

## Dolly the Sheep's Fellow Clones, Enjoying Their Golden Years



The four clones created from the same cell line as Dolly the Sheep. Scientists found that they aged as normally as sheep that were not cloned. University of Nottingham

these four sheep, created from the same cell line as Dolly, and nine other cloned sheep, finding that, contrary to popular belief, cloned animals appear to age normally.

"They are not monsters," [Pasqualino Loi](#), a scientist who studies cloning at the University of Terama in Italy and was not involved in the research, wrote in an email.

Dolly's birth, 20 years ago this month, blew the world away. Scientists had taken a single adult cell from a sheep's udder, implanted it into an egg cell that had been stripped of its own DNA, and successfully created a living, breathing animal almost genetically identical to its donor.

But Dolly's health challenges, along with other cases in which cloned animals developed symptoms of diabetes or obesity, made it harder to grapple with the ethical and safety controversies of the procedure. Not only did many countries, including Canada and Australia, ban reproductive cloning in animals, but the United Nations

[Dolly the Sheep](#) started her life in a test tube in 1996 and died just six years later. When she was only a year old, there was evidence that she might have been physically older. At five, she was diagnosed with osteoarthritis. And at six, a CT scan revealed tumors growing in her lungs, likely the result of an incurable infectious disease. Rather than let Dolly suffer, the vets put her to rest.

Poor [Dolly](#) never stood a chance. Or did she?

Meet Daisy, Diana, Debbie and Denise. "They're old ladies. They're very healthy for their age," said [Kevin Sinclair](#), a developmental biologist who, with his colleagues at the University of Nottingham in Britain, has answered a longstanding question about whether cloned animals like Dolly age prematurely.

In a [study](#) published Tuesday in Nature Communications, the scientists tested

[banned](#) all kinds of cloning in humans in 2005. Last year the European Union made importing food from cloned animals or their offspring [illegal](#).

The inefficiencies of cloning have fed into these prohibitions. Few embryos make it to the fetus stage, fewer fetuses develop past the age of one or two, and even fewer become adults. Many blamed cloning when mature animals appeared to show signs of early aging.

In 1997, Scottish scientists revealed they had cloned a sheep and named her Dolly, sending waves of future shock around the world that continue to shape frontiers of science today.

By Retro Report on October 14, 2013. . [Watch in Times Video »](#)

Now, based on results of this new study, researchers have confirmed what most scientists believed years ago: Cloning does not lead to premature aging.

Dr. Sinclair and his colleagues started studying aging in these 13 sheep, which were originally intended for studies on efficiency and artificial reproduction, after [Keith Campbell, who was in charge of Dolly's relatives, died](#) in 2012.

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The cloned sheep were between the ages of 7 and 9, about 60 in human years.

To detect subtle signs of aging, the scientists conducted a battery of tests to check for symptoms of heart disease, type 2 diabetes and osteoarthritis.

“All we wanted to establish was: Are they normal?” Dr. Sinclair said.

For the most part, they were. Glucose tolerance and insulin resistance tests revealed nothing abnormal, and their blood pressure was fine. The sheep were flexible and reactive in musculoskeletal tests, but some did show early signs of osteoarthritis. Debbie's X-ray indicated her arthritis was slightly more advanced, but Dr. Sinclair said it was nothing out of the ordinary.

Similar evidence disproving premature aging in cloned animals was previously found in mice and cows, said [Jose Cibelli](#), who studies reproductive cloning at Michigan State University. The study of the sheep confirms that once cloned animals survive the first few years of life, they won't die any sooner than other animals.

“It really changes the perception of how people look at cloning,” said [Charles Long](#), a scientist who studies artificial reproduction at Texas A&M University and was not involved in the study.

## How Square Watermelons Get Their Shape, and Other G.M.O. Misconceptions

No, these watermelons were not genetically modified. And neither were those funny looking white strawberries.

clone humans anytime soon, nor do they condone it, but they can't say someone won't try.

But is cloning safe?

"If they could speak, they would say, 'Yes; it's perfectly safe,'" said Dr.

Sinclair. "For them, their whole process

worked perfectly. But there are others who struggled to adapt after birth."

Cloning won't be truly safe until embryos survive at rates similar to those produced through natural conception or in vitro fertilization. Even then, welfare and ethical concerns will remain.

With recent advances, some scientists think safe and efficient cloning procedures will emerge in five to 10 years. "Cloning is entering a new era," said Dr. Loi.

Dolly's relatives are expected to live for about another year. Scientists will then search for other abnormalities that may be lurking undetected. Meanwhile, Debbie is taking ibuprofen with her breakfast cereal.

Many scientists hope that changes in perception will lead to advances in reproductive technology that will enable us to provide food for a growing global population, save endangered species and develop advanced therapies. Scientists involved in and separate from the study don't think it will mean we might

