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**“From Imagination To Reality: Using DNA From An Exceptional Carcass To Produce
A Sire Or Donor Cow”**

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INTRODUCTION

The term cloning first entered our vocabulary with “Dolly” the cloned sheep in 1996. At that point it seemed unlikely that somatic cell nuclear transfer would benefit agricultural and some might still hold that argument true today. Since the cloning of Dolly, numerous species have been cloned, including cattle and horses. The overwhelming majority of all clones produced have been created by taking a tissue biopsy from an outstanding individual, most likely an outstanding sire or dam that was alive at the time of tissue biopsy. In contrast we chose to start with the end product and work backwards.

At West Texas A&M, we questioned what really defined outstanding. For us outstanding was the end product of the beef chain, the carcass. In 2010, West Texas A&M partnered with an elite group of individuals, outside of the university in an attempt to use cloning technology to produce bulls and heifers from the highest USDA quality and yield grade carcasses, Prime Yield Grade 1. Cattle that grade USDA Prime are approximately 2.25% of the fed beef population – carcasses that are stamped with a yield grade of 1 are 12.4% of fed beef (Moore et al., 2012). Of the 20 possible combinations of quality (Prime, Choice, Select, Standard) and yield (1, 2, 3, 4, 5) grades that occur within the young fed beef population, the probability of a Prime, yield grade 1 carcass is approximately 0.03% of the fed beef in the U.S.

To accomplish this goal we were able to gain access to the Prime rail at several commercial beef slaughter facilities. The Beef Carcass Research Center at West Texas A&M serves as a third party verification group that provides carcass data collection/analysis on a fee basis. This group led by Dr. Ty Lawrence is in the unique position to see and grade carcasses across the United States. Once the desired carcasses (Prime Yield Grade 1) were identified a muscle biopsy was collected and then divided into 3 samples. Two samples were

sent to two commercially available gene marker companies to verify that what we saw phenotypically was confirmed by DNA tests, hopefully increasing the likelihood that the traits excelling in carcass merit and feed and growth efficiency could be passed on. The third aliquot from the muscle biopsy sample was sent to Viagen for tissue banking. Due to the genotype x environment influence on phenotype, the only tissues that went forward for cloning were those that were outliers (exceptional) in the DNA marker traits. When these results were sorted, animals that had both confirmed phenotypic traits (Prime Yield Grade 1) coupled with DNA markers for growth, feed efficiency and high quality and high yield traits, the pool of cloning candidates was reduced down to 0.006% of the fed beef population.

The tissue samples that were positive for both DNA (genotype) and carcass (phenotype) results were then cultured by Viagen in an attempt to grow the cells from samples that had been tissue banked. Growing cells from a carcass that had been harvested 5+ days before sampling was not always accomplished. Yet Viagen did get cell lines from a steer and heifer carcass to grow and these viable cells were used to create the clone bull calf named Alpha (which is 86% Angus and 14% Brahman), and the heifers (n=3) named Gamma. Alpha is a bull that was cloned from a steer carcass that was USDA Prime (high quality), yield grade 1 carcass (high yield). Gamma 1, 2, and 3 are heifers that were cloned from a heifer carcass that was Prime Yield Grade 1 as well. These cattle are a statistical rarity. We have found 29 of these Prime and YG 1 carcasses to-date since the fall of 2010.

To accomplish the actual cloning, embryo transfer, birth and care of the clones a group of experts from the University and private sector collaborated. The cloning process was conducted by scientists at Viagen. Cloned embryos were sent to Jason Abraham in Canadian, Texas. Jason conducted the embryo culture to sort transferable embryos that would be placed in recipient cows. Todd Stroud from Weatherford, Texas and Dr. John Nelson, from Chickasha, Oklahoma performed the embryo transfers. Dr. Gregg Veneklasen, Timber Creek Veterinary Hospital, Canyon Texas was involved in every aspect of the project and provided invaluable consulting and technical expertise. Faculty (Dr.s' Ty Lawrence, David Lust, John Richeson and students (Ph.D. student Kelly Jones and others) at the University were involved in the care of the receipt cows and cloned calves. The project is still in its infancy as semen is currently being collected from Alpha.

What now? Our immediate plans are to superovulate the cloned heifers in March, inseminate them with semen from Alpha and transfer the resulting embryos into recipients. The progeny from this mating will be tested for DNA markers for carcass merit and growth efficiency. A portion of the resulting progeny will be feed at the university feedlot and slaughtered to determine their quality and yield grade. Additional cows will be inseminated with semen from Alpha or a purebred bull with known EPD's to determine if Alpha is truly genetically superior. The obvious shortcomings and unknowns are numerous, yet what if we hit the target of moving toward a higher percentage of cattle that achieve prime or choice at yield grade 1 or 2? Stay tuned.

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