



Managing Genetic Abnormalities

by **Troy Smith**

Anxiety over genetic abnormalities in cattle is nothing new. Just more than 60 years ago, the issue was dwarfism and 25% of Gino Pedretti's registered Hereford calves exhibited the unmistakable signs. It was a staggering blow to the then fledgling El Nido, Calif., breeder. At that time there was only one thing to do.

"You got rid of anything suspected of carrying the defect, and that often meant eliminating entire bloodlines," explains Pedretti, whose family now maintains a herd of some 200 cows and provides seedstock to a mostly commercial cattleman clientele.

"Back then, I was just starting out, trying to build a registered herd. Of course, we had the dwarf gene on both sides. I had to start over with 'clean pedigree' cattle," he adds. "It was the only way to get rid of it. Thankfully, there are better ways to manage genetic defects now."

During recent years producer anxiety has increased along with the prevalence of a variety of genetic abnormalities. Defects are occurring with what geneticists call "moderate" frequency among a variety of breeds. Most recently, concern among Hereford breeders and their patrons

have been related to a couple of genetic abnormalities. Hypotrichosis results in partial or nearly complete lack of hair, while idiopathic epilepsy (IE) leaves affected animals subject to seizures, which may be triggered by stress.

Like dwarfism and most other genetic abnormalities, hypotrichosis and IE are transferred by recessive genes. The experts say every individual of every breed, or species for that matter, possesses recessive genes for characteristics or traits seldom expressed. Typically, recessive abnormalities are masked by dominant genes. However, defects are expressed when an individual inherits the associated recessive gene from both parents. So, for a calf to exhibit a recessive genetic defect, both parents must be carriers and each must have contributed the gene to the calf. Increased prevalence of defects is the result of increased, though unintentional, mating of carriers.

That is a side effect of intensive genetic selection and advancement in selection technology. The industry has seen widespread use of breeding animals that defy genetic antagonisms — the so-called curve-benders, which excel in a variety of desirable traits. Their influence has been magnified through

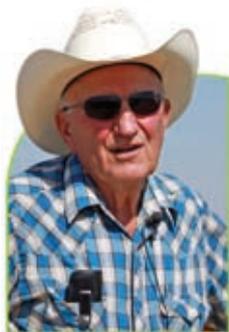
artificial insemination (AI) and embryo transfer technology. And linebreeding is frequently applied to increase the effect of favorable genes. Unfortunately, sought-after good genes can be accompanied by recessive genes that are both bad and ugly.

University of Nebraska geneticist Matt Spangler says it's no longer necessary to eliminate an entire bloodline that might harbor a defect, thereby forfeiting its otherwise valuable contributions to genetic improvement. Through DNA testing for genes associated with defects, individual carriers can be identified. Spangler says producers can then avoid defects by making mating decisions correctly.

As a rule of thumb, Spangler advises producers to remember that a mating between a carrier and a non-carrier will not result in offspring that exhibit a recessive gene defect. However, 50% of offspring will be carriers. A mating between two carriers will produce calves that exhibit the defect 25% of the time. Fifty percent of the time, offspring of two carrier parents will also be carriers but will not exhibit the defect. And 25% of all offspring produced by mating carriers will exhibit neither the defect nor carry the recessive gene.

"If you know you have carrier cows, obviously you're well advised not to breed them to carrier bulls," says Spangler. The expression of a specific recessive defect can be avoided, he adds, by always using non-carrier bulls.

As a first step in managing genetic defects, Spangler advises seedstock producers to determine the status



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of animals having a large influence on the breeding herd, including all AI sires and donor dams, and then to determine the status of natural service sires. Starting with the most influential animals will determine to what extent further testing may be necessary. For example, testing of replacement females is unnecessary if their parents have been tested and found free of known genetic defects.

Spangler advises against culling cows found to be carriers, when problems can be avoided by mating them with bulls known to be non-carriers. Nor should carrier bulls be thrown away. They can be marketed for terminal use, with full disclosure by the breeder.

A majority of breed associations still allow registration of carrier animals, including the American Hereford Association (AHA). Current president and Baker City, Ore., breeder Bob Harrell says the AHA policy is very appropriate.

“We’re allowing breeders to clean up genetic defects without wiping out entire lines of cattle and throwing away genetics that otherwise contribute a lot to the industry,” explains Harrell. “As an Association, we’ve worked to help develop genetic tests and we’re recording carriers in pedigrees, but we’re allowing Hereford seedstock breeders to take responsibility and use the tools available to them.”

Harrell says many breeders are working directly with University of Illinois animal scientist Jonathan Beever, a lead researcher in identifying genetic defects and developing DNA tests for identifying carrier animals. From the standpoint of testing for known recessive defects, breeders can also utilize Maxxam Analytics, the laboratory approved by AHA for parentage verification testing. Now available is a panel of multiple tests that Harrell calls very affordable.

While the increased incidence of genetic defects was unexpected, it’s

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not hard to understand how it could happen. Considering the intensity of genetic selection practiced in recent years and expanded application of reproductive technologies, the potential for increased homozygosity has increased. And, it’s possible that more recessive defects will emerge. But, for now and in the future, Jonathan Beever sees genetic testing and managed breeding as keys to a proactive approach to reducing losses and increasing profit margins.

“Genetic testing is a tool that allows beef producers to manage these problems. They are highly accurate and are becoming more cost-effective,” states Beever, urging seedstock producers to take the lead.

“Most of the responsibility falls on you to manage your herd as best you can so these genetic defects don’t trickle out into commercial populations.”

According to Beever, when breeders take a proactive approach to surveillance and reporting, solutions can be found more rapidly and management of genetic defects can be relatively painless.

“Some other breeds have had more problems than Herefords, and we do have the technology to address our issues and move forward,” adds Harrell. “The AHA Board has tried to approach the whole issue with a positive attitude, even look for opportunity. There is potential to develop DNA tests for other abnormalities, such as cosmetic defects, but also additional tests for desirable traits related to performance and carcass merit. Those represent opportunity to add to our productivity and profitability.” **HW**

Hereford abnormality descriptions

Idiopathic Epilepsy (IE)

Symptoms: Age of onset (occurrence of the first seizure) can be variable, ranging from birth to several months of age. Occurrence and persistence of seizures may be influenced by environmental stressors such as temperature extremes (e.g., extreme cold during calving) or increased physical activity (e.g., processing at vaccination or weaning). Upon initial onset of seizure episodes individuals will typically lie on their side with all limbs extended in a rigid state. Manual flexing of the limbs is possible, but return to the extended position occurs after release. Seizure episodes may last from several minutes to more than an hour. Autosomal recessive.

No anatomic abnormalities or histologic lesions detected.

Confirmation: AHA approved expert

Hypotrichosis (hairlessness)

Symptoms: Partial to almost complete lack of hair. Affected calves are often born with very short, fine, kinky hair that may fall out leaving bare spots or areas particularly susceptible to rubbing. The condition may vary in expression as the animal matures and is usually less noticeable in older animals. The haircoat color will sometimes appear “frosted” or “silverish.” Tail switch may be underdeveloped. Simple autosomal recessive.

Confirmation: Megatrachohyaline granule skin biopsy

Color Dilutor

Symptoms: Carrier Hereford bulls or females when mated to black cattle can produce offspring with a haircoat that is gray, smokey or chocolate color.

Confirmation: Clinical diagnosis with photos **HW**