Beef Logic

► by *R.A. "Bob" Long*

Cloning leaves room for doubt about EPDs

The American Angus Association Board of Directors recently and unanimously approved a rule requiring cloned animals recorded in the Association Herd Book to be the determinant of their own expected progeny differences (EPDs) computed through the performance records of their offspring.

The decision has been branded "too conservative" by some, implying that, since clones are genetically identical, they should carry the same EPDs as the animal from which they came. On the contrary, I believe the Board's decision was wise for the following reasons.

Whose DNA?

Cloning was first accomplished by obtaining the nucleus of a cell taken from an embryo in the first few days of development. Next, an unfertilized egg cell from an animal of the same species was collected, and the nucleus removed and replaced by the nucleus from the developing embryo. The now-fertile egg was then placed in the uterus of a surrogate mother and carried to term.

Repetition of the procedure using nuclei from the same developing embryo resulted in several animals of theoretically identical genetic makeup. An obvious disadvantage of the procedure is the lack of information upon which to predict the excellence of the animals that result.

However, in 1997, Scottish scientists produced the first live birth of a healthy sheep cloned from an adult. The nucleus of an udder cell from Sheep A was used to replace the nucleus of an unfertilized egg from Sheep B and placed in a surrogate mother. That resulted in the now-famous Dolly so widely proclaimed as the genetic duplicate of Sheep A.

Cloning procedures are not yet perfected. With current procedures, the donor of the unfertilized egg and the donor of the nucleus both are contributing genetic material.

Now for a review of cell anatomy. Check a high-school biology textbook and find a drawing of a cell as seen under a microscope. Note that there is a cell wall that surrounds the entire cell. Inside that wall is the protoplasm (the living part of the cell), the all-important nucleus and some less well understood material, such as mitochondria, Golgi bodies and ribosomes. Note the mitochondria are within the cell but not in the nucleus.

Therefore, the cell that produced Dolly contained the nucleus of Sheep A and the mitochondria of Sheep B. Scientists have known for some time that a few genes are located on the mitochondria. Therefore, Dolly is not identical to Sheep A and not a true clone.

The Scottish scientists who produced Dolly are to be commended. Instead of basking in their recognition for the first cloned mammal, they continued their work and reported that Dolly's mitochondrial DNA matches that of Sheep B (the unfertilized-egg donor) and not that of Sheep A (the nucleus source). So Dolly had two mothers.

Far from perfect

Current cloning techniques have progressed, allowing the use of cells from various body parts and from all mammals. If breeders possess either the knowledge and equipment or sufficient money, they can acquire a "clone" of their favorite bull or cow. However, an unfertilized egg from some female of the same species must be used, and the mitochondrial DNA (mtDNA) is still a problem.

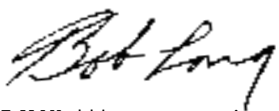
Mitochondrial genetic material represents only a small part of the total genetics of an animal. But it could be extremely important in meat-producing animals since it has to do with protein synthesis and energy metabolism. Further, recent research has indicated that certain maternally inherited human diseases can be traced to the mitochondria. In view of those facts, the use of current procedures for cloning might well open a Pandora's box for a breed of cattle.

The point of the story is that cloning procedures are not yet perfected. With current procedures, the donor of the unfertilized egg and the donor of the nucleus both are contributing genetic material. So calves produced in that manner are not true clones and do not deserve to receive the same EPDs as the animal from which the original cell was taken.

Further, the procedure is expensive, and the percentage of successful cloning attempts is small.

Finally and realistically, by the time a bull is proven, he will have fathered a superior son or the breed's data bank will have identified his replacement. Why clone him?

The Association Board would appear to have made a wise decision indeed.



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We welcome your input

"Beef Logic" and "Breeders' Forum" serve as platforms for Angus breeders and industry experts to express their opinions on current issues and topics of breed improvement.
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