A QUESTION OF SPEED & STAMINA

DR. STEVE HARRISON of The Thoroughbred Genetics Company explains why better results will be obtained by building on known aptitudes rather than trying to modify them with totally dissimilar genes

Above: Kyllachy, whose parents shared similar talents

What would you get if you crossed Paula Radcliffe with Gary Lough? No, there is no punch line. It is a serious question. The world's greatest human female stayer and her 'middle-distance' running husband, who ran 3.34 over 1500 metres in his prime. A better example might have been provided if Gary Lough had been a sprinter, but there is still quite a difference between running 1500 and over 40,000 metres. Thoroughbred breeders might learn much from considering the theoretical breeding dynamics of the human species.

A useful model is provided here which humans might more readily relate to and empathize with. It is also an area, unlike in thoroughbred breeding, where commercial and selection variables do not have a role. Moreover, a considerable amount of money and effort has been spent on the examination of the role of physiology and genetics in human athletic performance.

It is a complicated situation but there is already sufficient evidence in human studies to suggest that some genes, or versions of genes, implicated in athletic endurance success differ from those with a greater influence on prowess in power-orientated activities.

There are also numerous metabolic processes and biochemical cycles going on at any one time in the cells of an individual. Many of these have a bearing on an athlete's ultimate athletic niche, for example those involved in energy release in the muscles. It is clear that certain metabolic cycles can be categorised as to whether their influence is more pronounced with regard to power or endurance events. For instance, some biochemical processes have a role in breaking down specific high energy compounds during a marathon but not in a 100 metres sprint. There can be at least 30 genes controlling some of the cycles.

Within these biochemical cycles some gene versions are more efficient in doing their jobs than others. Therefore, an individual's athletic career route can be determined, at least in part, by the relative efficiencies and strengths of gene versions involved in the different biochemical cycles which primarily favour either endurance or power.

This logically suggests that an aspiring prodigy born to athletic parents has a more predictable athletic future if his or her parents competed successfully in similar events. This would provide greater consistency by reproducing genetic strengths contributing to the same athletic goal, rather than providing genetic improvement in 'non-targeted' and physiologically 'incompatible' areas.

There is not enough evidence to show that a 1500 metres runner has wildly different genetic requirements to a marathon runner, but this example might be more appropriate in translating these observations into an equine format where race distance variability is less clear cut.

There is no such major variance in the distances of races run by Thoroughbreds where a marathon is 400 times the distance of a 100 metres sprint. Here we are looking at a situation where the difference may only be two- or three-fold between all major race distances. Given this situation, the physiological and genetic differences between 'sprinting' and 'staying' Thoroughbreds may be more subtle.

However, it is clear from the fact that sprinters cannot perform well over longer distances and that the form of various horses does take a dip when tried over extended distances, that different mechanisms are at work in determining a horse's optimum trip.

For example, there are certainly differences in distribution of muscle fibre types between stayers and sprinters. Crossing animals from the two groups does seem to result in animals with intermediate fibre distribution but, as with humans, there are many other genetic variables that will play a role in determining the final outcome.

If the human model suggests that there is athletic specialisation of specific body types between a 100 metres runner and a 400 metres runner, which is more in the 'ball park' figure of the range of horse racing distances, then it is probably true that this also applies to horses.

Distance categories are less well defined in horse racing and there is a main genetic grey area in the 'pay dirt zone' between a mile and ten furlongs. The uncertainty as to whether a top-class horse is capable of 'getting' the longer distance is curious, given the fact that changes in training regime might be capable of swinging a horse's performance by one or two furlongs extra. However, this would suggest that it is difficult to place horses into convenient, tidy little distance packages within this

group and that genetic potential is highly horse specific. Many of the horses running over the variety of middle distance races and sprints look similar and differ probably in their physiology rather than conformation.

Whilst the racing industry has its different tiers of operation, it is now perennially argued that racing attention has become generally focussed commercially on the shorter or shorter middle distance races. Generally, breeders seem to be attracted towards producing horses that fall into the 8-10 furlongs category.

They are more valuable and it is understandable that breeders will try to breed horses which are more specialised and not compel trainers to waste time on producing an 'all-rounder'.

The Ascot Gold Cup and the St. Leger were once popular races and horses could be unashamedly bred with winning these races as an objective. For a variety of reasons, this has changed. It is possible that the influx and influences of American bloodstock and racing objectives have played a major role. Horses which could compete over a wide range of distances are very rare and a winner of an English Triple Crown is now an unlikely prospect.

It is true that some winners of the Derby could perform well in the St. Leger and others may not be disgraced in the 2000 Guineas, but the potential to exceed in all is diminished. Regardless of whether this is due to increased competition, lack of interest, commercial pressures or greater specialisation within given distances, it would now appear that more horses tend to fall into a narrower range of stamina categories than previously seen.

The true longer distance horse was conformationally different from the speedier horse. It could be argued that this is now less true, as horses bred to run over longer distances on the flat no longer exist and those that do are discarded failures from races over the shorter distances. The possession of extended stamina is now mainly an accident and colts with the ability to perform over longer distances hold no attraction in the breeding world.

Does this mean that there is less genetic difference between Thoroughbreds in general? The answer is 'probably not'. There has just been a shift of emphasis and a change in dynamics. The increased popularity of two-year-old racing has undoubtedly led to an increase in the number and subsequent popularity of sprint and miler stallions. We have a situation where stamina-orientated stallions are sidelined as un-commercial, but there is still a mish-mash of genetic diversity as stamina attributes are maintained through mares and broodmare sires. These factors mean that there is probably more chance than ever of being tempted to cross animals that are dissimilar to each other.

This means that we still have a Thoroughbred population carrying a mixture of genes, with some affecting stamina potential more than sprinting potential and vice versa. There is ample genetic material to suggest that what we can learn from human systems is applicable to horses. If stamina and sprinting attributes are controlled by genetic mechanisms or genes that are diametrically opposed, then attempting to compensate for a deficiency in speed or stamina by crossing a mare with a stallion of the opposite extreme might not be the best ploy.

Similarly, the common policy of mating stallions of low stamina index with mares of opposite extremes in order to produce a middle distance runner may work in some cases, but it is genetically more likely to produce neither one thing nor the other and statistically more likely to end in failure.

The economics of breeding and racing puts the emphasis on the quick fix, but it may not be possible to achieve a breeding objective by crossing dissimilar animals together in the space of one generation. In 'fixing' other multi-genetically controlled characteristics in other species, it is often necessary to back-cross animals over a number of generations to animals with the desired characteristics. Alternatively, line-breeding using animals with the desired traits may work.

Most breeders do not have the time to do this. Also many people take pot luck on the outcome of a mating. There are different distances of race, ground conditions, track, etc., and a horse may find its niche eventually.

It can be argued that, to get the best from a mare, irrespective of her stamina range, it is better to accept her limitations and reinforce her primary qualities by crossing her with a stallion of similar stamina influence. There are obviously more pedigree and genetic parameters in play, but this increases the chances of 'concentrating' genes compatible for doing the same job rather than creating a mixed bag of genes that cancel each other out. The theory also holds true for the reverse in the case of the stallion. This does not necessarily lead to an increase in inbreeding. Crossing unrelated horses with similar stamina attributes may not only concentrate compatible genes but also enhance hybrid vigour.

Breeding compatible genetic components into the one horse is important and should possibly be borne in mind as a target. Putting a Formula 1 engine into a tractor is not necessarily going to make an efficient touring car.

Now. What would you get if you crossed Kithanga with Kyllachy?

Dr. Harrison appears courtesy of The Thoroughbred Genetics Company. Pacemaker

Below: Bahamian Bounty, a very successful product of the matching of similar aptitudes