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[The Changing Landscape of Quarter Horse Genetics, Part 1](#)

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Certain populations of the American Quarter Horse are losing genetic diversity, as revealed in genetic research supported by the American Quarter Horse Foundation.



“We were able to prove quite clearly that horses were in a specific genetic cluster, depending on what performance group they came from,” says Dr. Molly McCue. *Journal* photo

From [The American Quarter Horse Journal](#)

Talk to an equine geneticist long enough, and you are bound to hear two assertions made about the American Quarter Horse breed that sound like opposites: First, it is one of the most genetically diverse equine breeds in the world; and second, it's becoming increasingly inbred.

Beginning in colonial America, the breed began from a diverse genetic base of largely Thoroughbred and Spanish blood that was added to and developed for roughly 200 years, focusing on producing quickness and durability. But fast-forward to the modern era of specialized American Quarter Horse performers – especially at the highest levels – and you find specialization in the [horse-breeding herd](#), too; specific groups of individuals used to produce those top performers.

That suggests there are narrowed gene pools in those subgroups, and now a genetic study clearly shows it. A research team from the University of Minnesota has published its findings in an issue of the Journal of Heredity, “The American Quarter Horse: Population structure and relationship to the Thoroughbred.” The 2012-2013 study was partially funded by the [American Quarter Horse Foundation](#).

“We wanted to delve into understanding the true genetic differences between the Quarter Horse subpopulations, and see what kind of impact the practice of breeding for specialized performance has had on the breed,” explains research team member Dr. Molly McCue, a veterinarian and geneticist at the University of Minnesota College of Veterinary Medicine and a lifelong Quarter Horse enthusiast who grew up with [ranch-bred horses](#).

“Within these subpopulations, we're probably doing a lot of things to limit genetic diversity, and that's probably especially true over the last 25 to 30 years. There is narrowing of the gene pool and evidence of increased inbreeding over time.”

You could say that's stating the obvious: what we already knew about our breed as a whole and its specialized performers. However, what we didn't know was exactly how inbred those population subgroups already are, and the implications of what could happen if current breeding practices and trends don't change.

One of the most influential sires of the American Quarter Horse is the Thoroughbred Three Bars. Read more about him and his influence on the Quarter Horse breed by downloading AQHA's [Three Bars Bloodline](#) report.

The Sample

The team analyzed six Quarter Horse performance subgroups they identified as halter, [western pleasure](#), reining, [working cow horse](#), cutting and racing. The team pulled the top 200 performers for each group in 2009 and 2010, selecting by money earned for the reining, working cow, cutting and racing groups, and by AQHA points earned for western pleasure and halter.

The team then eliminated half and full siblings, making the sample as diverse as possible. From the remaining horses, the team ran genetic and pedigree analyses on 24 random individuals in each subgroup.

“We genotyped them for about 65,000 genetic markers ... and we pulled their five-generation pedigrees,” Dr. McCue says, “So we could compare what both sets of information told us about the relationships between the individuals.”

What They Found

“The groups clustered into three genetic groups,” Dr. McCue says. “The [racing Quarter Horses](#) stood out on their own, genetically; the pleasure and halter horses clustered together; and the working cow, cutting and [reining horses](#) formed the third group.

“We were able to prove quite clearly that horses were in a specific genetic cluster, depending on what performance group they came from.”

In the pedigree analysis, some groups shared no common sires, such as halter and racing, but other groups did, such as reining and working cow horse. Although popular sires within one group were rarely shared with another group, all the pedigrees reflected the common roots of the Quarter Horse.

Additionally, pedigree analysis showed that the most common 15 sires across the groups were all direct tail-male descendants of [Three Bars \(TB\)](#), with several of those stallions showing more than one cross to the Thoroughbred in the first four generations.

“Inbreeding” refers to the mating of relatives and results in an “inbred” individual. The amount an individual is “inbred” can be estimated from its pedigree or genetic data.

Three Bars (TB) can be found somewhere in the pedigrees of a large number of today’s Quarter Horses, making him one of the American Quarter Horse’s most influential sires. Download a copy of AQHA’s [Three Bars Bloodline](#) report to learn more about the mark Three Bars made on American Quarter Horse history.

In a pedigree analysis, determining an individual’s “coancestry coefficient” gives an idea of how closely related individuals are on a pedigree page. Two individuals can be highly related without either of them being inbred, but if you breed two individuals with a high coancestry coefficient, their offspring will be inbred.

“Diversity” quantifies the amount of genetic variation there is in a population. Typically, a highly inbred population has low genetic diversity.

Using both pedigree and genetic analysis gives a more complete picture of a population’s relatedness, inbreeding and diversity. For example, the average Thoroughbred could very well exhibit a much lower genetic diversity in its genome than the average [Quarter Horse](#), even though the Thoroughbred might show no repeated individuals in its five-generation pedigree.

“(In this study) the lowest genetic diversity within a subpopulation was in the cutting and racing groups,” Dr. McCue says. “The highest average inbreeding was found in cutting.

“When inbreeding was calculated from the pedigree analysis, the reining group had the lowest average inbreeding; when it was calculated with genotype, the pleasure group was the lowest.

“[Halter horses](#), on average, were about 3 percent inbred, although some individuals were as high as almost 27 percent inbred.”

What’s more, the study found that, due to the contribution of popular sires, relatedness within the groups is on the rise.

“This increase in relatedness, or coancestry, is likely to lead to an increase in the number and extent of inbred individuals,” Dr. McCue says.

Check back next week for Part 2 to read more about the study’s findings and what these things mean for the future of our American Quarter Horses.

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