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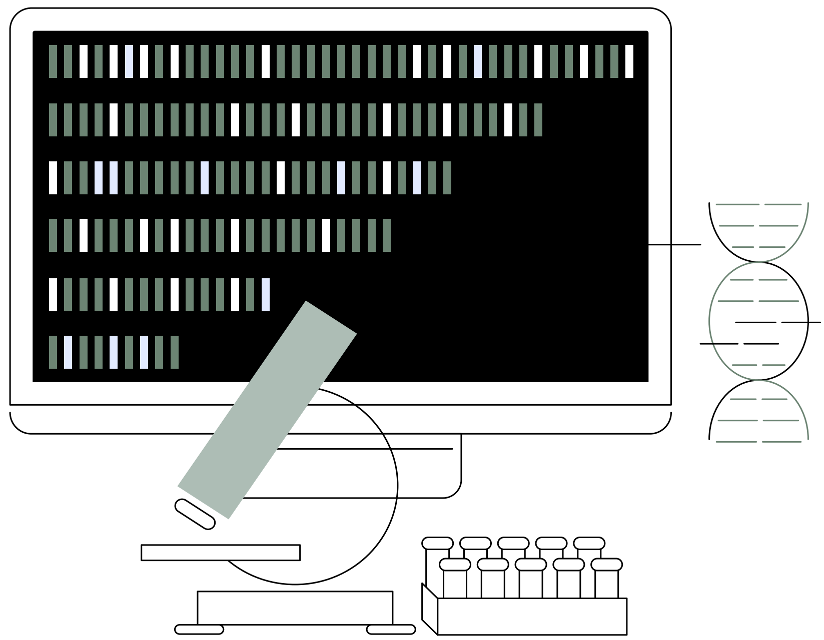
Reproductive technologies lend producers a hand in preserving genetic advancements.

by Sarah Harris-Christian



The throes of cattle production can often hinder the plans producers have for their best animals. From challenges with nutrition, health and reproductive efficacy, purebred breeders are faced with many obstacles when advancing their genetics. Genetic technologies available among the cattle industry, however, have proven to be beneficial allies in preserving the forward strides of seedstock producers.

"There are many things in our lives that are cloned, and you never knew it," says Diane Broek, Trans Ova advanced technologies manager. "Cloning is making copies of the very best, and if you remember that, you understand how agriculture uses cloning today."

For seedstock producers, optimizing the bottom line is often directly correlated to stamping a precedent with the next generation. Purebred cattle breeders are tasked with supplying other purebred and commercial multiplier firms with high-caliber genetics. Thus, the supplication of premier genomics alongside an effective environment plays a large role in raising the next great one.

Embracing the technology

What options do breeders have to maintain their advancements? To take a step further into preserving the legacy of producers' most beneficial genetics, Broek says cloning is a potential method.

The battery of reproduction technologies available for livestock producers is vast, but Broek says replicating a producer's "once in a lifetime animal" is possible with cloning technology. Cloning, along with other technologies such as sexed semen selection, embryo transfer (ET), *in vitro* fertilization (IVF) and precision breeding, can be used as a tool in the equation for genetic gain, Broek says.

The science of cloning lies in making genetic copies, or genetic twins, of an animal. Broek relates this phenomenon as creating an identical twin to an animal who is born at a later point in time. In contrast to other technologies, cloning leads to identical genomic curation.

"You can make animals using ET and IVF — you can make siblings — but every single time you do that, you have a shuffling of the genes, and they will be different," Broek says.

In comparison, when cloning animals, Broek says the biggest takeaway for Angus breeders to understand is that "the genomics are exactly the same."

Cloning technologies are instituted to capture the most beneficial qualities of the very best animals. Accuracy is imperative for advancing seedstock genetics, and Broek reiterates that when you make a

clone, the clone's genetic material is 100% accurate to the original animal. The relevance of preserving highly sought-after genomics comes into play by maintaining and increasing the genetic contribution of an operation's outliers.

So, how does it work? To clone an animal, first, measures must be taken to preserve its genetic contribution. Living tissue samples can be collected from a live animal or recently deceased animal. Broek says tissue samples must be collected to obtain living diploid somatic cells, meaning the genetic material features maternal and paternal contribution.

Broek points out that cloning cannot take place by simply collecting cells from haploid semen samples, as genetic information from both parents is required. Often, the collection of tissue samples is conducted using a common Allflex tagger fitted with a different tissue sampling unit (TSU) tube.

Next, the tissue samples are used to grow cell lines. Broek says cell lines, also called genetic preservations, can preserve the DNA of an animal indefinitely.

Following genetic preservation, a collection source of oocytes, or unfertilized eggs, are used to progress the cloning process. Unfertilized eggs from a recipient herd are aspirated and used for reconstruction.

Broek says nucleating the oocyte removes the chromosomal material, and "in essence, what we have left is a bagged cytoplasm." A diploid cell extracted from the cell line is then inserted into the bagged cytoplasm and receives an electrical current to jumpstart the oocyte growth.

For approximately a week, Broek says they go into culture exactly like IVF embryos before being transplanted into recipient animals. The surrogates carry the calf to term, and at parturition the calf born is genetically identical to the animal that provided the original ear sample.

While cloned animals are primarily used for breeding purposes, Broek says cloning technologies are effective methods for saving endangered species and rare genetics for altruistic purposes, evaluating human biomedical cases such as cystic fibrosis through swine genetic investigations, and capitalizing upon meat and animal quality.

Concerns regarding the safety of meat and milk products derived from cloned animals and their offspring were addressed in 2008 by the Food and Drug Administration (FDA). This risk assessment additionally found no labeling was required to denote products from cloned animals.

Though cloned animals present with identical genetic information, Broek says variations can exist among the animals with respect to color spot pattern and phenotype. She reiterates the importance environment plays, in correlation with high-caliber genetics, in making a champion.

"A champion animal is probably 25% genetics," Broek says. "It's probably 50% environment, animal husbandry, nutrition, all the things you did to it. Then it's probably 25% luck… so we can make you that 25% match." AJ

EDITOR'S NOTE: Sarah Harris-Christian is a freelance writer from Centralia, Okla.