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December 19, 2014

What does the flattening genetic landscape mean for the future of the American Quarter Horse?



“Any time we take a single individual and increase its ability to generate offspring, that is going to decrease the genetic pool that is reproducing,” says Dr. McCue. *Journal* photo

From [The American Quarter Horse Journal](#)

In [Part 1 of this series](#), you were introduced to the research team from the University of Minnesota that analyzed the genetic diversity of six Quarter Horse performance subgroups: halter, western pleasure, reining,

working cow horse, cutting and racing. The 2012-2013 study was partially funded by the American Quarter Horse Foundation.

Now, we continue with the rest of the findings and what they mean for the future of the American Quarter Horse.

Generation time – “We looked at the generation interval randomly across the groups,” says 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. “Ten and a half years was the average generation length, with (a low of) 9.5 in the halter group and (a high of) 11.8 in cutting.

“It gives us some idea of how soon these [horses are retired](#) from performance and becoming breeding animals. It’s not easily interpreted because some animals start breeding very early and can continue into their 20s.”

Relatedness to the Thoroughbred – “We wanted to look at genetic sharing between the Quarter Horse and the Thoroughbred,” Dr. McCue says. “Not surprisingly, the cutting group was the most genetically distanced to the Thoroughbred, followed by the working cow horse and [reining](#) (group). The Thoroughbred was more similar to the racing group.”

What It Means

“We are changing the genetic landscape in the Quarter Horse,” Dr. McCue says, within the top-level performance groups. “This study clearly demonstrates that we’re concentrating the genetics within certain lines of Quarter Horses, and we’re increasing inbreeding within particular performance groups.”

A horse’s conformation affects his ability to perform certain tasks. Read more about this interesting concept in AQHA’s [Form to Function](#) report.

Longstanding breeding practices likely contribute to that. Habits such as “popular sire syndrome” – the tendency for many breeders to breed to a top-performing [stallion](#) – or the use of assisted reproductive techniques such as frozen semen and embryo transfers can greatly amplify one individual’s genetic impact. Even the practice of always breeding the best to the best can contribute to increased inbreeding in a subpopulation.

“Any time we take a single individual and increase its ability to generate offspring, that is going to decrease the genetic pool that is reproducing,” Dr. McCue points out.

Additionally, when you increase inbreeding and reduce diversity, you increase the incidence of undesirable genes making an appearance.

“A good example is the incidence of HERDA (hereditary regional dermal asthenia) in [cutting horses](#),” Dr. McCue says. “It’s very frequent within this subpopulation, which might be the result of decreasing diversity and/or popular sire effect.”

A previous study revealed that 28.3 percent of cutting-bred individuals carried the recessive gene for [HERDA](#).

“And we have no idea what other deleterious mutations may at the same time be being concentrated,” she says. “There is a tipping point (in any subpopulation) where mutations happen frequently enough that lots of matings result in individuals with disease and you have inbreeding depression (reduced fitness in a genetic population).”

Dr. McCue points out that the six Quarter Horse subgroups the team studied don't show an "overt problem" yet with inbreeding depression, but "it may be just a matter of time, especially if we continue to see this loss of diversity" in the gene pools.

"We need to [outcross](#)," Dr. McCue says, simply. "If we continue to use three or four sires to create most of our elite performers within a population, we will continue to decrease genetic diversity and increase inbreeding. We can only do that for so many generations before there is a problem."

The data also suggest that the [Thoroughbred](#) might not be a significant source for genetic diversity for the modern Quarter Horse.

Naturally, with the trend of breeding horses within specific groups, there are going to be certain body types within those groups. AQHA's [Form to Function](#) report teaches about the correlation between a horse's conformation and his ability to perform certain skills.

"The Thoroughbred as a breed is not haplotype rich (or genetically diverse)," Dr. McCue says, indicating that outcrossing to it might not add significantly new genetic material to the Quarter Horse.

In this study, five of the six Quarter Horse performance groups showed lower average inbreeding than the random Thoroughbred sample; only the cutting group was higher.

"There were a lot of breeds involved in the [horses that founded the Quarter Horse](#)," Dr. McCue points out. "It started from a place of being incredibly diverse. The problem is that (the elite performers) are losing that diversity with what we are doing."

However, she points out "the further you step back away from those elite performers, the more outbred our horses get."

Previous studies have indicated the breed as a whole has a wealth of genetic diversity to draw from.

"Breeders should consider stepping back from popular sires and 'top' bloodlines," she says, "and add diversity back into their breeding programs by choosing individuals that have complementary traits that can serve as an outcross."

She adds: "It's important to have this scientific evidence that demonstrates that inbreeding is happening and we can see it in the genomes. And it is increasing over time.

"I hope it gets some people to think harder about the breeding choices they are making."

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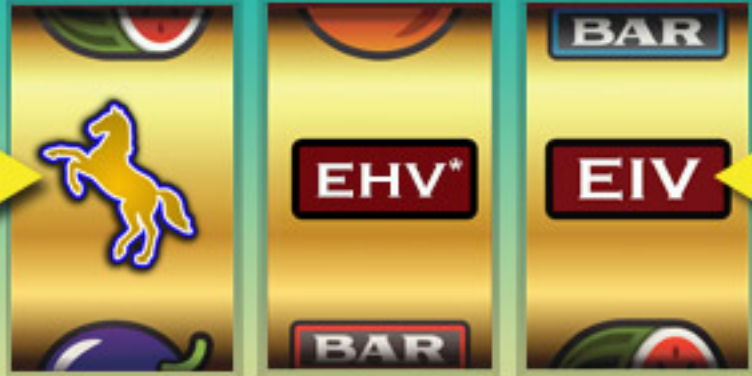
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