

Glossary

of terms associated with genetics

- Chromosome:** A chromosome is formed from a single DNA molecule that contains many genes and is present in the nucleus of every cell.
- DNA:** Deoxyribonucleic acid. The molecule inside the nucleus of a cell that carries the genetic instructions (genes) for making living organisms.
- Gene:** A sequence of DNA that occupies a specific location on a chromosome and determines a particular characteristic.
- Gene mapping:** Determining the relative positions of genes on a chromosome and the distance between them.
- Genetic marker:** A segment of DNA with an identifiable physical location on a chromosome. A marker can be a gene, or it can be some section of DNA with no known function. Because DNA segments that lie near each other on a chromosome tend to be inherited together, markers are often used as indirect ways of tracking the inheritance pattern of a gene that has not yet been identified, but whose approximate location is known.
- Genetics:** The study of heredity, focusing on how particular qualities or traits are transmitted.
- Genome:** The entire DNA contained in an organism or a cell.
- Genotype:** The genetic identity of an individual.
- Nucleotide:** The basic unit of DNA, consisting of one chemical base, a phosphate group, and a sugar molecule.
- Phenotype:** Observable traits or characteristics, for example hair colour, weight, or the presence or absence of a disease. Phenotypic traits are not necessarily genetic.

Equine Genetics
Research Ltd

For further information, please contact

Annie Dodd
Equine Genetics Research Ltd
c/o British Horseracing Authority
151 Shaftesbury Avenue
London WC2H 8AL
Tel: 020 7152 0010
Fax: 020 7152 0001

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Equine Genetics

Following a 10-year programme to create an equine genetic map, involving groups of scientists from around the world, sequencing of the equine genome was completed and made publicly available in 2007. This information represents a major milestone in our quest to understand the genetic aspects of equine physiology and diseases. The ultimate aim of this work is not to manipulate the genetic composition of horses, but to provide us with the knowledge to take genetic information into account, thus improving the health and welfare of the horses in our care.

Genome sequencing

Genome sequencing is the process of determining the order of the building blocks that make up the DNA which carries the genetic information of a cell. It is performed using very sophisticated technology which scans a sequence of individual components, much as we would scan a series of letters to read a sentence.

Knowledge of the genome sequence provides valuable clues about which genes are present and where they are positioned on the chromosomes. This is an important first step towards the understanding of how they work together to direct the growth, development and maintenance of an organism.

What are the main benefits to be gained?

Although it has become clear that genetics represent only one part of a multi-factorial picture, it is anticipated that genetic studies will allow scientists to identify specific genes which are associated with inherited diseases and predispositions to injury. If this is achieved, breeders and trainers will be armed with knowledge that will allow them to implement appropriate managerial and breeding strategies and reduce the risks relating to the conditions involved.

What progress has been made to date?

Through funding provided initially by the British Horseracing Board and now by the Horserace Betting Levy Board (HBLB) and the Thoroughbred Breeders Association (TBA), three specific conditions have been identified for investigation in the UK by scientists at the Animal Health Trust and Royal Veterinary College: recurrent exertional rhabdomyolysis (tying up), osteochondrosis (OCD); and fracture. It is thought likely that there may be an association between these conditions and markers of specific genes or combinations of genes.

Tissue samples from cases and controls for each of these conditions have been collected to conduct genetic studies. This is the current focus of research being performed under the auspices of EGR Ltd.

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Scientists at the Animal Health Trust were major contributors to the genetic mapping of the horse. Through concern that information arising from it should be made as widely available as possible, for the benefit of horses and the equine industry, the Trust linked with the British Horseracing Board (now the British Horseracing Authority) in a joint venture under the name of Equine Genetics Research Ltd (EGR). The aim of EGR is to investigate the potential applications of this powerful new research tool, determine the areas of research that are most likely to prove beneficial and ensure that access to the new technology is available to all.

The future

The next stage is to expand our understanding of the way in which genetics interacts with environmental factors such as training and nutrition. In the same way that people who have predispositions to, for example, heart disease can reduce their risk by adjusting their diet and exercise regime, so horses which are genetically predisposed to a variety of conditions can be managed to reduce the risks.

Genetic research is being conducted on a wide number of species, including the Thoroughbred horse, by scientists in many countries. It is vital that research workers in the UK remain at the forefront of this field of study in the horse to ensure that the resulting information, which has great welfare and economic potential, is made widely available to our equine industry.

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