

Science

## **Yes, They've Cloned Monkeys in China. That Doesn't Mean You're Next.**

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Researchers in China reported on Wednesday that they have created two cloned monkeys, the first time that primates have been cloned with the technique that produced Dolly the sheep more than 20 years ago.

The long-tailed macaques, named Zhong Zhong and Hua Hua, were made from fetal cells grown in a petri dish. The clones are identical twins and carry the DNA of the monkey fetus that originally provided the cells, according to a study published in the journal *Cell*. They were born at the Chinese Academy of Sciences in Shanghai.

Dolly the sheep was produced from udder cells that had been frozen for six years. Until that feat, many researchers had thought that type of cloning was impossible, because it required taking adult cells and bringing them back to their original state, when sperm first fertilized egg.

The cell would then have to start to grow in a surrogate's womb and to differentiate into an entire animal, genetically identical to the one that provided the initial cell.

But once cloning proved possible, researchers began improving their method and testing it on other species. Since Dolly was born, researchers have cloned 23 mammal species, including cattle, cats, deer, dogs, horses, mules, oxen, rabbits and rats.

The two monkeys were cloned using the same technique as Dolly the sheep. The new monkey clones stand out, though. "It's the first primate ever to be cloned," said Dr. Leonard Zon, director of the stem cell program at Boston Children's Hospital. "We are closer to humans than we've ever been before."

"That raises questions of where we would want to go," he added.

Still, the techniques used to make those clones are not new, and other researchers previously had initiated the process in primates.

An initial step was reported in 2007 by Shoukhrat Mitalipov at Oregon Health and Science University. He and his colleagues removed skin cells from a 9-year-old macaque and inserted them into eggs from which the original DNA had been removed.

The eggs adopted genes from the inserted cells, and the resulting clones were grown to an early embryo stage. Dr. Mitalipov and his colleagues did similar work with human embryos in 2013.

The researchers, led by Qiang Sun, director of the primate research facility at the Chinese Academy of Sciences Institute of Neuroscience, began with cells taken from an aborted female monkey fetus.

From those, he and his colleagues created 149 early embryos, clones whose DNA was entirely derived from the fetal cells. Seventy-nine embryos survived in the lab, apparently healthy enough to transfer into the uteruses of surrogate monkey mothers.

Four of those surrogates remained pregnant, but two soon miscarried. In the end, there were two live births.

The investigators say they followed international guidelines for animal research set by the National Institutes of Health. They anticipate that the method could be used to produce monkeys for

research. (The United States, however, is backing away from the use of primates in medical research.)

The genes of cloned monkeys could be manipulated before the process begins, yielding animals that have edited genes in every cell of their bodies, the researchers suggested. This might allow scientists to probe the genes' functions and to test experimental drugs on monkeys custom-made to have various genetic conditions.

The scientists tried cloning adult cells, but those attempts failed. The older a starting cell, the more difficult it is to clone and the more likely the resulting embryo or fetus will be miscarried in a surrogate female.

If scientists wanted to create a monkey identical to an adult, or even an adolescent, this method so far would not succeed. And the technique used by the Chinese scientists is still a long way from producing human babies, even if that were ethically permissible.

"It is unlikely it can be applied to humans," Dr. Mitalipov said.