

# Using Genomics to Make Better Breeding Decisions

Ben Hayes addresses the future of genomics for cattle breeding and management.

by *Shelby Mettlen*, assistant editor

The last 10 years have been an exciting time to explore genomics, said Ben Hayes, leader of the “1,000 Bull Genomes Project” in Australia. With more than 3.5 million cattle genotyped around the world using genomic-estimated breeding values (EBVs), cattlemen have access to the greatest degree of precision breeding the industry has seen.

Hayes spoke to Angus producers and members of the American Angus Association Nov. 5 during the International Genomics Symposium sponsored by Neogen GeneSeek Operations at the 2016 Angus Convention in Indianapolis, Ind. With such a large number of both beef and dairy cattle genotyped using genomic-EBVs, it’s time to look at the impact the technology has had on the world’s cattle herd, Hayes said.

## Reducing generation interval

“Genomics technology is so powerful because you can get these genomic-estimated breeding values almost at the birth of the animal,” he said. “As soon as you can pull a tail hair or get a sample of DNA from the animal, you can get back these genomic breeding values and start to make selective decisions about those animals.”

As a result, the age of breeding those animals is starting to come down, and that’s leading to more rapid genetic gains, Hayes explained. “We’re turning over generations more rapidly.”

The most significant gains are being seen in the sires-to-breed-sires group, he pointed out, citing information on Holstein cattle taken from the U.S. Holstein database (see Fig. 1).

“This is the really pointy end of genetics,” he said. “These are the really elite sires that are breeding the next crop of bulls.”

From 2007 to 2016, for all classes of cattle measured, including cows to breed cows, dams to breed bulls, sires to breed cows and sires to breed sires, there has been a drop in generation interval. As Hayes pointed out, the most significant drop in generation interval has been seen in sires to breed sires,



PHOTOS BY LEANN SCHLEICHER, ANGUS MEDIA

▶ “As soon as you can pull a tail hair or get a sample of DNA from the animal, you can get back these genomic breeding values and start to make selective decisions about those animals,” Ben Hayes told those attending the International Genomics Symposium at the 2016 Angus Convention. Listen to Hayes’s presentation at <http://bit.ly/IGS-Hayes-audio> or access his PowerPoint at <http://bit.ly/IGS-Hayes>.

dropping from seven years to just two years.

“The genomic breeding values are so accurate now that these really elite bulls can be identified very early,” he said.

For all classes of cattle, fertility rate is increasing and a significant increase in genetic gain is being observed, he said.

So, what else can we do with this technology? Hayes gave three examples.

### 1. We can add value to breeding decisions by using genomic technology.

One way is to add new traits to the selection process, something the beef industry is already exploring. Marbling, fertility and feed efficiency — traits that were difficult to measure just a few years ago — are a few traits for which producers can now find genomic breeding values.

In Australia, Hayes noted, a substantial push for a genomic value for heat tolerance is being evaluated. Research conducted during heat events in Australia has proven that heat tolerance is a trait that can be selected for, and Hayes continues to work toward perfecting those values.

**2. Genomics can be used within management plans to increase production and profitability.** For example, genomics can be used to help producers avoid inbreeding, in turn warding off declines in production and avoiding recessive and lethal genetic defects.

A leading Holstein breeder utilized Hayes’s research to test a genomic management plan. Out of 49 heifers, only three full sisters resulted with an embryo transfer program. Those siblings were then profiled to determine what sisters should be mated to what bulls to ensure a lesser degree of inbreeding.

“It shows you there’s power in this genomic information to decrease inbreeding without really decreasing merit,” Hayes said.

Another example of using genomics to improve management is prescreening cattle prior to feedlot entry for differences in profit potential, as well as for traits like growth rate, feed efficiency, marbling and disease resistance.

**3. A third opportunity for using genomic technology is profiling rumen microbiomes.** As Hayes pointed out, there are differences in the profitability of animals as they go through the feedlot. Some gain efficiently and some don’t.

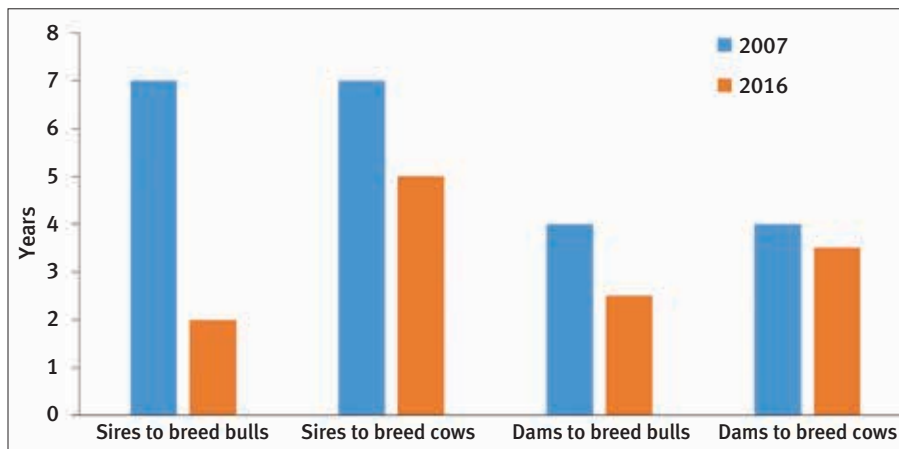
“If you genotype those animals, you’re only getting a handle on the contribution to profit through the feedlot from the animal’s own genome,” he explained. “In fact, every animal actually carries tens of millions, hundreds of millions, even a billion other genomes along with it, and that is the microbes that are in the rumen of our animals. They also contribute to feed efficiency and possibly disease resistance.”

Hayes explained that you can now take

a handful of rumen contents, extract the DNA from those rumen contents and profile the rumens of animals. It's something for the future, he said, but according to a small study profiling the microbiomes of selected animals, it can contribute to greater accuracy in predicting feed efficiency of animals in the feedlot.

To access an Angus Media interview of Hayes for *The Angus Report*, to listen to Hayes's presentation or to view the slides from his presentation, visit <http://bit.ly/IGS-Hayes> in the convention newsroom. For more news from the Angus Convention — including summaries, speaker presentations, photos, videos and more — visit the convention newsroom at [www.angus.media/news/Angus-Convention](http://www.angus.media/news/Angus-Convention).

**Fig. 1: Generation interval, dairy cattle**



Source: Garcia-Ruiz et al. Proc Nat'l Acad Sci USA 113(28):E3995-4004.

## Don't Say No to Technology

International Genomics Symposium panelists urge members to embrace technology, innovation.

To wrap up the International Genomics Symposium Saturday morning, Nov. 5, at the 2016 Angus Convention in Indianapolis, Ind., three experts gathered for a panel discussion moderated by John Pollak, director of the U.S. Meat Animal Research Center (USMARC) in Clay Center, Neb. Panelists included Ben Hayes, Dan Moser and Stephen Miller.

Australian Ben Hayes leads the "1,000 Bull Genomes Project," an initiative that aims to accelerate the rate of genetic gain in domestic cattle, while preserving high standards for animal health and welfare. Hayes offered a worldwide look at how genomic profiling of animals is shortening generation interval and improving breeding accuracy of beef cattle.

Dan Moser, president of Angus Genetics Inc. (AGI), offered insight into what the affiliate company of the American Angus Association has done, will continue to do and is presently working on to improve the Angus breed through precision genetics, testing and breeding practices.

AGI's Director of Genetic Research Stephen Miller commended the future of genomics in domestic cattle breeding, saying, "Don't say 'no' to technology," and asserting that producers must be open to new technology to continue to improve their herds and the Angus breed as a whole.

### What's now, and what's ahead

Moser started off the discussion by telling Pollak that in years previous he would have "never believed" the advancements in genomics the industry has seen, and that we should "embrace them," and remain prepared for challenges along the way.



► From left, John Pollak, director of the U.S. Meat Animal Research Center at Clay Center, Neb., led a panel discussion with genomics thought leaders Ben Hayes of the "1,000 Bull Genomes Project" and Dan Moser and Stephen Miller of Angus Genetics Inc. Listen to the full panel discussion at <http://bit.ly/IGS-panel>.

Hayes's goal is to make genomic evaluations effective across breeds and to improve the accuracy and effectiveness of those evaluations in *Bos indicus* cattle. Rather than just "snapshots across the genome," Hayes said he wants to "nail the traits that are causing differences."

Moser revealed that AGI hopes to soon release an expected progeny difference (EPD) value for carcass tenderness in Angus cattle. He also pointed out work toward EPDs involving regional adaptability, including values for things like fescue tolerance and high-altitude disease.

Miller pointed out AGI's progress on structured sire evaluation, and commercial traits and their impacts on cattle health and performance at the feedlot.

Hayes mentioned that he would like to set the stage for a "consumer acceptability EPD," by testing steaks ordered by customers and restaurants, and breeding cattle to produce meat with characteristics most favorable to consumers.

All panelists agreed that the value of genomic testing is clear, and that producers, researchers and consumers will continue to improve the technology and benefit from it in the years to come.

The second-annual International Genomics Symposium was sponsored by Neogen GeneSeek Operations.

Listen to the full panel discussion at <http://bit.ly/IGS-panel>. For more news from the Angus Convention — including summaries, speaker presentations, photos, videos and much more — visit the convention newsroom at [www.angus.media/news/Angus-Convention](http://www.angus.media/news/Angus-Convention).

— Shelby Mettlen, assistant editor