EFTBA Veterinary Newsletter 29

Caenorhabditis elegans

The name of this nematode is a blend of the Greek *caeno-* (recent), *rhabditis* (rod-like) and Latin *elegans* (elegant)

The bottom line and the mtDNA

November 2018

. *The 'bottom line' is the direct line of female descent in a tabulated pedigree*

. Most of a cell's DNA is contained in its nucleus; but the mitochondrion also has an own, independent genome (the mtDNA) which is passed only from the mother to the offspring.

. Might there be a common denominator for the dam line and the maternal mtDNA?

"Many thanks to Mrs. Eva-Maria Bucher-Haefner, Moyglare Stud Farm, for her valued sponsorship of this newsletter."

Welcome to EFTBA's veterinary newsletter

Dear Breeder,

Welcome to the 29th edition of the veterinary newsletter, researched and produced by Dr. Hanspeter Meier and kindly sponsored by Mrs. Eva-Maria Bucher-Haefner of Moyglare Stud Farm. Once again Dr. Meier has skilfully managed to cover the topic in question in layman's terms.

The topic under the spotlight on this occasion is the very intriguing and complex matter of mitochondrial DNA (mtDNA) and the role it can play in modern day breeding practices. The whole area of genome testing is very much in its infancy as scientific research and studies continue at pace. It has the potential to heavily influence breeders in the future when it comes to mating plans.

The EFTBA veterinary committee works hard on behalf of all European breeders in dealing with the whole area of infectious diseases, availability of vaccines, shuttle stallions and as well as the contentious issue of BREXIT and in particular the need to secure a workable replacement to the Tripartite Agreement. It is essential free movement of Thoroughbreds across the whole of Europe continues.

If there are any topics you would like to be included in future editions of the EFTBA veterinary newsletters please e-mail Kerry on kryan@itba.ie and she will forward your request on.

I look forward to catching up with those of you attending the Autumn Meeting on 27th November in Newmarket.

Best regards

Joe Hernon

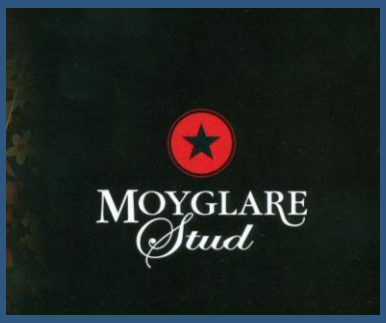
Chairman, EFTBA

Editorial

This autumn, our colleague Max Rothschild (member of the genomics monitoring group), called our attention to a new publication of the geneticist **Byron Rogers** (2018) in Kentucky: ***Mitochondrial DNA haplotypes and mating outcomes***. The title of this scientific study certainly does not sound very familiar to the practicing breeder – a good reason for occupying ourselves with this subject in our newsletter.

Dr Hanspeter Meier

EFTBA veterinary advisor & Newsletter editor



Introduction

The term "mitochondrial DNA" (mtDNA) may sound pretty obscure at first sight - but there is absolutely no reason for reservation, please. First, because the mitochondrial DNA generally didn't play a great role in horse breeding yet and second, as Rogers (2018) refers here to traditional, ancient and already almost forgotten methods of breeding the Thoroughbred - the theories of Hermann Goos (1885) and Bruce Lowe (1913). Goos published „Die Stamm-Mütter des Englischen Vollblutpferdes" and the work of Lowe carried the title "Breeding Racehorses by the Figure System".

The reason for this context is quite simple as both Goos and Lowe made great efforts on investigating the dam lines of the Thoroughbred. The connection between these old fundamental studies and the modern genetic research is now that mtDNA only is passed on by the female horses – the dam line. These findings did – of course – stimulate great new interest for studying the 'bottom line' in pedigrees.

Therefore, let's get more familiar with the subject of mitochondrial DNA first.

The Mitochondrion and its DNA

The **mitochondrion** (plural **mitochondria**) is an organelle found in most eukaryiotic organisms (eukaryote: any cell that possesses a nucleus in which the chromosomes with hereditary material are located). This organelle, the mitochondrion, is a cellular 'energy exchanger', as it generates most of the cell's supply of adenosine triphosphate (ADP > ATP), the source of chemical energy (fig. 1 & 2).

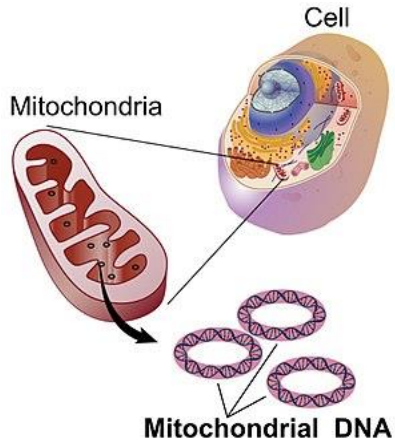


Fig. 1 Mitochondrial DNA is the small circular chromosome found inside mitochondria. The mitochondria itself often is called the 'powerhouse' of the cell (Wikipedia).

In addition to supplying cellular energy, mitochondria are also involved in other tasks, such as cellular differentiation and growth as well as maintaining control of the cycle and death of the cell. To fulfil all these tasks, **the mitochondrion has its own genome** (the mtDNA), independent from the DNA in the nucleus of the cell (fig. 1 & 2) (Wikipedia).

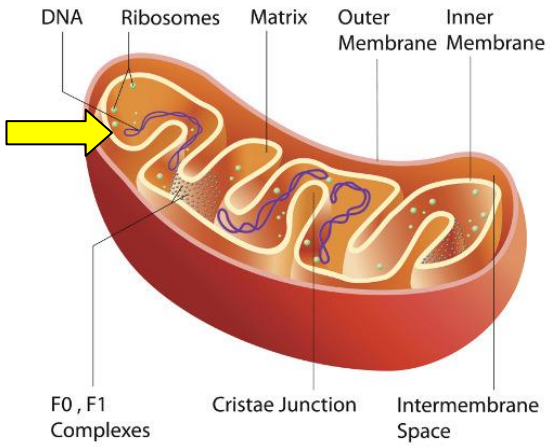


Fig. 2 Diagram of a Mitochondrion and its DNA. Mitochondria are commonly between 0.75 and 3 µm in diameter and can be shown by microscopy only; they vary in size and structure. In humans, the mtDNA has 16,569 base pairs and encodes for only 37 genes. The mitochondria, and thus the mtDNA, are passed only from mother to offspring through the egg cell (Wikipedia).

In our days now, and of importance especially for us breeders, one knows that the mtDNA also has a meaning for heredity. In most animals, sperms contain only some hundred mitochondria, but the eggcells hold several hundred thousand of them. After fertilization, the progeny therefore will get almost 100% of the maternal DNA. – By the way, this discovery must make us pretty proud, as our equids did help to prove this peculiarity. Breeding mules and hinnies did show that the mitochondria of mules contain horse-mtDNA, the ones of hinnies donkey-mtDNA only (Knippers 2006).

First, uniparental (maternal) mitochondrial DNA inheritance was commonly thought to be caused by simple dilution of paternal mtDNA, as paternal gametes (sperms) are much smaller than maternal gametes (eggs) and contribute only a limited amount of mitochondria to progeny. But the mechanisms, by which this occurs, have remained largely elusive. Therefore, further investigations were initiated and carried out with the transparent nematode (round-

worm) ***Caenorhabditis elegans*** (fig. 3) (Levine and Elazar, 2011).

Fig. 3 *Caenorhabditis elegans* is a free-living (not parasitic), transparent nematode (roundworm), about 1 mm in length, that lives in temperate soil environments. The majority of these nematodes are hermaphrodites and a few are males (Wikipedia).

Caenorhabditis elegans, the tiny roundworm, is one of the most important coworkers for the worldwide research in our days in physiology, medicine, chemistry and space:

- In 2002, the Nobel Prize in Physiology or Medicine was awarded to Sydney Brenner, H. Robert Horvitz, and John Sulston for their work on the genetics of organ development and programmed cell death in *C. elegans*.

- The 2006 Nobel Prize in Physiology or Medicine was awarded to Andrew Fire and Craig C. Mello for their discovery of RNA interference in *C. elegans*.

- In 2008, Martin Chalfie shared a Nobel Prize in Chemistry for his work on green fluorescent protein; some of the research involved the use of *C. elegans*.

- *C. elegans* made news when specimens were discovered to have survived the Space Shuttle *Columbia* disaster in February 2003.

- Later, in 2009, live samples of *C. elegans* from the University of Nottingham were announced to be spending two weeks on the International Space Station that October, in a space research project to explore the effects of zero gravity on muscle development and physiology. The research was primarily about genetic basis of muscle atrophy, which relates to spaceflight or being bed-ridden, geriatric, or diabetic.

- 2011: Descendants of the worms aboard Columbia in 2003 were launched into space on *Endeavour* for the STS-134 mission.

- Additional experiments on muscle dystrophy during spaceflight will be carried on starting in November 2018 on board the ISS – good luck (Wikipedia).

These studies showed that **sperm mitochondria are destroyed by autophagy at fertilization** in *C. elegans*, explaining the maternal origin of mitochondria in this and perhaps other animals. This degradation is thought to be a process that removes structures that may threaten cell survival.

Further research **in mammals** demonstrated that here, **the sperm mtDNA isn't actively digested but inactivated by a protein modification** (called "ubiquitination")(Levine and Elazar, 2011).

The mtDNA and the Thoroughbred

Of course, all this fantastic basic research with the maternal mitochondrial DNA did also find the interest of the Thoroughbred industry, and, to my knowledge, the Australian bloodstock consultant **Ken McLean** (1996) was the first author who dedicated a whole chapter of his book '**Genetic Heritage**' to *"The mitochondria of cells and its maternal importance"*. Here he also referred to the techniques used by one of the most celebrated breeders and theorizers of the 20th century, Lt. Col. J.J.Vuillier (consultant to HH Aga Khan III) and his wife. Madame Vuillier is quoted to have said: *"It is always the mare which improves the stallion, and not the stallion which improves the mare."*

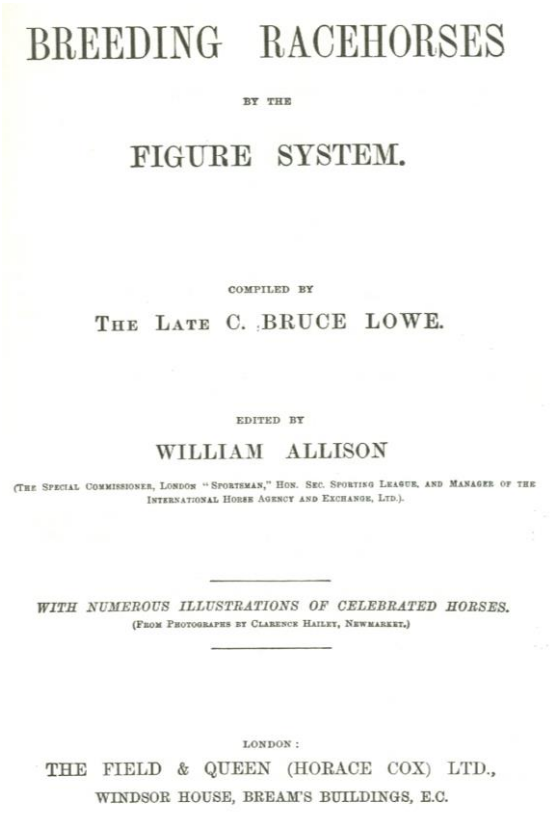
McLean also mentioned that the existence of the mtDNA helps to understand non-Mendelian inheritance and why some human diseases are confined to women. A few years later, **Frank Mitchell** (2004) made reference to McLean's work in his book '**Racehorse Breeding Theories**' with the short chapter "*A complementary Theory: The M Factor*".

Matthew Binns and **Tony Morris** published the book '**Thoroughbred Breeding Pedigree Theories and the Science of Genetics**' in 2010. They also did remind us of the work of Bruce Lowe more than a century ago, because mitochondrial DNA acts as a female "surname" and follows the same pattern through a pedigree as his family numbers. This path is the tail-female line for each individual, i.e. the bottom line on a typical pedigree. However, though Lowe's work came after the discovery of the mitochondria, it was not until relatively recently that a link was made between the two (Binns and Morris, 2010).

At the same time, quite a few scientific articles were also devoted to the research in the fields of mtDNA and breeding. Jansen (2002) e.g. studied phylogenetics (evolutionary history) and the domestication of the horse, and Hill and coworkers (2002) explored the history and integrity of thoroughbred dam lines. The latter subject was also followed by

Bower et al. (2012) with the study '**Thoroughbred racehorse mitochondrial DNA demonstrates closer than expected links between maternal genetic history and pedigree records**'.

Comparable investigations of this subject are now the already mentioned ones of **Byron Rogers** (2018). He sequenced the mtDNA of over 4'000 Thoroughbreds from varying Bruce Lowe families (fig. 4), and from samples in the US, Europe, Japan, Australia, New Zealand and South Africa. He did expect that it would prove that some errors had crept into matrilineal records spanning more than three centuries during which the Thoroughbred spread far and wide from its country of origin. However, it was actually quite remarkable, and an enduring testament to the earliest compilers of the General Stud Book, the extent to which so many of the Lowe-numbered families have actually remained somewhat conserved to the same type of mtDNA since the closing of the stud book.



BREEDING RACEHORSES

BY THE

FIGURE SYSTEM.

COMPILED BY

THE LATE C. BRUCE LOWE.

EDITED BY

WILLIAM ALLISON

(THE SPECIAL COMMISSIONER, LONDON "SPORTSMAN," HON. SEC. SPORTING LEAGUE, AND MANAGER OF THE INTERNATIONAL HORSE AGENCY AND EXCHANGE, LTD.).

WITH NUMEROUS ILLUSTRATIONS OF CELEBRATED HORSES.

(FROM PHOTOGRAPHS BY CLARENCE HAILEY, NEWMARKET.)

LONDON:

THE FIELD & QUEEN (HORACE COX) LTD.,

WINDSOR HOUSE, BREAM'S BUILDINGS, E.C.

Fig. 4 Bruce Lowes families (reprint 1980)

All the results as above certainly can make us very proud in regard to the high quality of our studbook. But even greater interest may find the research of **Harrison and Turrion-Gomez**, who, already in 2006, published the article '**Mitochondrial DNA: An important female contribution to thoroughbred race-horse performance'**. They made clear that the mitochondrial DNA molecule, carrying genes encoding for respiratory chain enzymes, is a primary candidate for demonstrating associations between genotype and athletic performance in mammalian species. In humans, variation at seven protein encoding mitochondrial loci has been implicated in influencing fitness and performance characteristics.

These authors think that mitochondrial gene variation may represent a measurable component contributing to performance variability, and indeed, they have observed that there is also an independent and extensive functional mitochondrial gene variation in the current Thoroughbred racehorse population. Significant associations between mtDNA haplotype, as defined by functional genes, and aspects of racing performance do exist. Binns and Morris (2010), however, were not quite so optimistic about such aspects, as the small circle of mtDNA only codes for 37 genes (fig. 1); they rather think that the odds are against such abilities.

Aren't these most interesting news? – many thanks to *Caenorhabditis elegans,* to the donkey, mule and hinny who helped to make all this progress in the research of the mtDNA.

Progress has to prove itself first to be such a one. Tradition however has proved itself long ago and is a better worldly wisdom.

Sophia Loren

Listening to Sophia Loren, we also might wonder about the tradition of our endeavors in this field - the influence of the dam, the importance of the **bottom line** in the pedigree, respectively.
(The line of female descent always appears at the lowest level of a horse's tabulated pedigree (fig. 8). For this reason the direct female line is often known as the "bottom line").

The bottom line in the pedigree

First of all, we certainly are allowed to say that this tradition goes back far, as we certainly remember what Virgil (70-18 BC) mentioned quite some time ago: „*corpora praecipue matris legat*"(first of all, "choose good dams")(Löffler, 1866).

Are we Thoroughbred breeders respecting and following this advice? - I think so, but better let us substantiate this opinion.

In reference to the bearing of the dam, we already mentioned Hermann Goos and Bruce Lowe, but here we also must consider **Friedrich Becker** (1935)

with his book '**The Breed Of The Racehorse'** (fig. 5), as well as **Kazimierz Bobinski** and **Stefan A. Zamoyski** (1954) with their '**Family Tables Of Racehorses'**. These publications are very useful sources for studying maternal lines, as Becker also had published 'The Successful Female Lines in the Breeding of the Thoroughbred'.

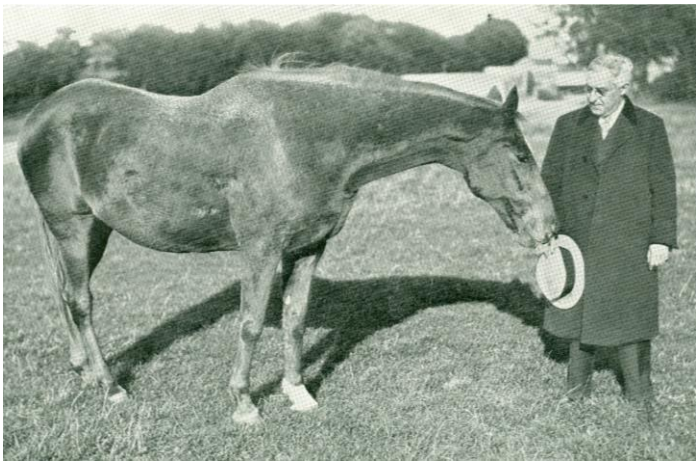


Fig. 5 *Pretty Polly* (28 years old) and Friedrich Becker 1929, Eyrefield Lodge (Becker 1935)
Pretty Polly never bred a horse of racing merit equal to herself. But the female descendants of her four daughters continued to win top-class races throughout the world

Moreover, **Miles Napier** (1977) did remind us correctly of the fact, that the General Stud Book had classified all families by direct female (rather than male) descent right from the beginning. At his time, he also mentioned that "*It cannot be said genetically, that the direct female (or tail female) line plays a dominant part in a horse's ancestral make-up. And for this reason the degree of its importance can well be questioned. The most obvious value of a female line is its commercial value. A yearling who belongs to an affluent female family will command a high sale price. Fillies and mares which belong to such a family will also possess a high breeding value. But the importance of the female line does not rest solely in its commercial value. There is a strongly held belief that the female line is an important part of a horse's ancestral make-up*."

Don't some of these statements of Napier contradict themselves? The standard of knowledge in genetics 40 years ago was in contrast to the "belief" (rather "feeling" or "intuition") of experienced breeders. However, Napier (1977) also noticed this and added a quotation of Nesbit Waddington (in The British Racehorse 1964): "*I cannot see how so many good horses of today trace to such great family names, if there is not some excellence in them which is transmitted to this day.*"

On top of this, Napier (1977) also mentioned later on: "*Since our knowledge of genetics is at present pitifully small, few people are at present in a position to produce constructive theories from this sphere.*"

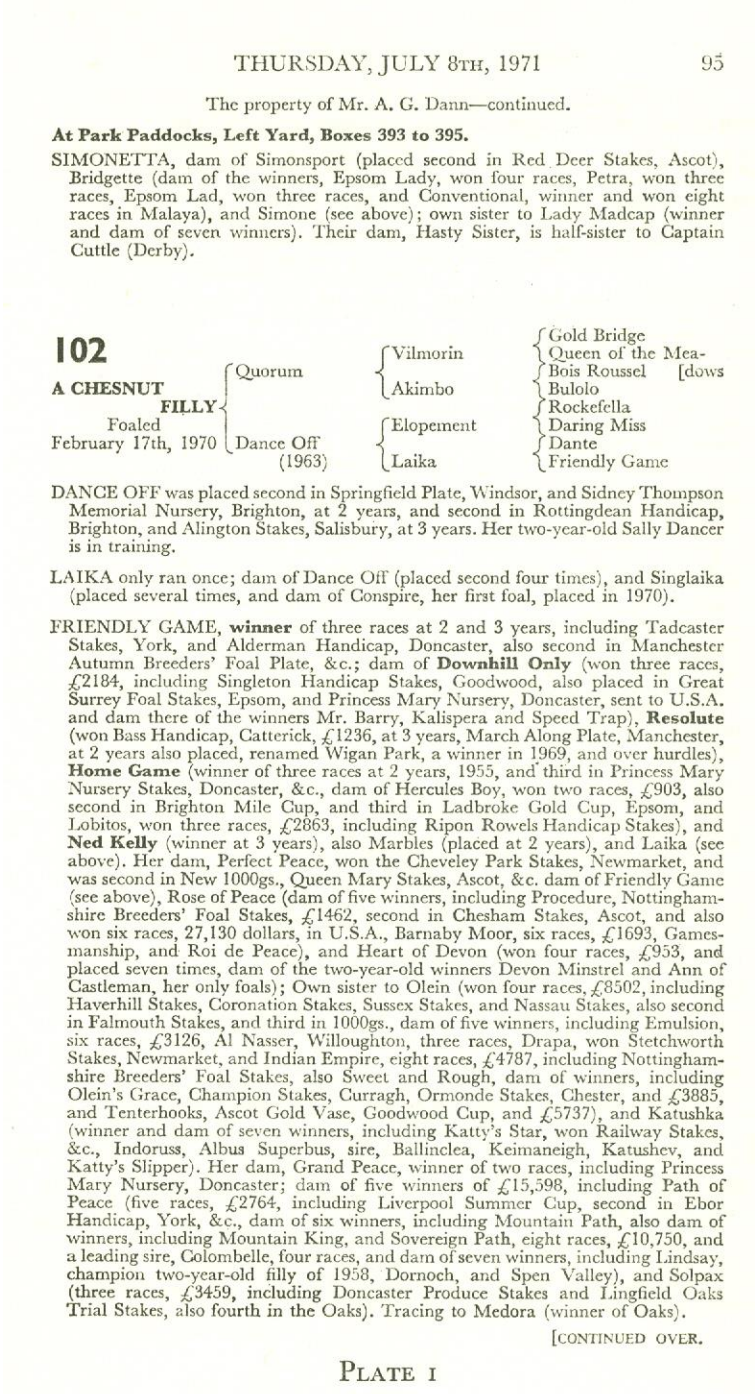
Napier (1977) therefore concluded this chapter with the sentence: "***And for this reason, if for no other, it is advisable, when assessing the pedigree of a racehorse to give due consideration to the female line.***"

Napier (1977) also made reference to Friedrich Becker and his belief in the omnipotent influence of the maternal element. He even spoke of his 'obsession' with the importance of the female line and the influence exerted on each racehorse by his dam, due to the long pre-natal contact that it undergoes with her.

Regarding the findings of Bruce Lowe, Napier (1977) considered them somewhat outdated. However, he praised the sound principles and hard work of Lowe and was of the opinion that our knowledge of the Thoroughbred would be much less without Lowe's research.

Already 4 years earlier, Napier (1973) also had published a booklet with the title '**Thoroughbred Pedigrees Simplified'**. This publication was meant to be an instruction to understand the principle of a pedigree and how to compile it. He expressed the impression that the field of racehorse pedigrees had been a specialized one of interest only to a minority, though it also is an important commercial facet of breeding. Moreover, he criticized that, at his time, there has remained an almost lack of any agreed formula for tabulating the family backgrounds (fig. 6).

Napier (1973) fancied a short work of no more than three generations, as it is pointless to tabulate the ancestry farther back in the majority of cases. He considered best a tabulation of the immediate generations of a horse's ancestry plus the breeding records of the mare in its direct female line. He presented such an example of an American sales catalogue (fig. 7).



THURSDAY, JULY 8TH, 1971 95

The property of Mr. A. G. Dann—continued.

At Park Paddocks, Left Yard, Boxes 393 to 395.

SIMONETTA, dam of Simonsport (placed second in Red Deer Stakes, Ascot), Bridgette (dam of the winners, Epsom Lady, won four races, Petra, won three races, Epsom Lad, won three races, and Conventional, winner and won eight races in Malaya), and Simone (see above); own sister to Lady Madcap (winner and dam of seven winners). Their dam, Hasty Sister, is half-sister to Captain Cuttle (Derby).

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A CHESTNUT FILLY
Foaled February 17th, 1970

Quorum — Vilmorin — Gold Bridge / Queen of the Meadows
Quorum — Akimbo — Bois Roussel / Bulolo
Dance Off (1963) — Elopement — Rockefella / Daring Miss
Dance Off (1963) — Laika — Dante / Friendly Game

DANCE OFF was placed second in Springfield Plate, Windsor, and Sidney Thompson Memorial Nursery, Brighton, at 2 years, and second in Rottingdean Handicap, Brighton, and Alington Stakes, Salisbury, at 3 years. Her two-year-old Sally Dancer is in training.

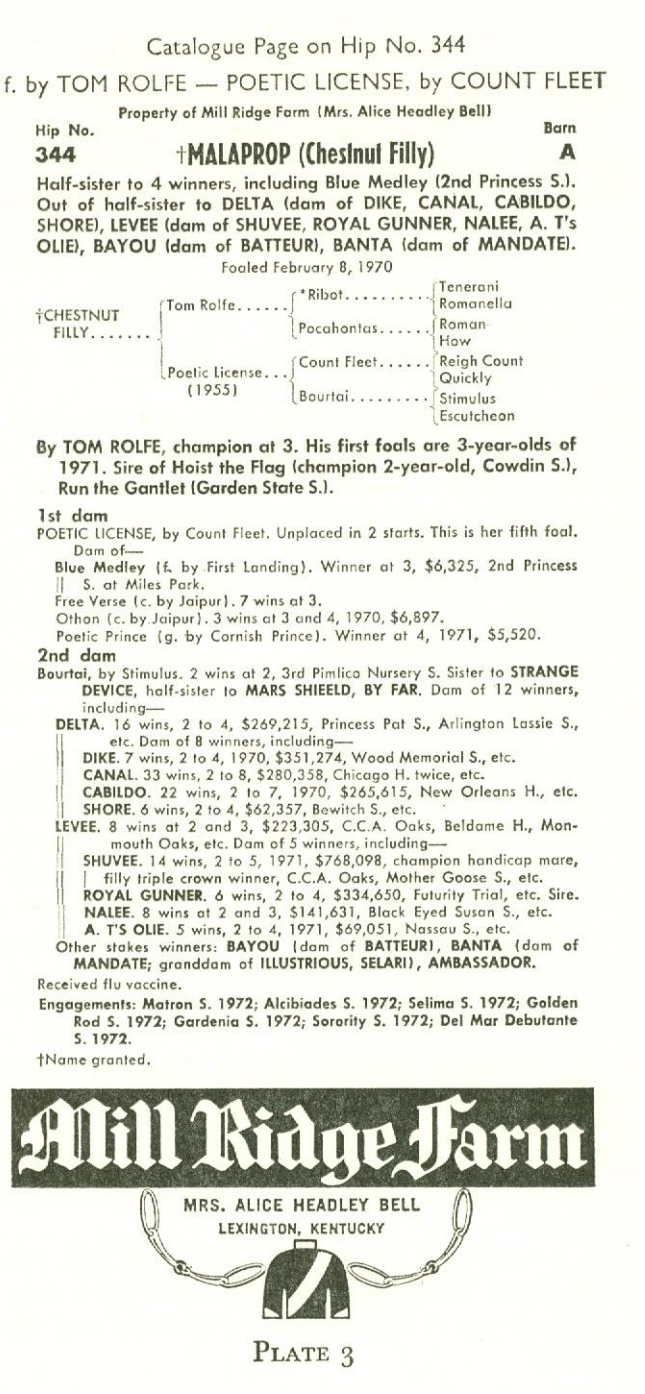
LAIKA only ran once; dam of Dance Off (placed second four times), and Singlaika (placed several times, and dam of Conspire, her first foal, placed in 1970).

FRIENDLY GAME, **winner** of three races at 2 and 3 years, including Tadcaster Stakes, York, and Alderman Handicap, Doncaster, also second in Manchester Autumn Breeders' Foal Plate, &c.; dam of **Downhill Only** (won three races, £2184, including Singleton Handicap Stakes, Goodwood, also placed in Great Surrey Foal Stakes, Epsom, and Princess Mary Nursery, Doncaster, sent to U.S.A. and dam there of the winners Mr. Barry, Kalispera and Speed Trap), **Resolute** (won Bass Handicap, Catterick, £1236, at 3 years, March Along Plate, Manchester, at 2 years also placed, renamed Wigan Park, a winner in 1969, and over hurdles), **Home Game** (winner of three races at 2 years, 1955, and third in Princess Mary Nursery Stakes, Doncaster, &c., dam of Hercules Boy, won two races, £903, also second in Brighton Mile Cup, and third in Ladbroke Gold Cup, Epsom, and Lobitos, won three races, £2863, including Ripon Rowels Handicap Stakes), and **Ned Kelly** (winner at 3 years), also Marbles (placed at 2 years), and Laika (see above). Her dam, Perfect Peace, won the Cheveley Park Stakes, Newmarket, and was second in New 1000gs., Queen Mary Stakes, Ascot, &c. dam of Friendly Game (see above), Rose of Peace (dam of five winners, including Procedure, Nottinghamshire Breeders' Foal Stakes, £1462, second in Chesham Stakes, Ascot, and also won six races, 27,130 dollars, in U.S.A., Barnaby Moor, six races, £1693, Gamesmanship, and Roi de Peace), and Heart of Devon (won four races, £953, and placed seven times, dam of the two-year-old winners Devon Minstrel and Ann of Castleman, her only foals); Own sister to Olein (won four races, £8502, including Haverhill Stakes, Coronation Stakes, Sussex Stakes, and Nassau Stakes, also second in Falmouth Stakes, and third in 1000gs., dam of five winners, including Emulsion, six races, £3126, Al Nasser, Willoughton, three races, Drapa, won Stetchworth Stakes, Newmarket, and Indian Empire, eight races, £4787, including Nottinghamshire Breeders' Foal Stakes, also Sweet and Rough, dam of winners, including Olein's Grace, Champion Stakes, Curragh, Ormonde Stakes, Chester, and £3885, and Tenterhooks, Ascot Gold Vase, Goodwood Cup, and £5737), and Katushka (winner and dam of seven winners, including Katty's Star, won Railway Stakes, &c., Indoruss, Albus Superbus, sire, Ballinclea, Keimaneigh, Katushev, and Katty's Slipper). Her dam, Grand Peace, winner of two races, including Princess Mary Nursery, Doncaster; dam of five winners of £15,598, including Path of Peace (five races, £2764, including Liverpool Summer Cup, second in Ebor Handicap, York, &c., dam of six winners, including Mountain Path, also dam of winners, including Mountain King, and Sovereign Path, eight races, £10,750, and a leading sire, Colombelle, four races, and dam of seven winners, including Lindsay, champion two-year-old filly of 1958, Dornoch, and Spen Valley), and Solpax (three races, £3459, including Doncaster Produce Stakes and Lingfield Oaks Trial Stakes, also fourth in the Oaks). Tracing to Medora (winner of Oaks).

[CONTINUED OVER.

PLATE 1

Fig. 6 A catalogue pedigree 47 years ago – in Napiers (1973) opinion a poor example in many aspects (e.g. the outsider was left not knowing who is the dam of who)



Catalogue Page on Hip No. 344

f. by TOM ROLFE — POETIC LICENSE, by COUNT FLEET

Property of Mill Ridge Farm (Mrs. Alice Headley Bell)

Hip No. 344 — †MALAPROP (Chestnut Filly) — Barn A

Half-sister to 4 winners, including Blue Medley (2nd Princess S.). Out of half-sister to DELTA (dam of DIKE, CANAL, CABILDO, SHORE), LEVEE (dam of SHUVEE, ROYAL GUNNER, NALEE, A. T's OLIE), BAYOU (dam of BATTEUR), BANTA (dam of MANDATE).

Foaled February 8, 1970

†CHESTNUT FILLY
Tom Rolfe — *Ribot — Tenerani / Romanella
Tom Rolfe — Pocahontas — Roman How
Poetic License (1955) — Count Fleet — Reigh Count / Quickly
Poetic License (1955) — Bourtai — Stimulus / Escutcheon

By TOM ROLFE, champion at 3. His first foals are 3-year-olds of 1971. Sire of Hoist the Flag (champion 2-year-old, Cowdin S.), Run the Gantlet (Garden State S.).

1st dam

POETIC LICENSE, by Count Fleet. Unplaced in 2 starts. This is her fifth foal.
Dam of—
Blue Medley (f. by First Landing). Winner at 3, $6,325, 2nd Princess S. at Miles Park.
Free Verse (c. by Jaipur). 7 wins at 3.
Othon (c. by Jaipur). 3 wins at 3 and 4, 1970, $6,897.
Poetic Prince (g. by Cornish Prince). Winner at 4, 1971, $5,520.

2nd dam

Bourtai, by Stimulus. 2 wins at 2, 3rd Pimlico Nursery S. Sister to **STRANGE DEVICE**, half-sister to **MARS SHIEELD, BY FAR**. Dam of 12 winners, including—
DELTA. 16 wins, 2 to 4, $269,215, Princess Pat S., Arlington Lassie S., etc. Dam of 8 winners, including—
DIKE. 7 wins, 2 to 4, 1970, $351,274, Wood Memorial S., etc.
CANAL. 33 wins, 2 to 8, $280,358, Chicago H. twice, etc.
CABILDO. 22 wins, 2 to 7, 1970, $265,615, New Orleans H., etc.
SHORE. 6 wins, 2 to 4, $62,357, Bewitch S., etc.
LEVEE. 8 wins at 2 and 3, $223,305, C.C.A. Oaks, Beldame H., Monmouth Oaks, etc. Dam of 5 winners, including—
SHUVEE. 14 wins, 2 to 5, 1971, $768,098, champion handicap mare, filly triple crown winner, C.C.A. Oaks, Mother Goose S., etc.
ROYAL GUNNER. 6 wins, 2 to 4, $334,650, Futurity Trial, etc. Sire.
NALEE. 8 wins at 2 and 3, $141,631, Black Eyed Susan S., etc.
A. T'S OLIE. 5 wins, 2 to 4, 1971, $69,051, Nassau S., etc.
Other stakes winners: **BAYOU** (dam of **BATTEUR**), **BANTA** (dam of **MANDATE**; granddam of **ILLUSTRIOUS, SELARI**), **AMBASSADOR**.

Received flu vaccine.

Engagements: Matron S. 1972; Alcibiades S. 1972; Selima S. 1972; Golden Rod S. 1972; Gardenia S. 1972; Sorority S. 1972; Del Mar Debutante S. 1972.

†Name granted.

Mill Ridge Farm
MRS. ALICE HEADLEY BELL
LEXINGTON, KENTUCKY

PLATE 3

Fig. 7 According to Napier (1973), a superior example of a pedigree in an American sales catalogue long time ago

In these days, in the majority of cases the vendors did the pedigrees themselves or had somebody to do them. There was therefore an inevitable lack of method and uniformity in the way the pedigrees were presented. Breeders often failed to realize what an excellent "shop window" a well laid out catalogue can be. Napier (1973) therefore did suggest to develop a method of cataloguing that is uniform throughout the world. – This suggestion was taken up and already for quite some time, the sales companies follow the "***Criteria for Pedigree Compilation***", agreed by the **International Cataloguing Standards Committee**. - Todays catalogue pedigrees show the bottom line of every horse, exactly

that information which is of interest in regard to mt-DNA-research. Another reason for us to be justifiably proud of these unraveled achievements of our industry. -
I suppose that even Sophia Loren might support our convictions.

Allegretta (GB) ch. 1978	Lombard (GER) ch. 1967	Agio (GER) b. 1955	Tantieme (FR)	Deux-Pourcent
				Terka
			Aralia (GER)	Alchimist
				Aster
		Promised Lady (GB) ch. 1961	Prince Chevalier (FR)	Prince Rose
				Chevalerie
			Belle Sauvage (GB)	Big Game
				Tropical Sun
	Anatevka (GER) ch. 1969	Espresso (GB) ch. 1958	Acropolis (GB)	Donatello
				Aurora
			Babylon (GB)	Bahram
				Clairvoyante
		Almyra (GER) ch. 1962	Birkhahn (GER)	Alchimist
				Bramouse
			Alameda (GER)	Magnat
				Asterblüte (GER)

Fig. 8 The bottom line in the pedigree of ***Urban Sea*** (- which might remind us of our former EFTBA-colleague and French delegate Michel Henochsberg)

According to Sexton (2014), *Urban Sea* was bred in 1989 by Marystead Farm in Kentucky, but she hails from a good German family cultivated by Gestüt Schlenderhan – the studfarm we were allowed to visit on the occasion of our meeting last spring in Cologne. – Again many thanks, Daniel and Andreas, for this great opportunity!

Her fifth dam, *Asterblüte*, won the 1949 German 1,000 Guineas, Oaks and Derby for Schlenderhan while her own dam, *Allegretta*, was bred by the stud by their then resident stallion *Lombard*. *Allegretta's* dam, *Anatevka*, was sent to *Lombard* on five occasions, a mating that resulted in 4x5 inbreeding to *Asterblüte's* dam *Aster* and 4x4 inbreeding to German champion sire *Alchimist*. Trained by Sir Michael Stoute, Allegretta ran second in the Lingfield Oaks Trial but after disappointing in the Oaks and Park Hill Stakes, was sent to Tattersalls, where she changed hands for 24,000 guineas ($40,800) to Ray Rowley of the Old England Bloodstock Agency.

Allegretta was transferred to the U.S., where she made three final unsuccessful starts, before returning barren in each of her first two seasons at stud. When she did finally conceive to *Irish Castle* in her third year in 1984, she was unsurprisingly sent by owner Big E Farm to the Keeneland November Sale, where she sold to Marc de Chambure and Michel Henochsberg (Sexton, 2014).

Urban Sea at the Irish National Stud
(Sexton 2014 / Photo Peter Mooney)

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If there is any aera you would like covered in these very informative newsletters you should contact Kerry on kryan@itba.ie and she will forward your request on.

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