Genome editing in cattle: Generation of a polled phenotype in cattle using CRISPR/Cas

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In modern livestock farming horned cattle pose an increased risk of injury for each other as well as for the farmers. Dehorning without anesthesia is associated with stress and pain for the calves and raises concerns regarding animal welfare. Naturally occurring mutations causing polledness are known for most beef cattle but are rarely distributed within dairy cattle populations such as Holstein-Friesians and Brown Swiss. In order to improve animal welfare, breeders agreed to increase the percentage of polled individuals.

In beef cattle, a small mutation consisting of a 210bp insertion and an 8bp deletion (Celtic mutation) causes the polled phenotype.

In order to generate polled offspring from horned Holstein-Friesian and Brown Swiss bulls, we successfully introgressed the Celtic mutation into the genome of fibroblasts derived from horned individuals using the CRISPR/Cas12a system (Cpf1).

Furthermore, we used the CRISPR/Cas9 system to create a novel knock-out mutation in the same locus to examine whether also a deletion in this genomic area causes a polled phenotype.

Edited fibroblasts were used as donor cells for somatic cell nuclear transfer to produce embryos carrying the respective mutation. The embryos were recently transferred into surrogate mothers to generate polled living offspring. First pregnancies are currently awaited.

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