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Animals

## Animal Clones: Double Trouble?

From agriculture to medicine to law, animal cloning to create genetic twins could change our lives.

By [Emily Sohn](#) 12:00am, January 27, 2004

Have you ever had a hamburger so good you wished you could eat the same thing all over again?

With the way that cloning research is going, you might someday get your wish. The United States government recently decided that it's safe to drink milk and eat meat that comes from cloned animals. The decision has inflamed arguments about human health, animal rights, and the difference between right and wrong.

Clones, like identical twins, are exact genetic copies of each other. The difference is that twins turn up without scientists' being involved and are born at the same time. Clones are created in the lab and can be born years apart. Already, scientists have cloned 11 kinds of animals, including sheep, cows, pigs, mice, and horses.



*Dolly the sheep was the first mammal to be cloned*

*from the DNA of an adult. Here she is with her first-born lamb, Bonnie.*

## **Roslin Institute, Edinburgh**

As researchers continue to refine their techniques and clone even more animals, some people are worried. So far, cloned animals haven't fared well, critics say. Few cloning attempts are successful. The animals that do survive tend to die young.

Cloning raises a variety of issues. Is it a good idea to let people clone a favorite pet? What if cloning could revive the dinosaurs? What would happen if scientists ever figure out how to clone people?

Still, research continues. Scientists who study cloning envision a limitless supply of disease-resistant livestock, record-setting racehorses, and animals of species that would otherwise have gone extinct. The research is also helping scientists learn more about the basics of development.

### **How cloning works**

To understand how cloning works, it helps to know how animals normally reproduce. All animals, including people, have a set of structures in each cell called chromosomes. Chromosomes contain genes. Genes are made of molecules known as DNA. DNA holds all the information necessary to keep cells and the body working.

Humans have 23 pairs of chromosomes. Cows have 30 pairs. Other types of animals may have different numbers of pairs.

When two animals mate, each offspring gets one set of chromosomes from its mother and one from its father. The particular combination of genes that you happen to get determines a lot of things about you, such as the color of your eyes, whether you're allergic to pollen, and whether you're a boy or a girl.

Parents have no control over which genes they give to their kids. That's why brothers and sisters can be so different from one another, even if they have the same mom and dad. Only identical twins are born with exactly the same combination of genes.

The goal of cloning is to take control of the reproductive process. "You are taking out all the randomness," says reproductive physiologist Mark Westhusin, "by selecting a specific combination of genes to get what you want."



*Dewey, the world's first deer clone, was born May 23, 2003.*

**Courtesy of the College of Veterinary Medicine, Texas A&M University.**

That's appealing to people who breed horses, dogs, or other animals for competition. It would be nice to preserve the combination of genes that make a horse fast, for instance, or a dog's coat especially curly. It might also be possible to use cloning to save endangered animals if there are too few of them to reproduce well on their own.

Farmers also have an interest in cloning. The average milk cow produces 17,000 pounds of milk a year, says Westhusin, who works at Texas A&M University in College Station. Every once in a while, a cow is born that can naturally produce 45,000 pounds of milk a year or more. If scientists could clone those exceptional cows, fewer cows would be needed to make milk.

Cloning could save farmers money in other ways, too. Livestock are particularly vulnerable to certain diseases, including one called brucellosis. Some animals, though, have genes that make them naturally resistant to brucellosis. Cloning those animals could produce a whole herd of disease-free animals, saving farmers millions of dollars in lost meat.

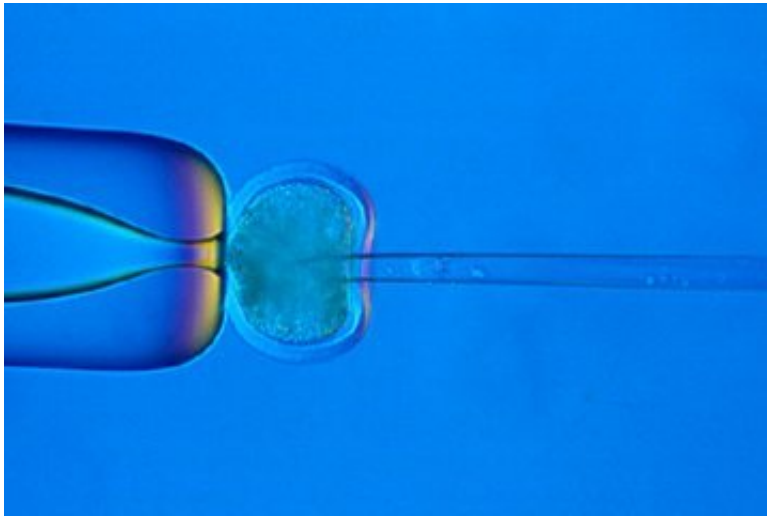
With an endless supply of healthy, fast-growing animals, we might worry less about getting sick ourselves. Farmers wouldn't have to pump their animals full of antibiotics, which get into our meat and, some people think, make us unable to respond to those antibiotics when we become ill. Perhaps we could also protect ourselves against diseases that jump from animals to people, such as mad cow disease.

### **Kinks in the process**

First, though, there are plenty of kinks still to be worked out. Cloning is a delicate procedure, and lots can go wrong along the way. "It's really quite remarkable that it works at all," Westhusin says. "There are lots of ways we know it doesn't work. The more difficult question is to figure out how sometimes it does."

Westhusin is one of many researchers working hard to answer that question. His experiments focus mostly on goats, sheep, cattle, and some exotic animals, such as white-tailed deer and bighorn sheep.

To clone an animal, such as a cow, he starts by removing the chromosomes from a regular cow's egg. He replaces them with chromosomes taken from a skin cell belonging to another adult cow.



*Cloning involves removing the chromosomes from an animal's egg cell and replacing them with chromosomes taken from a cell belonging to a different adult animal.*

### **Roslin Institute, Edinburgh**

Ordinarily, half the chromosomes in an egg would have come from the mother and half from the father. The resulting combination of genes would be entirely up to chance. With cloning, all of the chromosomes come from just one animal, so there's no chance involved. An animal and its clone have exactly the same genes.

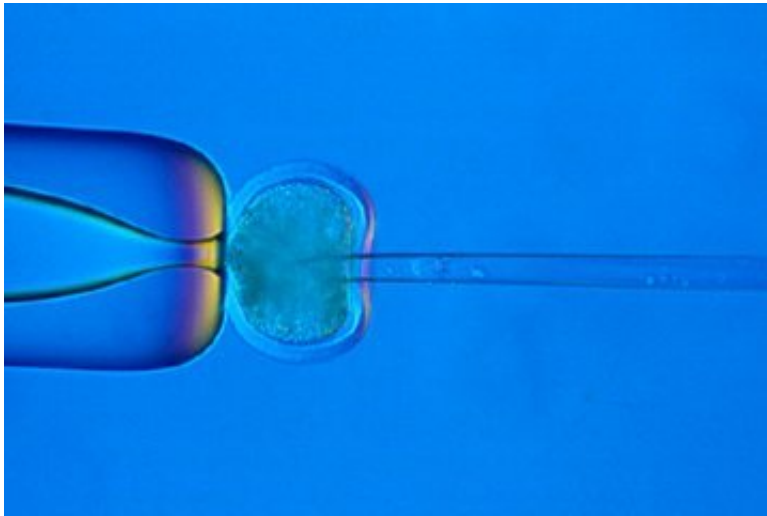
When the egg starts dividing into an embryo, Westhusin puts it into a surrogate mother cow. The mother doesn't have to be the same cow that provided the skin cell. It just provides the womb for the clone to develop. If everything works just right, a calf is born, looking and acting just like a normal calf.

More often than not, however, things don't work out quite right. It may take 100 tries to get one embryo to develop inside the mother, Westhusin says.

### **Dying young**

Even if they make it to birth, cloned animals often seem doomed from the start. For reasons scientists don't yet understand, cloned baby animals often resemble animals born prematurely. Their lungs aren't fully developed, or their hearts don't work quite right, or their livers are full of fat, among other problems. As they age, some clones grow hugely overweight and bloated.

Many cloned animals die at an earlier age than normal. Dolly the sheep, the first cloned mammal, died after only 6 years from a lung disease rare for sheep of her age. Most sheep live twice that long.



*These three mules are genetically identical. University of Idaho scientists used genetic material from the same male mule to create three embryos. They implanted the embryos into surrogate mother mules 1 month apart, so one was born last May, another was born last June, and the third one was born last July.*

J. Miller

The problem, Westhusin thinks, is in the genes. Even though a skin cell has the same chromosomes as every other cell in the body, certain genes get turned on or off when a cell becomes specialized during development. That's what makes a brain cell different from a bone cell different from a skin cell. Scientists haven't yet figured out how to completely reprogram an adult cell's genes to recreate an entire animal.

Yesterday, they were acting like skin cells," Westhusin says. "Today, you're asking them to activate all their genes and start life all over again. You're asking them to turn genes on that normally wouldn't be turned on."

There's a lot to be learned from these complications. "Studying what goes wrong," Westhusin says, "can give us clues and keys to what happens in nature. It's a model of development that shows how genes are reprogrammed."

Such complications also suggest why it might not be a good idea to clone a beloved pet. Even if a clone is nearly genetically identical to the original, it will still grow up with its own personality and behavior. Because of differences in diet before birth and as it grows up, it could end up a different size and have a different pattern of coat color. There's really no way to get a favorite pet back through cloning.

### **Clone chops**

Even though cloning technology is far from perfect, milk and meat from cloned animals should be safe, Westhusin says. And the U.S. government agrees.

"There's no reason to believe, based on how clones are produced, that there are any food safety issues involved," Westhusin says. Cloned food products might appear on supermarket shelves in the near future.

Still, the thought of eating cloned creatures just doesn't sit right with some people. In a recent article in the *Washington Post* newspaper, science reporter Rick Weiss wrote about the old saying, "You are what you eat," and what that might mean for someone eating "clone chops."

"The whole prospect left me inexplicably disgusted," Weiss wrote. Though he admitted his reaction might be partly emotional, he didn't like the idea of a world where identical animals are produced like food pellets in a factory. "Is my dream of Compassionate Cold Cuts a rational one?" he asked.

That may be a question you'll have to answer for yourself some day not too long from now.

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