THE GCCF EXOTIC BREEDING POLICY

1. Purpose of this Breeding Policy & history of the Breed.

This breeding policy accompanies and supplements the Exotic Registration Policy and is designed to be read in conjunction with that document and the GCCF's General Breeding Policy. Any queries regarding either document should be referred to the Exotic BAC.

The aim of this breeding policy is to advise and guide breeders regarding "best practice" in breeding Exotics, with the main objective being to improve the Exotic cat toward the ideal described in the Exotic Standard of Points. Breeders associated with the GCCF are required to adhere to its General Code of Ethics for Breeders & Owners.

The history of the Exotic breed is well documented. For many years, British Shorthair breeders had occasionally mated their British cats to Longhairs in order to improve the bone, body shape, eye colour etc. The subsequent kittens from these matings were usually too 'over-typed' or with an overly soft and long coat to show them as British Shorthairs. They were nevertheless very attractive with a look of their own, having the characteristics of the Persian but with a short plush coat. Some breeders were keen to maintain this different 'look' and decided to develop a 'new' breed by breeding from these kittens (mating them back to Persians); thus the Exotic Shorthair was born. After much work by these dedicated UK breeders, preliminary GCCF recognition was granted to Exotics in 1986, followed in 1995 by full Championship status. Since then Exotics have become very popular and are always amongst the top show winners in the UK.

The Exotic, as the shorthaired equivalent of its close relative the Persian, is bred in all of the recognized Persian colours and patterns. Many years of breeding in the UK has established good phenotype, and the introduction of imported cats has resulted in a healthy gene pool. The only permitted outcross is the Persian.

2. Genetic Makeup of the Breed

The Exotic, in common with all domestic cats, has 38 chromosomes which hold all the genes necessary for determining the size, shape, colour, pattern and hair length of each individual. There are thousands of genes involved, the majority of which are unknown; however, breeders are able to predict the outcome of the majority of matings via their knowledge of a small group of genes. Over many hundreds of years, genetic mutations have taken place that have resulted in new colours, patterns and hair structure, giving rise to the distinct differences between the cat breeds we recognize today. In the case of the Exotic, the key genes influencing colour, pattern and hair length within the breed are:

Dense (D) – a gene causing pigment granules in the hair shaft to be evenly distributed, resulting in "dense" colours (often referred to as "Dominant") e.g. black, chocolate, red.

Dilute (d) - the recessive form of D, causing pigment granules to be enlarged and unevenly deposited in the hair shafts. When homozygous (i.e. dd), this results in the familiar "dilute" series of colours e.g. blue, lilac, cream.

Agouti (A) – the "wild type" dominant gene that allows tabby patterns to be expressed. The basic agouti pattern consists of hairs alternately banded with black and yellow; other pattern genes operate to produce the various tabby patterns (classic, mackerel, spotted) seen in the breed. The basic black/yellow pigmentation may also be affected by other colour genes (see below)

Non-agouti (a) – the recessive form of Agouti; when homozygous (i.e. aa), the appearance is changed from Tabby to Self (solid colour) or Smoke (if the inhibitor gene is also present). Occasionally, "ghost" tabby markings may be seen on Self or Smoke cats.

Black (B) – the "wild type" colour gene, resulting in a cat with black (eumelanin) pigment in its hairs.

Brown (b) - a recessive form of B. When homozygous (bb) this causes a change in pigment granules from the normal round/spherical shape seen in eumelanin, to an oval shape. Despite the genetic description, this colour in cats is known as Chocolate.

Orange (O) – a gene responsible for changing eumelanin (black) pigment into phaeomelanin (red) pigment. The O gene is found on the X-chromosome and is therefore said to be sex-linked. Male cats (genotype XY) with the O gene will be red or cream. Female cats (genotype XX) with one O gene will be Tortoiseshell, those with O genes linked to both X chromosomes will be red or cream. Note that the non-agouti gene's action is inhibited in the presence of O, meaning that red/cream non-agouti cats still retain a degree of tabby marking. Hence, the Exotic BAC registration policy states that any red or cream Exotic with an agouti (Tabby or Shaded) parent must be registered as Tabby or Shaded unless proven otherwise via DNA testing.

Full Colour (C) – produces full expression of colour; pigment is evenly distributed along the hair shafts and over the cat's body.

Siamese Colour Restriction (cs) – An allele in the albino series; a recessive, mutant form of C. When homozygous (cscs) produces the well known Colourpointed varieties; the colour distribution is due to the mutant gene causing pigment deposition to be temperature-sensitive, such that the cooler areas of the cat's body ("points") appear much darker than warmer areas. This mutant gene also affects eye pigmentation, resulting in the familiar blue eyes of the Colourpointed cat. NB: cs may be referred to as Himalayan Colour Restriction in older (particularly American) books or articles.

Dominant White (W) – An epistatic gene, meaning that it masks the effect of all other colour genes present in an individual cat. Cats with one or two dominant white genes will be visually white. If a heterozygous (i.e. only having one dominant white gene) white cat is mated to a non-white, the offspring may be white or coloured, depending on the underlying colour genes of the white cat. White cats may have varying eye colour – blue, non-blue, or odd-eyed. A percentage of white cats are either unilaterally or bilaterally deaf and breeders must take this into account when planning matings. (see registration policy)

White Exotic

White Spotting (S) – Can occur in conjunction with any of the other colour and/or pattern genes; responsible for Bi-coloured and Tri-coloured cats. S is very variable in expression (but is generally considered to be "additive", so that mating two "and white" cats may produce higher grade white spotted offspring). Can be controlled to a certain extent by breeders wishing to produce show quality cats where the distribution and amount of white must be within certain specified limits. Rarely, high grade white spotted cats may have odd eyes. (see Appendix)

Cream & White

Brown Tabby & White

Inhibitor (I) – A dominant gene that inhibits the deposition of pigment in hair shafts, resulting in white roots to the hair. The length of the white portion is dependent on other genes, including Agouti. Agouti cats with Inhibitor are Silver Tabby or Silver Tipped/Shaded; non-agouti cats with Inhibitor are Smoke.

Black Smoke

Black Shaded Silver

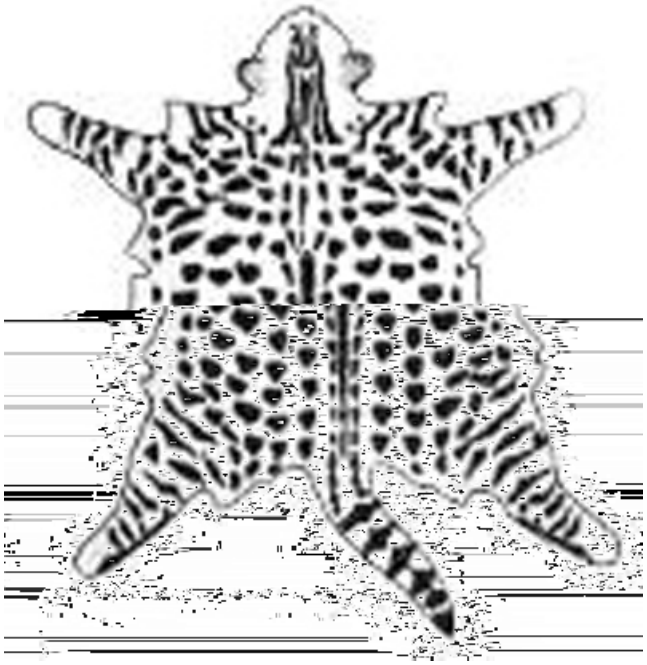
Tabby Pattern Genes.

Traditionally it had been believed that the three forms of tabby pattern were inherited as an allelic series; however, it now appears as if at least two and probably three, different loci are responsible for the various tabby patterns (Lorimer, 1995). At one locus are the alleles for mackerel and classic tabby patterns with mackerel dominant to classic; at another locus is the Abyssinian or ticked pattern, which is epistatic (masking) to both mackerel and classic; (NB Ticked pattern is not present in the Exotic gene pool), and at the third locus there appears to be a modifying gene for either the classic or mackerel patterns resulting in the spotted tabby pattern. The patterns found in the Exotic can be summarised as follows:

Mackerel (Mc) – the basic tabby pattern of narrow vertical stripes on the body, overlaying the agouti base (i.e "wild type")

Mackerel Pattern – note NARROW stripes

Spotted (Sp) – current thinking is that it is likely a specific single gene causing the spotted tabby pattern, breaking up the mackerel or classic pattern into elongated or rounder spots respectively.



Spotted Pattern

Classic (mc) – a mutation of the mackerel allele recessive to all other tabby patterns which give a blotched pattern with the characteristic "butterfly" motif across the shoulders and "oysters" on flanks.

Classic Pattern

Wide-Banding (Wb) - Postulated by Robinson as a distinct gene although this hypothesis has never been proved – in fact more likely to be polygenetic. Undercoat width genes determine the width of the undercoat whether or not the cat has a (silver) Inhibitor gene. The term "undercoat" refers to the part of the hair shaft closest to the body and includes both guard hairs and the shorter hairs often referred to as "undercoat" hairs. The variability seen in undercoat widths in cats points to the probable polygenetic nature of wide-banding genes. If a single gene, it is likely an incompletely dominant gene mutation. The effect serves to push the darker pattern colour up and away from the hair base towards the tip, turning the normal tabby patterns into a Shaded or Tipped cat.

typical pigment distribution on shaded hair shafts

Shorthair (L) – Longhair in cats is recessive to shorthair, and in fact it has been found that 4 distinct mutations are responsible for controlling hair length in domestic cats. (Kehler et al, 2007) The majority of Exotics used for breeding are heterozygous shorthair (Ll), therefore longhaired kittens are frequently produced in Exotic litters.

Polygenes – these are collections of genes which modify the effect of the main dominant and recessive genes above. A build-up of polygenes serves to enhance the effect of the main colour genes, for example turning the effect of the orange gene from the sandy colour of the ginger domestic tom to the rich vibrant red of the Red Exotic. It is likely that the effect of a group of polygenes is the reason for variation in the degree of tipping in wide-banded Exotics - the polygenes working to create the band-width in interaction with the inhibitor gene (when present) resulting in the range of pattern from tipped to heavily shaded.

3. Development of a Breeding System – Improving the Breed

A recommended systematic approach should adopted by breeders. The prime objective should be to perpetuate the breed as distinct and recognisable; to improve the quality of the breed as measured against the Standard of Points, and potentially to gain success on the show bench whilst maintaining excellent health, temperament and virility.

In order to ensure the maintenance of good breed type as defined in the Standard of Points , while allowing scope to further improve aspects of coat, pattern and colour, all breeders need to have a clear, defined, and well understood *breeding system*. This means the development and management of a breeding programme in which certain cats are carefully selected to be bred to each other for predetermined reasons. Equally important, it also means that a mating is not permitted until careful consideration to the outcome and consequences for the breed has been considered. In particular four key rules must be followed:

- Health shall be the overriding consideration in any breeding programme.
- The good (positive) and bad (negative) features of the individual cats should be assessed and weighed against each other before any mating. This is to preclude or minimise the risk of passing on genetic faults/anomalies.
- When planning a breeding programme, breeders must realise that re-enforcing of the good traits in a cat may also result in re-enforcing the defects. The breeding of cats with similar faults should be avoided to minimise the danger of creating a characteristic which cannot subsequently be eliminated.
- Breeders shall make themselves aware of the nature of the characteristics they wish to promote or avoid. These may be due to a dominant factor (which will always be visible when present) or a recessive factor (though not immediately visible, may affect future progeny if mated to a cat with the same characteristic)

Type – As previously mentioned, the Exotic is equivalent in type to the Persian - a well balanced cat with a rounded head showing good breadth of skull, small ears fitting into the rounded contours of the head, full cheeks and a short, broad nose with a well defined stop. Breeders should pay particular attention to the nose leather (to be fully formed) and nostril apertures (to be of adequate size). The body of the Exotic should be medium to large, well muscled, cobby, low on the legs, with massive shoulders and rump. The legs should be short and thick with large rounded paws; the tail short, but in proportion to the body length. Breeders should familiarize themselves with the Exotic Standard of Points; this document is available from the Exotic BAC website at www.exoticbac.co.uk. The Standard of Points discourages the breeding of extreme type that may lead to physical anomalies. Refer also to the GCCF List of Veterinary Defects for guidance.

Coat – The Exotic coat is unique, being soft, dense and plush in texture, with enough density to stand well away from the body. It is medium in length; longer than in other shorthairs, but should never be long enough to flow. A flat or close-lying coat is undesirable. There may be differences in coat quality, particularly in length, between heterozygous and homozygous shorthaired Exotic cats.

Colour and Pattern – Please refer to the GCCF Exotic Standard of Points for descriptions of colour and pattern.

4. The Selection Process

The appearance (phenotype) of the individual cat is made up of a large number of genetic characteristics of varying expression. The ideal cat is one in which the expression of each of these characteristics is just right in the eyes of the breeder – this may mean that an intermediate expression will be required for some characteristics, but a more extreme expression required for others. The degree of expression is controlled by selective breeding. It should be noted that random selective breeding by itself is not very efficient in eliminating variation and diversity.

Inbreeding - Inbreeding is the act of mating individuals of various degrees of kinship, if continued it produces ever increasing homogeneity in the offspring. Inbreeding (including "line breeding") is an inclusive term covering many different breeding combinations and degrees of relationship. Inbreeding is consistently more efficient in reducing variation and diversity by increasing homozygous (same) genotype. This tends to increase the likelihood that kittens will more closely resemble their parents. Some inbreeding is essential to stabilise conformation around a definite type and to maintain the integrity and distinct physical and genetic characteristics of any breed of pedigree cat.

The constraints relating to inbreeding and outcrossing suggested in the GCCF's Breeding Policy should be taken into account together with the restrictions included in the Exotic BAC's registration policy. Breeders may wish to consult a pedigree database, many of which are available on the internet; these allow the calculation of the expected degree of inbreeding from proposed matings between specific cats. Advice should also be available from the Exotic Breed Clubs.

5. Genetic Anomalies affecting the Exotic Breed

Defects that are the direct result of inheritance are termed genetic anomalies and all breeders should be aware of these potential problems. The GCCF List of Withholding Faults and list of the more well known genetic disorders included below give an indication of these undesirable traits. It is recognised that breeders may want to test for any genetic anomalies in their own lines and that the mating of very closely related cats is the simplest way to do this. Other non-invasive techniques are available (e.g. ultrasound scanning), although a DNA test, if available, may be a more acceptable alternative.

Polycystic Kidney Disease (PKD) – More correctly called Autosomal Dominant PKD (AD-PKD) - a deleterious gene mutation which causes enlarged kidneys composed of dilated cystic channels, resulting in early kidney failure and death. Being a dominant gene, only one copy is needed for a cat to be affected; this makes it relatively easy to eliminate the problem within a few generations. A DNA Test is available. It is strongly recommended that breeders of Exotics should work only with cats from lines tested clear of PKD.

Other Inherited Defects - Please refer to the GCCF Breeding Policy, Chapter 6, for further information.

Appendix – Useful references and website links

Genetic testing for cats:

http://www.vgl.ucdavis.edu/services/cat/
http://www.aht.org.uk/genetics_tests.html#feline
http://www.animalsdna.com/feline/
http://www.laboklin.co.uk/laboklin/GeneticDiseases.jsp?catID=CatsGD
http://www.langfordvets.co.uk/laboratory_owners.htm (discount available for members of a recognized breed club)

Genetic anomalies:

http://www.messybeast.com/gene-anomalies.htm
The book "Robinson's Genetics for Cat Breeders& Veterinarians" by Vella, Shelton, McGonagle & Stanglein, published by Butterworth & Heinemann. ISBN-10: 0750640693: ISBN-13: 978-0750640695
White cats, eye colour & deafness: http://home.earthlink.net/~featherland/off/white.html