

## In defense of cloning

A University of Maryland professor who helped the FDA assess the potential dangers of selling meat and milk from cloned animals maintains that such food is safe



**Carol L. Keefer, shown in her College Park office, says cloning differs from genetic engineering. (Sun photo by Barbara Haddock Taylor / January 9, 2008)**

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Carol L. Keefer has played a significant behind-the-scenes role in the government's deliberations on whether to permit sales of meat and milk derived from clones. An associate professor at the University of Maryland, Keefer was one of three animal scientists who reviewed the Food and Drug Administration's research into the safety of such food last year.

The agency's tentative endorsement of the food's safety has been the subject of much hand-wringing among consumers, within the food industry and in Washington. Sen. Barbara A. Mikulski of Maryland, among others in Congress, is trying to block the FDA from making a final ruling that would pave the way for grocery shelves to carry meat and milk from cloned cows, pigs and goats and their offspring.

The cloning of farm animals is a hot-button issue for animal welfare advocates, who say the process leads to serious health defects. Mikulski and others say many consumers are uncomfortable with the prospect of eating meat or drinking milk from a cloned animal. If cloned foods are marketed, she wants them to be labeled to give consumers the option of avoiding them.

Still, the FDA is expected to issue a decision opening the door to selling cloned foods soon.

During an interview last week in her university office, across the hall from the labs where she studies animal reproduction, Keefer discussed the implications of FDA approval. She said cloning should not be confused with genetic engineering, in which the nature of the animal might be altered. She emphasized that the food wouldn't be genetically modified and said the food would be as safe to eat as food produced through existing means. She said she ate a steak from a clone in Japan.

Keefer has been looking into new technologies for breeding animals since she was a post-doctoral fellow at the Johns Hopkins University in the early 1980s, researching in vitro fertilization of rats. After leading a team of cloning researchers at a biotechnology firm in Montreal, she moved to College Park three years ago. She served as president of the International Embryo Transfer Society.

### **How does cloning work?**

This is just another advancement in reproduction, another method of reproducing an animal.

In this case, you might have a high-value animal that you would like another copy of. ... Well, if you breed him and look at the sons, they're not going to be identical to him because of the recombination of the DNA during fertilization. The way you make a copy of him is through cloning.

You need just one of his cells, which has a nucleus in it. The nucleus contains information on how to make him. We all have DNA in our nuclei which tells cells how to be a cell, how to make a new individual. (Actually, you need more than one cell due to the inefficiencies in the process.)

If you take the nucleus from one of his cells and put it into an unfertilized egg after you remove the DNA from that egg, then the egg cytoplasm - the material inside the egg - can utilize the information that's provided by the nucleus to start development of a new embryo.

### **What happens after the transfer of the DNA from the nucleus of the cell you want to copy?**

An oocyte is obtained - an unfertilized egg - and the DNA from that egg is replaced with the DNA from the animal that you're copying. This reconstructed embryo is activated; that is, it goes through the embryo development process - that means cells divide, it forms an embryo.

This embryo is then transferred into the reproductive tract of a surrogate, a recipient, where in some cases it will initiate a pregnancy. And the surrogate animal will hopefully carry that pregnancy to term. And then you have the offspring born.

So the clone itself undergoes the normal embryo/fetal development process inside what you might call the surrogate mother. The birth is normal. ...

The time during which the embryo is outside of a cow and being handled in a laboratory situation is approximately one week.

### **Is it genetic engineering - transgenics?**

It's not genetic engineering. No. The confusion arises because you can use the cloning process to make a transgenic animal. But in that case, ... other procedures become involved to alter the genome of the transgenic animal.

When you're talking about cloning to reproduce an animal, you're not altering the genetics that you're copying. You're just taking that copy of genetics from the animal that you're copying and using it, through this reproductive cloning process, to make a genetic copy of that animal. ...

The confusion arises, I think, because we use the same technique - somatic cell nuclear transfer - to either do reproductive cloning or to produce transgenic animals.

A lot of the published literature says cloning or somatic cell nuclear transfer for the production of transgenic animals and so it is easy to think that cloning by somatic cell nuclear transfer means transgenic animals. But it doesn't. It's just one process that's used in producing transgenic animals.

### **Why isn't the clone an identical copy of the original animal?**

The example I like to use for my class is: If I have a classroom of, say, a hundred students, and I give each of them a set of directions about how to get to a certain corner in downtown D.C., and tell them to be there by a certain time, they're not all going to be there at exactly the same instant. They have the same information, they're reading it and it's a matter of interpretation.

If you look at natural twins - either natural twins or identical clones - you might see different coat color patterns. In this case, the coat color pattern is due to migration of the cells that produce the colors in the coat, the melanocytes. Each one of those melanocytes has the same set of instructions on where to migrate in the body, but just like the students being given directions to a certain street corner, they will not necessarily all reach there at the same time.

**If I'm a dairy farmer, say, why would I want to clone a great milking cow?**

In a dairy, quite often farmers have a favorite cow. It gives them consistently good milk production or has really nice offspring. Farmers would like to improve the milk production in their herd, so they would like to have more of that particular cow for breeding purposes. She would give offspring that would also have better production traits.

Primarily right now, cloning is for increasing your breeding stock - giving you better sires and dams for production purposes.

**If I'm a consumer buying milk from a clone, should I be worried?**

I don't think consumers have any need to worry.

For one thing, at this point in time, clones are rather expensive to make. So farmers are going to be limiting their use of clones to breeding stock. Suppose you have a highly valuable cow that you want to copy. You will copy her and you will use that clone as breeding stock to produce new offspring.

It's the offspring that would go to making milk or meat.

**I shouldn't be worried about the offspring either?**

No, the offspring seem to be completely normal. ...

What you have to consider is that food from the offspring, or even the food from clones, are going to go through the same screening process that animals produced by standard production methods goes through.

In this screening process, only products from healthy animals go through. Unhealthy animals are screened and eliminated in this system.

So you wouldn't have any more worries than you would from meat or milk produced through standard practices.

**Does cloning yield unhealthy animals?**

There are some effects of the cloning process on the clones themselves. Most of that is seen very early on - in the embryological stages.

In the past, there were also losses during pregnancy and gestation, but these losses are decreasing as we learn more about the cloning process.

This is not, I don't think, a safety concern as far as the consumer. It's more of an animal welfare issue.

And of course as scientists, we want to do the best we can for producing healthy animals, and so there are a lot of studies to eliminate or at least decrease these gestational abnormalities. And there are practices being put into place for the care of the newborn offspring to help manage them better.

But we are seeing decreases in the losses and the abnormalities as we improve the system and as the cloning process evolves.

**What do you mean by gestational losses?**

The early gestational losses would be very similar to what we call a miscarriage for humans.

There are some issues with the viability of the offspring. But again, as we develop maintenance procedures for the care of these animals, the losses of newborns is also decreasing.

**Given the evidence you've found supporting the safety of food from clones, why do you think concerns about "Frankenfoods" persist?**

Part of it is the confusion between the reproductive cloning process, which is what we're talking about now, and transgenics. But they are two separate issues.

The other issue is some people are concerned about our utilization of animals for food. They would almost prefer that animals not be used in food production systems.

But as far as the safety of the product - the milk or the meat - that is not really an issue.

I don't think anybody who works with cloning doesn't agree that we would like to improve the efficiencies and decrease the losses that we see. But that is basically something to do with the production of the animal, not with the safety of the animal as it concerns the consumer.

Some groups that are interested in animal welfare will focus on that part of it, but it really should be a separate issue from the safety issue.

**So the inefficiencies and losses in the production of clones is no different than the inefficiencies and losses we see in other forms of reproduction?**

The incidences might be higher than during natural breeding. But during natural breeding, embryos are produced that don't result in pregnancies, pregnancies are lost, calves are born which die. That is part of nature. It happens for cattle. It happens for humans. And in the cloning process, we also see these losses.

**Have other countries found food from clones is safe?**

A number of studies have been done in Japan, and so they're moving forward. I've actually eaten cloned meat in Japan. Meat derived from embryo clones, not from somatic cell nuclear transfer. ... I believe it was the Wagyu meat, the expensive meat. It was very tasty.

**One option proposed for addressing the concerns of consumers is to label food derived from clones. Should we label food derived from clones?**

The main problem with labelling food derived from clones is there is nothing different about the food. There is no way to analyze the meat or the milk and say, "This is different." So what you're doing is putting a label on the process.

When you're talking about the safety of meat and milk, it's irrelevant. We don't label foods saying that, "This food was derived from animals that we bred naturally" or "This food was derived from animals that were bred by artificial insemination." And so as cloning is just another method of producing an animal, it is sort of irrelevant to labelling the meat or the milk.

If in the future, we have something like transgenic animals which are more resistant, say, to disease or more resistant to BSE, mad cow disease, and this is done through genetic modification, then labeling would actually be, in fact, a form of advertising. But in that case, it would be something you could measure in the meat or maybe the milk depending on what the transgene is.

But in this case, because there is no difference, in the meat or the milk itself, it's in the production method, it's questionable.

**Why do you think some members of Congress have expressed concern?**

That's a very intriguing question, and I wish I knew more. I don't know why some of them are jumping in. I guess it depends on who approaches them and what information they tell them. And because I don't know what information they're being given, I don't know why they're jumping in. Of course, any new technology there are proponents and opponents. Both have their own agendas.

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