Siamese. Generally bites that are misaligned tend to be overshot, are occasionally undershot, and very occasionally slightly twisted. *

Cleft palate
Cleft palates may have an environmental cause, but some lines of Siamese appear to be over-represented.*

Feline Asthma
Feline Lower Airway disease is typified by wheezing and bouts of coughing. As asthma in humans has a hereditary component, it is speculated that there may be a hereditary component to the disease in cats, but any genetic predisposition has yet to be identified. Siamese cats seem to be over-represented. *

Flat-chest syndrome
There is good evidence that this is caused by a simple recessive gene, but it may also have a more complex genetic cause; the disorder results in a kitten with a compressed flattened rib-cage that has difficulty in breathing, etc. It can be fatal in a number of cases, depending on degree of severity. No test is available. *

Heart defects
It is believed that the majority of cases have a genetic origin. However there may be several genetic mutations *

Kink
Kinks typically result from deformities of bone and are listed as defects by the GCCF. However, they are usually only of aesthetic relevance as they cause no pain or discomfort to the cat. *

* *Information from the Feline Advisory Bureau*

Mammary tumour
Siamese are at increased risk of developing mammary carcinomas and affected Siamese cats tend to be younger compared to other breeds. Male cats can occasionally be affected. Tumours occur with equal frequency in all glands in cats. Single or multiple nodules associated with the gland or nipple may develop; the masses may be ulcerated, inflamed swollen or associated with discharge from the nipple.

Nystagmus
Nystagnus causes the eye's to jerk back and forth. It can be associated with squint and is believed to be a polygenic trait with a threshold character

Progressive retinal atrophy (PRA)
PRA describes an inherited ophthalmic condition leading ultimately to irreversible blindness.
The underlying pathology is of rod and cone photoreceptor dysplasia and/or degeneration. Usually the rod photoreceptors are affected first, leading to night blindness as an early sign. In time, the cone photoreceptors also become involved, so that ultimately total blindness ensues. Two forms of PRA have been described in the Abyssinian breed: autosomal dominant retinal dystrophy (Rdy) and autosomal recessive rod-cone degeneration (rdAC):
DNA tests are available

Squint
Convergent squint is seen commonly in Siamese. It is believed to be a polygenic trait with threshold character. *

Thymic lymphoma
Siamese cats are over-represented amongst cases of thymic lymphoma. Affected cats are usually young (often less than 2 years old), FeLV negative, and they typically respond favourably to chemotherapy. These cats MUST NOT be used for breeding. Although the mode of inheritance has not been confirmed, it is suspected to be recessive in nature.

* *Information from the Feline Advisory Bureau*

Appendix 1. Normal + Mutant Genes

Gene	Symbol	Effect
Agouti	A	Yellow band to the hairs
Non-Agouti	a	Absence of band in the hairs
Black	B	Blackish Brown hair pigment granules
Brown	b	Brown hair pigment granules
Light Brown	b^l	Light brown pigment granules
Full Colour	C	Maximum production of pigment
Burmese	c^b	Reduction in production of pigment
Siamese	c^s	Greater reduction in production of pigment
Blue Eyed White (Recessive White)	c^a	No pigment develops in the coat, the eyes are pale blue
Dense	D	Normal packing of pigment molecules
Dilute	d	Dilution of pigment granules
Dilute Modifier	Dm	Lightens hair of dilute phenotypes
Normal	dm	Normal dilute phenotype
Inhibitor	I	Inhibits production of pigment granules
Normal	i	Normal production of pigment granules
Orange	O	Converts black/brown pigment granules to yellow
Normal	o	Normal black/brown pigment granules

Appendix 2. Glossary of Genetic Terms used in the text

Allele	One of two or more alternate forms of a gene at the same site or locus in each of a pair of chromosomes, which determines alternative characters in inheritance.
Chromosome	The carrier of the genes in the cell nucleus.
Dominance	When the expression of one allele of a heterozygous pair completely hides the expression of the other.
Dominant gene	The allele whose expression completely hides the expression of another at the same locus.
Expression	The manifestation of an heritable trait in an individual carrying the gene or genes which determine it.
Fixation	A result of selection or inbreeding causing the genes of a group of cats to become homozygous or fixed.
Gene	The ultimate determinant of heredity.
Gene Pool	The genetic make up of a group of individual cats
Genotype	Genetic Constitution of a cat.
Heterozygous	Where members of a gene pair are different, as in Aa.
Homozygous	Where members of a gene pair are identical as in AA or aa.
Inbreeding Depression	A decline in the vigour of a breeding line.
Incomplete Dominance	Where one allele for a specific trait is not completely dominant over the other allele resulting in a combined phenotype. For example the offspring of a Burmese x Siamese mating are Tonkinese.
Mutant Gene	Mutant (altered) form of an original gene.
Normal Gene	Original gene present in the genotype of the cat.
Phenotype	The physical appearance of the cat or the expression of a gene.
Polygenes	Minor genes each with a small, cumulative effect on the expression of a characteristic. These may explain, for example, the variation in type from the round, cobby British to the long, slender Siamese.

Recessive	Where the effect of one allele of a heterozygous pair is completely hidden by the expression of the other.
Recessive gene	The allele whose expression is hidden by another at the same locus. Where there are multiple alleles (in the colour restriction series for example), one allele can be dominant in some combinations and recessive in others. Recessive genes can be hidden for many generations
Threshold	Build up of polygenes with no discernable effect until a tipping point results in a sudden large effect

Appendix 3. GCCF Registers

FULL REGISTER (REG NO. BEGINS CS)
A cat/kitten resulting from an ideal mating to produce that breed; it can be shown, and if agreed by the breeder, it can be used for breeding.

SUPPLEMENTARY REGISTER (REG NO. BEGINS CSSR)
A cat/kitten resulting from a more mixed mating but nevertheless acceptable as an example of the breed; it can be shown, and if agreed by the breeder, it can be used for breeding.

EXPERIMENTAL REGISTER (REG NO. BEGINS CSEXP)
A cat/kitten of a relatively new breed which had Preliminary Status when it was registered. It can be both shown and bred from. It may or may not be eligible for Championship status depending on how far the breed has progressed since the cat/kitten was originally registered (Original registration numbers are not altered even when a breed progresses).

REFERENCE REGISTER (REG NO. BEGINS CSREF)
A cat/or kitten from a mating regarded as an outcross for this breed (but not necessarily for other breeds). This cat/kitten is NOT ALLOWED to be shown and will not be intended for breeding except under very specifically controlled circumstances.

It is possible to progress upwards from the Reference Register with a minimum number of five suitable breeding generations. This is acceptable to a breeder with a well planned breeding programme, such as when developing a new breed, but not something that a new breeder should be considering

References

Feline Advisory Bureau
"Robinson's Genetics for Cat Breeders & Veterinarians" Edited Valla, Shelton, McGonagle & Stanglien, published by Butterworth & Heinman Press.
GCCF Breeding Policy