# Shaping the sport of kings: Key genes linked to successful racehorses identified by international team

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A critical set of genes linked to successful racehorses has been identified by an international research team.

Scientists from Asia, Europe, North America, and the Irish equine science company Plusvital compared the genomes of Thoroughbred, Arabian and Mongolian racehorses to horses bred for other sports and leisure, and were able to pinpoint a set of genes that play a significant role in muscle, metabolism, and neurobiology.

These genes were found to be clearly different in racing horses, and were common to all racing breeds compared to those animals from non-racing breeds.

"Since the discovery of the 'Speed Gene' in 2009, we have generated genetic data for thousands of Thoroughbreds and horses from other breeds," said University College Dublin Professor Emmeline Hill, lead scientist on the project and Chief Science Officer at Plusvital.

"This is the first time this set of genes has been linked to the success of racing breeds. Two of the genes were previously identified for performance in Thoroughbreds and Arabians, but the approach we took was to ask what genes were common to all racing breeds and different from non-racing breeds.

"The very large number of horse breeds developed over the last hundreds of years all over the world have been carefully shaped by selective breeding for different traits desired by breeders. This has led to tall horses, small horses, powerful draft horses, useful riding horses, and fast racing horses.

"We have discovered a set of genes common to racing horses, but not all horses within a racing breed have the advantageous gene version, so these findings will be useful to identify the most suitable individuals within a breed for racing or for breeding."

Co-author UCD Professor David MacHugh commented "Although

racing is a multifactorial trait, with management and training having a considerable influence on the success of a racehorse, this study provides good evidence for major-effect genes shaping the racing trait in horse populations."

The research, published in *Communications Biology*, an open access journal from *Nature*, included the collection of hair samples from 100 horses owned by the champion Ajnai Sharga Horse Racing Team at their breeding farm in Khentii province, Mongolia, the birthplace of Chinggis Khan.

Using the DNA from these Mongolian racing horses, along with Thoroughbred and racing Arabian horses, the scientists compared the genomes of these breeds with 21 other non-racing breeds, such as Clydesdale, Connemara pony, Hanoverian, Morgan, Norwegian Fjord, Paint, Shetland, Shire, and identified seven essential genes for racing.

Among the top genes was NTM, which functions in brain development and influences learning and memory. This gene was selected during the horse domestication process, and in Thoroughbred racehorses influences whether a horse ever races.

"This finding suggests that equine neurological systems perturbed by natural and artificial selection associated with domestication may overlap with adaptive traits that are required for racing," said Professor MacHugh.

Dr. Haige Han, another project collaborator and first author of the paper added: "Testing these variants in new sets of hundreds of horses from racing and non-racing breeds identified seven essential genes for racing. These genes have roles in muscle, metabolism, and neurobiological functions, and are central to racing ability among horse breeds."

The researchers used gene expression data from skeletal muscle from Thoroughbred horses to investigate if the genes they had identified were involved in the muscle response to exercise and training.

"By integrating these two different data sets we fine-tuned the list of racing genes to those that were most biologically relevant to racing. One of these genes was MYLK2 which is required for muscle contraction. In humans, MYLK2 is associated with exercise-induced muscle damage," said Professor Hill.

**More information:** Common protein-coding variants influence the racing phenotype in galloping racehorse breeds, *Communications Biology* (2022). DOI: 10.1038/s42003-022-04206-x

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