

Pig 26 and a new way to edit genetic code



The gene editing technique was demonstrated by specifically changing the DNA code of a pig known as 'Pig 26'.
Image: Thinkstock

Scientists from The Roslin Institute at the University of Edinburgh have developed a simpler, more efficient and more accurate way to edit genetic code.

The team, working with colleagues at the Universities of Minnesota and Texas A&M, edited the genome of pigs to fine tune the technique, which is known as 'gene editing'.

To demonstrate its accuracy a male piglet called 'Pig 26' was born with just one DNA mutation deliberately introduced into its genetic code in a specific place among three billion letters of its genome.

Subsequently they have also been able to demonstrate genome editing in sheep and cattle.

The ability to make targeted changes at specific sites in a genetic sequence makes the technique a very attractive option for scientists working on genetic modification.

Other benefits include that that the technique doesn't require the use of antibiotic resistance genes, which has been controversial, and because it can be used in a fertilised egg it cuts down on the need to use complex cloning techniques.

It is around 10 times more efficient than standard genetic modification methods and is also simpler process.

Professor Bruce Whitelaw, The Roslin Institute

"The TALEN technology is staggeringly easy, quick, and leaves no mark in the genome.

"We are just mimicking an evolutionary process with precise, man-made genome editors."

"DNA editors are poised to change both how we perform genome engineering in livestock and how the various stakeholder communities view this technology."

Key facts

10x The TALEN technique is around 10x more efficient than some other genetic modification techniques.

1 The number of letters changed in Pig 26's DNA out of a total of 3Bn.

0 The trace the technique leaves behind in the genome, other than the targeted mutation. No antibiotic resistance genes or genetic markers are required.



Pig 26 had just one letter in its genetic code altered, from three billion. Image: The Roslin Institute

How does it work?

Gene editing uses enzymes called TALENs to target mutations to specific genes in the pig's DNA.

TALENs are a type of DNA editor that cut the genome in a specific place. The DNA is then repaired by the cell, but often during this process mistakes are made. This changes the genetic code and so creates mutations which can make the gene inactive. Alternatively the technique can be used to swap which version of a particular gene, called an allele, is present in the DNA.

By being able to target where the TALENs will cut the genome the technique combines efficiency and precision, enabling pre-determined, accurate changes to the genome of pigs.

Professor Bruce Whitelaw, who led The Roslin Institute team, said: "The TALEN technology leaves no mark in the genome beyond mutation of a predetermined site within the genome - we are just mimicking an evolutionary process with precise, man-made genome editors."

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What could it be useful for?

The technology has potential for many fields involving genetic modification techniques.

The Roslin Institute team developed the technique as part of a research programme aiming to create pigs that are resistant to diseases, hoping to introduce mutations into domestic pigs which confer resistance in some wild pig species.

It has also been used to disrupt a gene in pigs which helps remove cholesterol from the blood. With this gene switched off, cholesterol builds up and leads to a disease called atherosclerosis, where arteries become clogged and can narrow and harden. This can allow pigs to serve as models of human atherosclerosis.



The research was conducted by an international team including BBSRC-funded scientists working at The Roslin Institute at the University of Edinburgh. Image: The Roslin Institute

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