

Developmental Duplication

On August 14, 2013, the American Angus Association released results of a new genetic condition, referred to as Developmental Duplication (“DD”). The studies were conducted by Dr. Jonathan Beever of the University of Illinois, at the request of Angus Australia. The results of Dr. Beever’s study are available online, at http://www.angus.org/Pub/DD/DD_Update08122013.pdf.

Dr. Beever reports that Developmental Duplication appears to be an inherited simple recessive genetic condition. As a simple recessive genetic condition, cattle with only one copy of the DD gene are only carriers for the condition—their bodies are unaffected, and they show no signs of the genetic condition. Cattle that have two copies of the DD gene, however, can generate additional limbs, usually originating from the neck or shoulder region. With the exception of mortality associated with calving difficulty, Dr. Beever reported that calves affected by DD (those with two copies of the DD gene) can often thrive, particularly if the extra limbs are surgically removed.

In 2013, Dr. Beever’s team identified a mutation that appeared to be consistent with the recessive pattern of inheritance in cattle affected with Developmental Duplication. After isolating the DD gene, Dr. Beever then tested Angus sires that have been used over the past 20 years to determine whether those bulls were DD carriers. The DNA analysis revealed two important concerns: (1) of the 1099 sires tested, only 6.5% were carriers of the DD gene; and (2) none of the sires tested were found to be homozygous (carrying two copies of the DD gene).

How does this affect you as a customer of GENETRUST and a breeder of livestock?

1. Do not panic. Genetic conditions such as these have existed throughout the history of animal breeding, and are easily handled by making informed and educated breeding decisions. By way of example, resources state that the dairy industry currently makes mating decisions to avoid approximately 100 or more genetic conditions that are presently known to exist in the dairy population. As Developmental Duplication is believed to be a simple recessive genetic disorder, calves will not be affected unless both the dam and the sire are carriers. And even when both the dam and the sire are carriers (meaning they each carry one copy of the DD gene), there is—at most—only a 25% probability that they will have an affected calf (carrying two copies of the DD gene). Dr. Beever has indicated, however, that the actual probability of two carriers producing an affected calf is significantly lower, as he explained that calves presenting at birth with the DD genetic disorder are “rare events that survive embryonic death.”¹ Indeed, after discussions with people heavily involved in the Brangus breed for decades, and who have together recorded thousands of births, the GENETRUST partners have only identified four possible cases of Developmental Duplication births in the past 30 years.
2. Genetic conditions first became prominent headlines within the beef industry in 2008, when the conditions of AM, NH, and CA were first recognized in the Angus breed. At that time, many breeders were concerned that these conditions would devastate the largest breed association in the world. However, through the insightful leadership of the Angus board, its staff, and its breeders, procedures were developed to properly identify and track carrier animals, and an appropriate breeding system designed to prevent carriers from mating with other carriers was encouraged. Through these measures, the potentially devastating effects of AM, NH, and CA were minimized. As was done after the discovery of AM, NH, and CA, GENETRUST will take active measures to ensure that DD carriers are properly identified and tracked, and GENETRUST will work with breeders to ensure that an appropriate breeding system is in place.
3. GENETRUST has already implemented a plan to minimize the potential economic loss the DD genetic discovery may cause to our customers and our herds. GENETRUST plans to test every animal we sell for the DD condition,

¹ See Dr. Beever’s paper, Likely Presence of Genetic Condition in a Line of Angus Cattle, available at http://www.angus.org/Pub/DD/DD_Update08122013.pdf.

until we have a large enough tested population to identify all carrier lines. At that time, we will sort via pedigree analysis to establish which cows are potential carriers, and we will then check those animals for the DD condition. We will then, either through the catalog or supplement sheet, release the status of all animals as to DDF (free) or DDC (carrier). By actively taking steps to ensure that DD carriers are not mated with other DD carriers, after several generations we can actively “breed out” the DD condition, reducing it to a minimal amount of animals in the Brangus herd.

4. We encourage all cattlemen to educate themselves as to how these genetic conditions are inherited, what procedures to follow in the event of an unusual or uncommon looking birth (many of which do not have to be genetic in nature), and how potential carrier animals within your population should be handled. We would also suggest that other purebred breeders test their population so as to identify the carriers. Current commercial tests are available through Zoetis and Geneseek/Igenity.

As new information or data becomes available on this as well as any other genetic conditions, GENETRUST will do our best to keep you informed through our website. Additionally, valuable information can be obtained via a google search of “genetic conditions in beef cattle,” through your state extension publications, and through a very enlightening YouTube video by Dr. Aaron Arnett, available at www.selectsiresbeef.com. We have also included the graphic explanation below to assist you in understanding how DD is inherited. Please recall, however, that even though there is a 25% chance that two DD carriers (each having only one copy of the DD gene) can have an affected offspring (having two copies of the DD gene), Dr. Beever reports that the actual occurrences are significantly lower. Dr. Beever’s hypothesis for this is that there is a high occurrence of embryonic mortality associated with calves carrying two copies of the DD gene. If we at GENETRUST can be of any help in this or any other concerns that arise with your beef cattle operation, we would be more than happy to assist you.

mate DDC to DDC

	D	d
D	DD	Dd
d	Dd	dd

25% free
50% carriers
25% affected ²

mate DDF to DDC

	D	d
D	DD	Dd
D	DD	Dd

50% free
50% carriers

mate DDF to DDF

	D	D
D	DD	DD
D	DD	DD

100% free

² As noted in Dr. Beever’s report, since the number of reported cattle affected by the DD gene (having two copies of the DD gene) is significantly lower than this 25% probability, Dr. Beever hypothesizes that early developmental duplication events prevent many embryos from developing to term, resulting in embryonic death and a reduced frequency of live births of affected cattle.

The following AI sires have been tested for the genetic condition Developmental Duplication DD with the following results indicated as DDF (free of the condition) and DDC (carrier of the condition)

TJM CORONADO 535X	R10180470	DDF
GR SWIFT 209W3	R10143304	DDF
LTD OF BRINKS 415T28	R10082892	DDF
SUHN'S FOUNDATION 331Z28	R10227122	DDF
CRC GUARDIAN 9U8U5	R10122023	DDF
SUHN'S CHISHOLM 331W45	R10161215	DDC
CRC LANDAU 263X2	R10189274	DDF
SUHN'S NEXT STEP 331R7	R10015200	DDC
CRC NORTH STAR 9U8W3	R10149791	DDF
CB PASSPORT 803Y11	R10216038	DDF
SUHN'S NEW CONCEPT 30Y24	R10204747	DDF
DMR HERITAGE 894Y	R10189980	DDF
BRINKS BRIGHT SIDE 607L11	R815045	DDF
MC ABRAMS 468T22	R10085458	DDF
GR ARMOUR 209W2	R10143303	DDC
SF DEPENDENCE 535U24	R10126187	DDC
NEWT OF BRINKS 302P16	R9685720	DDF
SUHN'S PATRIOT 440W	R10137307	DDF
PATTON OF BRINKS 30T22	R10082758	DDF
SINGLETARY OF BRINKS 675R	R10004011	DDF
CADENCE OF BRINKS 535D3	R9687927	DDC
SUHN'S AUGUSTUS 416Y14	R10204701	DDF
MC Onstar 924W4	R10154395	DDF
Suhn's Affirmed 30T	R10091417	DDF
Suhn's Affirmed 416N4	R9678800	DDF
Suhn's Alydar 416N3	R9678799	DDF
DMR Goodnight 607W3	R10149999	DDF
MC X Factor 889X34	R10182415	DDF
Texas Star 9U8Y	R10191789	DDF

