Submitting a Potential Defect

The Association provides insight for how to handle a suspected abnormality and what to expect during an investigative process.

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In the last 20 years, only six Angus calves have been documented by the American Angus Association to be genetic dwarfs. Those six calves resulted in the publication and listing of five cows and three bulls as carriers of dwarfism from December 2002 through February 2003.

As a result of that incident, Iowa State University (ISU) developed a DNA test for the mutation identified to have caused the defect in those calves. The Association has been granted an exclusive license to market the test, which it will begin offering through MMI Genomics upon publication of this article and the accompanying article, "Dwarfism Test Available," on page 75.

The following Q&A compiled with the assistance of Association staff is presented to help producers understand how to report suspected genetic defects, provide insight into the procedure by which the Association investigates and documents a genetic defect and some nuances about the new test.

What should a member do if he or she suspects a calf to be a dwarf?

If a member has an animal that is a suspected dwarf, he or she should report that animal to the Association in accordance with Rule 301 — notification to the Association. This rule states:

"Any member who becomes aware of an unusual physical abnormality in an animal registered with the Association, or in a calf of a registered animal, is required to promptly notify the Association of that finding, in writing, by completing the form located on the Association's web site or in the *Breeder's Reference Guide.* If a member has questions concerning whether or not to complete this form, they should contact the director of member services at the Association's offices in Saint Joseph, Missouri."

Then what happens?

The Association will request that the member submit information — such as photos, tissue samples and DNA — so officials designated by the Association can examine the abnormality and verify the parentage of the animal. Parentage verification is critical. Generally, the Association will request that the suspect animal be delivered to veterinary pathologist David Steffen, who is director of the University of Nebraska Veterinary Diagnostic Center, for physical confirmation of the deformity.

Dwarfism is a phenotype that is hard to determine, and the diagnosis needs to be conducted by an expert trained in identifying genetic forms of dwarfism. The judgment of a local veterinarian will not meet the requirements of Association policy. When Steffen examines these calves, he does so as an expert in the area. For instance, he will likely take radiographs of the spine, analyze the growth plates in the skull and measure the cannon bones in relation to the height of the animal — all things that are different in dwarfs than they are in normal calves.

Some animals thought to be dwarfs, upon physical examination by an expert, are determined not to be. What safeguards are there to protect a member's privacy and the reputations of the parent animals until the animal in question is indeed determined a carrier of a genetic defect?

The Association's director of member services, who is responsible for assisting members in this process, is bound by confidentiality. So, if a member were to officially report an animal to the Association, under the rules outlined in "The 300 series" (see page 76) regarding genetic defects, the Association cannot disclose information without the member's consent until its expert has determined that the animal is in fact defective.

There is a set of policies and procedures in place that must be strictly followed before an animal ever gets from "reported as a potential defect" to "published to the membership." Rules 301-307 outline procedures for notifying the Association, cooperating with the Association, the genetic determination process, notifying owner members, contesting the determination, procedures for a hearing and notifying the membership of the genetic defect.

An animal is considered normal until it is determined to be genetically defective based on the process the Association has to go through.

This process applies to all genetic defects and factors monitored by the Association. In the case of a potential defect or genetic factor for which the Association doesn't monitor, the Association would follow the same procedure.

If the animal is determined to be a genetic dwarf, what happens?

If the abnormality is determined to be a genetic defect and if parentage is confirmed, the Association will notify all owners of record as soon as practical. The rules provide owner members the right to contest the decision by providing written notification within 14 days of their being notified. The procedures for contesting the determination are spelled out in rules 305 and 306.

Owner members can waive the right to contest the determination, at which time the animal would be identified as a carrier. The animal's name and registration number would be published in the next available issue of the *Angus Journal,* on the Association's web site and in the "Genetic Defects and Factors" listing in the annual *Breeder's Reference Guide.*

Would the animal's registration be pulled?

Based on the rules governing registration, if it was a registered animal and it was a carrier, the Association would mark it as a carrier of the Class I defect. The registration would not necessarily be pulled, but progeny of confirmed carriers cannot be recorded unless tested free of the defect as outlined on page 19 of the *2007 Breeder's Reference Guide,* Rule 103(d)(2) — progeny of animal determined to have a genetic defect. That rule states:

"When a bull or cow is determined to possess a genetic defect, progeny of such affected animals shall be ineligible for registration unless such progeny are tested in accordance with Association-approved guidelines and determined to be free of the genetic defect."

Start to finish, how long does it take to go through the procedure to determine whether an animal is a genetic dwarf?

It just depends. There's not a set timeline, because conditions surrounding each case are so variable. For instance, it is essential that we verify parentage. That can be a time-consuming process.

In the past, how would a member go about testing an animal to prove it free of dwarfism?

In the past, to test an animal to prove it free of dwarfism, it had to go through a progeny test. According to the guidelines established in the late 1970s, a bull would have to be bred back to 35 of his own daughters or daughters of a known carrier.

Did they have to have 35 calves to complete the progeny test, or was there a percentage allowed in case not all 35 cows conceived and calved?

They had to have 35 calves out of 35 unique dams. If a cow aborted, the producer had to have a veterinarian look at the fetus to make sure the reason for abortion wasn't a genetic defect. If all 35 calves were diagnosed to be normal, the sire would be established as tested free of dwarfism and would thereafter be listed as such in the *Breeder's Reference Guide* and flagged in pedigrees with the FD designation behind the registration number to indicate an animal progeny-tested free of dwarfism.

With the test developed by ISU, how would a member go about testing an animal to determine whether it is a carrier of the form of dwarfism that appeared in 2002?

The producer would submit a blood spot on an FTA card to the lab with payment for the test, just like they would for parentage verification. The Board approved a rate of $75, which includes parentage verification.

If the parents are not in the system, would the producer have to send in blood spots for all three animals — the animal in question and its parents?

No. The Association will verify to the information that is on file. So, if the animal in question is the offspring of a sire or dam that isn't DNA-tested, the Association would not make them go back and test the dam, for example, if the dam's not on file. The pedigree is assumed to be correct unless proven wrong.

How long will it take to process the test?

In the absence of any unusual circumstances, it would be a similar turnaround time to parentage verification, so approximately two to three weeks once the lab receives the sample.

Will MMI Genomics report the results to the Association or to the breeder?

MMI Genomics will send the results electronically to the Association. The Association reports back to the person who submitted the test — just like parentage.

If an animal is found to carry this gene mutation, what happens?

The Association would follow the same protocol outlined previously for informing the owners, providing opportunty for the owners to contest the determination and informing the membership if at the end of the process the animal is confirmed a carrier of the defect. The animal would appear in the Association's genetic defect listing under a new D2 classification — dwarfism by DNA test.

If the animal does not carry this gene mutation, what happens?

If the animal were found through DNA testing not to carry this particular mutation, it would be designated FD2 — free of dwarfism by DNA test.

Why would it be listed under a different designation?

The test is a very specific test for a very specific mutation that causes a genetic form of dwarfism. While the Association is confident the test will identify the form of dwarfism that occurred with the six calves identified as genetic dwarfs in 2002, it is reluctant to portray the test as testing for all forms of dwarfism.

If in the event another mutation is found to also cause a genetic form of dwarfism, this would allow the new mutation to be designated D3, and so on.

Another important distinction between the original classification and the D2 classification is that every animal determined a carrier of dwarfism to date has produced an actual dwarf calf. The D2 classification could include animals that have not yet produced a dwarf.

How many forms of dwarfism are there?

Science has not yet provided an answer to that question. Keith Evans, former Association director of communications for the American Angus Association, discusses at least two phenotypic forms of dwarfism in his book *A Historic Angus Journey: The American Angus Association 1883-2000.* There were "snorter dwarfs" and what were described as "long-headed dwarfs."

Research reported from Reecy's lab indicates the mutation found in the six calves identified as dwarfs in 2002 was not the same as known dwarfism-causing mutations found in Japanese Browns and Dexter cattle. There are more than 200 forms of dwarfism recognized in humans.

In early reports to the Association Board of Directors, it was reported that the mutation may be a novel mutation. Later, the physiology was compared to the long-headed dwarfs of the 1950s.Without the ability to DNA-type the dwarf cattle of the 1950s, there is no way to prove or disprove whether this is the same form.

If an animal were determined through the DNA test to be free of the mutation, could it be promoted as free of dwarfism?

The Association would discourage that. It gets back to the earlier question of how many forms of dwarfism there are. We know the test is basically testing for one specific form of dwarfism. Is it the same form as these other animals that we've listed as carriers? We don't know for sure. This test may not be detecting all forms of dwarfism. You don't want to say an animal is free of dwarfism based on this test if there are multiple forms of dwarfism.

To be declared free of dwarfism vs. tested free of just this strain of dwarfism, would an animal need to be progeny tested?

To be classified as tested free of all forms of dwarfism, the animal would have to be progeny tested.

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