



BGI announced its plan to sell the micropigs as pets at a summit in Shenzhen, China.

GENE EDITING

Gene-edited pigs to be sold as pets

Chinese institute originally made the micropigs for research.

BY DAVID CYRANOSKI

Cutting-edge gene-editing techniques have produced an unexpected by-product — tiny pigs that a leading Chinese genomics institute will soon sell as pets.

BGI in Shenzhen, the centre that is famous for a series of high-profile breakthroughs in genomic sequencing, originally created the micropigs as models for human disease, by applying a gene-editing technique to a small breed of pig known as Bama. On 23 September, at the Shenzhen International Biotech Leaders Summit in China, BGI revealed that it would start selling the pigs as pets. The animals weigh about 15 kilograms when mature, or about the same as a medium-sized dog.

At the summit, the institute quoted a price tag of 10,000 yuan (US\$1,600) for the micropigs, but that was just to “help us better evaluate the market”, says Yong Li, technical director of BGI’s animal-science platform. In future, customers will be offered pigs with different coat colours and patterns, which BGI says it can set through gene editing.

With gene editing taking biology by storm, the field’s pioneers say that the application to pets was no big surprise. Some caution against

it: “It’s questionable whether we should impact the life, health and well-being of other animal species on this planet light-heartedly,” says geneticist Jens Boch at the Martin Luther University of Halle-Wittenberg in Germany. Boch helped to develop the technique used to create the pigs, which uses enzymes known as TALENs (transcription activator-like effector nucleases) to disable certain genes.

How to regulate the various applications of gene editing is an open question that scientists are already discussing with agencies across the world. BGI agrees on the need to regulate gene editing in pets as well as in the medical-research applications that make up the core of its micropig activities. Any profits from the sale of pets will be invested in this research. “We plan to take orders from customers now and see what the scale of the demand is,” says Li.

Compared to rats or mice, pigs are closer to humans physiologically and genetically, making them potentially more useful as a model organism for human disease. However, their larger size means that they cost more to keep and require bigger drug doses when they are used to test a pricey experimental medicine. Bama pigs, which weigh 35–50 kilograms (many farm pigs weigh more than 100 kilograms), have

previously been used in research.

To create the smaller, gene-edited micropigs, BGI made clones using cells taken from a Bama fetus. But before they started the cloning process, they used TALENs to disable one of two copies of the growth hormone receptor gene (*GHR*) in the fetal cells. Without the receptor, cells do not receive the ‘grow’ signal during development, resulting in stunted pigs.

SHOW STEALERS

BGI then created further micropigs by breeding stunted male clones with normal females. Only half of the resulting, naturally conceived offspring were micropigs, but the process is more efficient than repeating the full cloning procedure, and avoids potential health problems associated with cloning. Among the 20 second-generation gene-edited pigs, BGI has observed no adverse health effects, says Li.

He adds that the micropigs have already proved useful in studies of stem cells and of gut microbiota, because the animals’ smaller size makes it easier to replace the bacteria in their guts. They will also aid studies of Laron syndrome, a type of dwarfism caused by a mutation in the human *GHR* gene.

The decision to sell the pigs as pets surprised Lars Bolund, a medical geneticist at Aarhus University in Denmark who helped BGI to develop its pig gene-editing programme, but he admits that they stole the show at the Shenzhen summit. “We had a bigger crowd than anyone,” he says. “People were attached to them. Everyone wanted to hold them.”

In the United States, reports have surfaced of people who were disappointed when ‘teacup’ pigs weighing 5 kilograms grew into 50-kilogram animals. Gene-edited micropigs stay reliably small, the BGI team says. But gene editing will not solve other drawbacks of pet pigs, says Crystal Kim-Han, who runs a pig-rescue operation near Las Vegas, Nevada. If the animals are locked up in homes with no place to root or dig, they can become destructive. She also expects micropigs to have medical problems.

Some researchers think that dogs or cats will be next up for genetic manipulation. Scientists and ethicists agree that gene-edited pets are not that different from conventionally bred ones — the result is just achieved more efficiently. But that does not make the practice a good idea, says Jeantine Lunshof, a bioethicist at Harvard Medical School in Boston, Massachusetts, who describes both as “stretching physiological limits for the sole purpose of satisfying idiosyncratic aesthetic preferences of humans”.

Daniel Voytas, a geneticist at the University of Minnesota in Saint Paul, hopes that any buzz over gene-edited pets does not distract from or confuse efforts to use gene editing to alleviate human disease and create new crop varieties. “I just hope we establish a regulatory framework — guidelines for the safe and ethical use of this technology — that allows the potential to be realized,” he says. ■