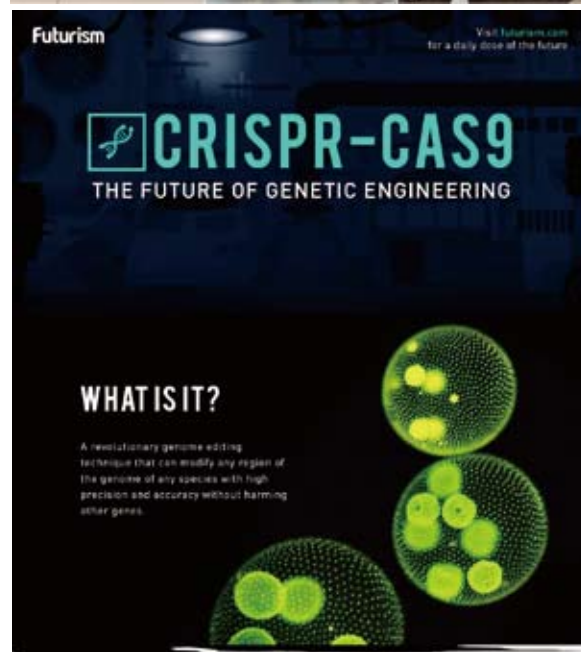Life Sciences

China Produces World's First Gene-Edited Dogs Using CRISPR/Cas9 System

Dogs exhibit close similarities to humans in terms of metabolic, physiological, and anatomical characteristics, and thus are ideal genetic and clinical models to study human diseases. Gene target technology is a powerful tool to create new strains of animals with favorable traits. However, gene-target dogs were not developed for a long time due to their unique species-specific reproductive characteristics which limited their applications, especially in the field of biomedical research. Recently, LAI Liangxue and his coworkers from the Key Laboratory of Regenerative Biology, the CAS Guangzhou Institutes of Biomedicine and Health have successfully used the clustered regularly inter-spaced short palindromic repeats (CRISPRs)/CRISPR-associated (Cas) 9 system to edit specific genes of dogs.

They used beagle dog, the most widely used breed in biomedical research, as their animal model. Myostatin (MSTN) was chosen as the first gene of interest. MSTN is a negative regulator of skeletal muscle mass. Spontaneous mutations of MSTN cause muscle hypertrophy in many species, including dogs, without causing severe adverse consequences.

First of all, LAI's group designed functional and effective sgRNA in canine cells. Then they generated MSTN KO dogs by manipulating dog zygotes using an auto-transplantation strategy. Eventually, eight females got pregnant and gave birth to 27 puppies. Two puppies from different mothers were found with genetic mutations in MSTN locus.

The study demonstrated for the first time that a single injection of Cas9 mRNA and sgRNA corresponding to a specific gene into zygotes, combined with an auto-embryo transfer strategy, can efficiently generate site-specific genome-modified dogs. This approach may not only greatly facilitate the generation of novel dog models for biomedical research, but also promote the creation of new strains of dogs with favorable traits for other purposes.