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Equine genetics

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Harnessing the genetic tool box for the benefit of the racing Thoroughbred

The concept that characteristics pass from one generation to the next was first described in scientific terms in the late nineteenth century.

Modern genetics, however, is only about 50-60 years old and has progressed remarkably quickly since 2001 when the first draft of the human genome was published.

Animal genetics has virtually kept pace with human genetics and, although a slow starter, the development of tools specifically to study horse genetics has caught up in the past few years, with the equine genome sequenced in 2007.

Much of the effort applied to horse genetics to date has been concentrated on developing a toolbox of techniques and information to enable future studies, which have huge potential both to improve horse health and welfare and to enable trainers to tailor training regimes for individual animals to allow them to achieve their full potential.

Real practical progress has already been made with, for example, a new test developed for carriers of foal immunodeficiency syndrome in Fell and Dales ponies, and strong indications that diseases important to the Thoroughbred, such as an increased tendency to sustain fractures, ostochondrosis, recurrent rhabdomyolysis (tying up) and recurrent airway obstruction (heaves) all have genetic components.

There is no doubt that geneticists and the British Thoroughbred Industry now stand together at a cross roads. Just as the development of genomic resources has gathered pace over the last few years, so will the application of those resources in the next decade.

The accumulation of this scientific knowledge across the world is inevitable; the way in which it can be applied to the British breeding and racing industries now lies in the hands of those industries.

The ideal characteristics of an animal population to facilitate genetic studies and the application of genetics for the benefit of the breed are that it has limited genetic diversity, detailed breeding records are maintained, individuals are exposed to similar environments, the phenotypes of the animals in the population are well defined and recorded and last, but importantly, DNA is routinely collected and archived from all members of the population.

By these criteria there is no population of animals more likely to benefit from genetic studies than the Thoroughbred racehorse.

The tools are in place to support an exponential accumulation of genetic knowledge about Thoroughbred horses dependent only on the availability of funding and the active cooperation and participation of those who breed and own them.

Genetics knows no national boundaries, so the science will develop in one country, or racing jurisdiction, if not in another.

The application of the science, however, will depend to an extent on its ownership and for that reason farsighted breeders, owners, racing authorities and national funding bodies may decide that it is vital to play an active part in genetic research to ensure that it can be applied for the greater good of the local Thoroughbred population.

Genetics research has benefited the welfare and/or the productivity of all animal species that have been studied to date. There is no reason to believe that this will not also be true for Thoroughbred racehorses and for their owners and breeders. Neither is there any reason to believe that genetics will threaten or replace more traditional means of selection of individuals to breed or buy such as pedigree analysis or assessment of conformation. Rather, knowledge of the genotypes of Thoroughbreds will enhance choices that are made and, by determining optimum systems for managing individual animals, make it more likely that they will reach their full potential.

To give a simple example, it appears highly likely that some horses are genetically more prone to suffer from bone fractures than others.

It is also not improbable that one or more of the genes that are risk factors for injury are closely linked to other, desirable, characteristics such as aspects of athletic performance. To select animals, therefore, to avoid an increased risk of fracture may also mean selecting slower animals. So buyers would be well advised to continue to apply their usual selection criteria when choosing potential racehorses but, having bought the animal, could use its genotype to inform them about the best way to train and manage it so that it has the best chance of fulfilling its potential. In doing so, it goes without saying it will also enhance the value of its immediate family and, especially, its sire and dam.

The use of estimated breeding values will allow Thoroughbred breeders to select breeding stock based on a number of criteria.

The Thoroughbred industry, and those conducting research on its behalf, will need to be clear on their primary breeding objective. This may be for racing performance or the reduction of disease and injury but with well-directed research these two aims can be complementary rather than exclusive.

While the genetic toolbox for horses has been developing, the same techniques have been applied to viruses, bacteria and parasites that cause diseases in horses and already show great promise in identifying new vaccine targets or new prevention strategies. Fascinatingly, as we understand the disease-causing organisms better, we are also developing a better understanding of how horses react to them, particularly in mounting an immune response, and we find that this, too, is likely to be influenced by the horse's genes.

To find out more about HBLB's research go to:

- HBLB's Advances in equine veterinary science and practice

  http://onlinelibrary.wiley.com/journal/10.1001/%28ISSN%292042-3306/homepage/hblb_virtual_issue.htm