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## Cloning May Lead to Healthy Pork

By [GINA KOLATA](#)

A group of university researchers said yesterday that they had created what sounds like a nutritional holy grail: cloned pigs that make their own omega-3 fatty acids, potentially leading to bacon and pork chops that might help your heart.

For now, the benefits of the research are theoretical. Omega-3 fatty acids, which have been linked to a lowered incidence of [heart disease](#), are primarily found in fish. No one knows whether they would have the same effect if eaten in pork.

And government approval for such genetically modified foods is certain to face monumental opposition from some consumer groups. Some already object to feeding farm animals genetically modified grain, and genetically modifying the animals themselves and cloning them would be "a double whammy," said Joseph Mendelson, the legal director for the Center for Food Safety, a nonprofit group that opposes the use of genetically engineered products. "I am confident that consumers would not want them."

Still, some scientists say the findings, published online by the journal *Nature Biotechnology*, are an important forerunner of things to come. Although close to a dozen animals have been cloned in the decade since Dolly the sheep, using cloning to change the nutritional value of farm animals is groundbreaking.

"At this point, it's a new era," said Alice H. Lichtenstein, a professor of [nutrition](#) science and policy at the Gerald J. and Dorothy R. Friedman School of Nutrition Science and Policy at Tufts University.

Alexander Leaf, an emeritus professor of clinical medicine at [Harvard](#), said he was confident that pork and other foods with omega-3's would eventually get to American consumers and that they would be better for it.

"People can continue to eat their junk food," Dr. Leaf said. "You won't have to change your diet, but you will be getting what you need."

For years, people have been urged to eat fish rich in omega-3 fatty acids. But fish can be expensive, not everyone likes it, and omega-3's are in greatest abundance in oily fish like tuna, which contains mercury.

That nutritional conundrum led a group of scientists from Harvard Medical School, the University of Missouri and the University of Pittsburgh Medical Center to think of modifying pigs.

What resulted was five white piglets with muscle tissue larded with omega-3 fatty acids. They live at the University of Missouri in individual pens with fiberglass-railed sides, concrete floors and black foam pads for beds.

Pigs with their own omega-3 fatty acids exist in nature, notably a Spanish breed called Ibérico. But Dr. Jing X. Kang, an associate professor of medicine at Harvard Medical School and the lead author of the new paper, said pigs were only the beginning, adding that he was also developing cows that made omega-3's in their milk and chickens that had the fatty acids in their eggs.

It will be years before such products make their way to market, if ever. Michael Herndon, a spokesman for the [Food and Drug Administration](#), said in an e-mail message that research with genetically engineered animals would probably require approval from the agency and that the F.D.A. "also expects documentation of plans regarding the disposition of all investigational animals after their participation in the study is completed."

Mr. Herndon said the F.D.A. had not yet approved any genetically modified animals for food.

Mr. Mendelson of the Center for Food Safety added that his group worried about the ability of the food and drug agency to determine the safety of genetically modified foods. And he said the cloning process could produce unhealthy animals.

For those who do not object to genetically modified or cloned animals, the question is whether eating such altered foods will make a difference in health. And on that, "all bets are off," said Dr. Lichtenstein of Tufts.

Many questions remain, she said: How important are omega-3 fatty acids to human health? Would getting the fatty acids in meat be the same as getting them in fish? And is it really such a good idea to put omega-3's into foods like pork that contain saturated fats and [cholesterol](#), which could increase risk of heart disease?

Dr. Kang said the work began a few years ago when he put a gene for the production of omega-3 fatty acids into mice. Mammals do not have that gene; it is found instead in microorganisms, plankton, algae and worms, he said. Fish get the fatty acids by eating algae.

Dr. Kang used a gene from roundworms that converts an abundant form of fatty acid, omega-6, to omega-3. He had to modify the worm enzyme, making it into one that would function in mammals.

Then he injected the gene for the enzyme into mouse embryos, some of which took it up, yielding mice that made their own omega-3's. (In a paper that is being readied for publication, he says these mice are protected from a variety of chronic illnesses, presumably because they make the fatty acids.)

The next step was to create pigs with the enzyme. That work was done by Randall S. Prather, a pig cloning expert at the University of Missouri, who used genetically modified pig cells to create the five cloned pigs that had the gene in every cell of their bodies and made their own omega-3 fatty acids in their muscles.

Although pigs have been cloned before — along with a growing list of animals, including sheep, mice, rats, cows, goats, rabbits, cats, a mule, a horse and a dog — these are the first livestock to be cloned and genetically modified to make omega-3's.

Dr. Prather said the omega-3 pigs, born in November, will be bred when they reach puberty. Then, he said, "we will distribute them to researchers who are interested."

Pigs are often used to study heart disease, and the cloned pigs offer a new opportunity, Dr. Prather said. Instead of comparing human populations who happen to eat, or not eat, foods with abundant omega-3, scientists can ask their question directly: Compared with pigs without the omega-3 fatty acids, do these cloned pigs have a reduced heart attack risk, or don't they?