

# Gene Editing: An exciting tool, scary science or somewhere in between?

*Researchers explain the technology, opportunities and implications.*

*by Miranda Reiman, director of digital content and strategy*

With long generation intervals and traditional breeding, making change in the cattle industry has always been a slow and steady process.

Some producers and scientists alike imagine a future where that's not the case. The broad bucket of genetic engineering has been around for decades, but the more targeted technology of gene editing has become more practical and applicable in animal agriculture in the last five to ten years.

The tools have advanced a lot,

but they can always get better, says Larry Kuehn, U.S. Meat Animal Research Center (USMARC). They aren't a distant, yet-to-be-developed technology.

"We are absolutely able to do this today, in terms of the science."

Other livestock species and even some in the cattle industry are already employing gene editing to make more rapid advancements.

## Editing explained

It may sound part science fiction, but it's the world Angus breeder and former National Junior Angus Association (NJAA) member Maci Mueller works in every day.

She's currently a research geneticist at the University of California, Davis and explains: "Gene editing is a biological tool that we can use, as animal and plant breeders, to add, delete or replace letters in the genetic code, and the genetic code can be thought of as kind of a recipe book for how an

organism is created or developed."

Using a protein to cut the DNA, animal breeders take advantage of the cell's innate tendency to try to repair that cut, Mueller says.

"The natural cell repair mechanism can either delete a small section of that DNA code or add in different base pairs, and ultimately it can inactivate that gene that was being targeted by that protein cutting the DNA, and that's what we would call a gene knockout or deletion," she says.

Similar to editing a document, the gene editing can allow for a copying, pasting or deleting specific letters in the DNA code. Changing those instructions or the "recipe," changes the trait of interest in the animal.

Using a breed that's not naturally polled, a cattleman can eliminate horns using the tool. That doesn't apply to Angus, but it's an example where a single gene could be responsible for a trait.

"We can do them in really just a single generation, which we haven't had that capability before," Mueller said.




---

"Gene editing is a biological tool that we can use, as animal and plant breeders, to add, delete or replace letters in the genetic code, and the genetic code can be thought of as kind of a recipe book for how an organism is created or developed." — Maci Mueller

---



Larry Kuehn

## Adoption ahead?

Gene editing technology could change the cattle business, but there are a lot of questions to answer before it becomes mainstream.

“We need to do our due diligence as far as knowing what we’re doing,” Mueller says. “We mentioned how we can make rapid progress, and so with rapid progress can come rapid gains or rapid challenges.”

Today, gene editing is regulated by the Food and Drug Administration (FDA), and each edit must go through a process similar to getting a new drug approved. There are checks and double-checks in place, Mueller noted.

Fifteen years ago many in the cattle industry were working to understand DNA sequencing and chips.

“It doesn’t mean everybody has to be an early adopter to be successful here. It means that we have to be aware of what’s out there, and let’s make ourselves aware,” Kuehn says, encouraging cattlemen to seek out resources from the USDA, universities or breed associations.

In addition to understanding the technology at a cellular level, there are many conversations in industry about how to best incorporate information from gene-edited

animals into breed registries and the current expected progeny difference (EPD) structure.

The easy answer may be to ignore gene editing all together, but there’s risk in “getting left behind,” Mueller countered, “whether it’s other countries that are pursuing the technology, or other breeds and species.”

## Some traits easier than others

Gene editing could help solve many economically relevant challenges, from environmental adaptability to disease tolerance, Kuehn says.

“The most likely early candidates here are things that have large effects and often single-gene effects, because we know how to find them and we know where they’re at, and we know they have an economic impact in many cases,” he noted.

For example, the slick gene has been determined “low risk” by the FDA because it exists naturally. The low-risk determination means these animals and their products can enter the food chain without labeling. Thus, the slick edit may be one of the first to see wider application in the cattle industry.


In February, an American Angus Association member submitted an application to the Board of Directors

for the approval of the slick-gene edit. Discussions will continue at the June board meeting.

Quantitative traits, such as marbling, weaning weights and yearling weights, may be harder to pinpoint, because it’s harder to find extremely large effects, especially in single genes, Kuehn says. Researchers are also anxious to solve health problems, but that provides a different set of complexities to be sure that changing a disease pathway doesn’t delete something vital.

“While [health] is not a low-hanging fruit, I do think it is one that’s ripe for the picking because that’s one that’s really challenging to do with our traditional breeding methods,” Mueller says. The pork industry is trying to tackle porcine respiratory syndrome with a gene knockout of a receptor that allowed the disease to enter the cells, she said.

Regardless of the pace of the advancements in gene editing or the adoption across the industry, Mueller says it doesn’t change the fundamentals of genetic improvement.

“The foundation of animal breeding is a solid breeding objective and structured program,” Mueller says. “Then from there, when we have our objectives in mind, we can choose which tools we use to reach those objectives.” 



## Gene editing and Angus

Larry Kuehn and Maci Mueller joined *The Angus Conversation* podcast to discuss the future of gene editing. To hear the whole discussion, find *The Angus Conversation* wherever you listen to podcasts, or follow the QR code direct to the episode, “Gene Editing and Angus: A New Way to Solve Old Problems.”

**SCAN FOR MORE** on gene editing and to listen to this *The Angus Conversation* episode or visit [www.angusjournal.net](http://www.angusjournal.net).

