Scientists are testing mRNA vaccines to protect cows and people against bird flu

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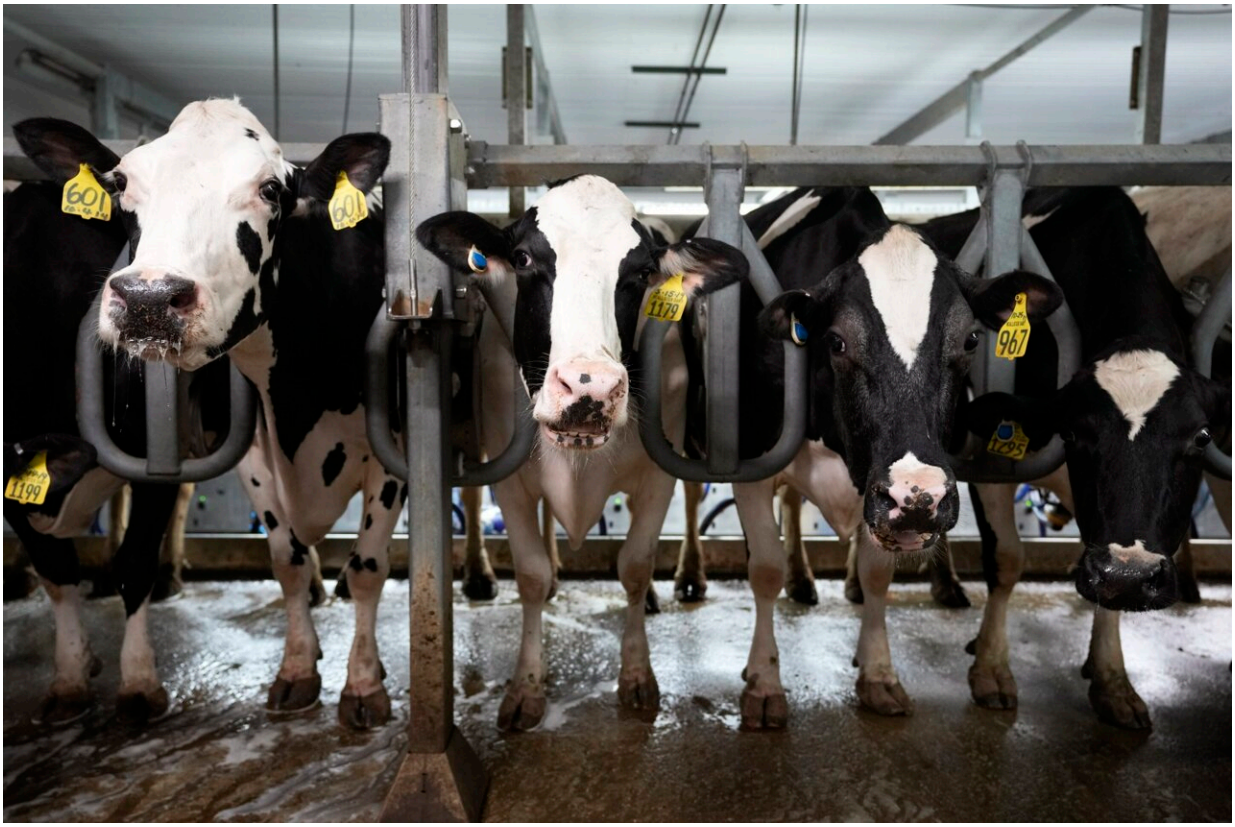

Cows stand in the milking parlor of a dairy farm in New Vienna, Iowa, on Monday, July 24, 2023. The bird flu outbreak in U.S. dairy cows is prompting development of new, next-generation mRNA vaccines — akin to COVID-19 shots — that are being tested in both animals and people. In June 2024, the U.S. Agriculture Department is to begin testing a vaccine developed by University of Pennsylvania researchers by giving it to calves. Credit: AP Photo/Charlie Neibergall, File

The bird flu outbreak in U.S. dairy cows is prompting development of new, next-generation mRNA vaccines—akin to COVID-19 shots—that are being tested in both animals and people.

Next month, the U.S. Agriculture Department is to begin testing a vaccine developed by University of Pennsylvania researchers by giving it to calves. The idea: If vaccinating cows protects dairy workers, that could mean fewer chances for the virus to jump into people and mutate in ways that could spur human-to-human spread.

Meanwhile. the U.S. Department of Health and Human Services has been talking to manufacturers about possible mRNA flu vaccines for people that, if needed, could supplement millions of bird flu vaccine doses already in government hands.

"If there's a pandemic, there's going to be a huge demand for vaccine," said Richard Webby, a flu researcher at St. Jude Children's Research Hospital in Memphis. "The more different (vaccine manufacturing) platforms that can respond to that, the better."

The bird flu virus has been spreading among more animal species in scores of countries since 2020. It was detected in U.S. dairy herds in March, although investigators think it may have been in cows since December. This week, the USDA announced it had been found in alpacas for the first time.

At least three people—all workers at farms with infected cows—have been diagnosed with bird flu, although the illnesses were considered mild.

But earlier versions of the same H5N1 flu virus have been highly lethal to humans in other parts of the world. Officials are taking steps to be prepared if the virus mutates in a way to make it more deadly or enables

it to spread more easily from person to person.

Traditionally, most flu vaccines are made via an egg-based manufacturing process that's been used for more than 70 years. It involves injecting a candidate virus into fertilized chicken eggs, which are incubated for several days to allow the viruses to grow. Fluid is harvested from the eggs and is used as the basis for vaccines, with killed or weakened virus priming the body's immune system.

Rather than eggs—also vulnerable to bird flu-caused supply constraints—some flu vaccine is made in giant vats of cells.

Officials say they already have two candidate vaccines for people that appear to be well-matched to the bird flu virus in U.S. dairy herds. The Centers for Disease Control and Prevention used the circulating bird flu virus as the seed strain for them.

The government has hundreds of thousands of vaccine doses in pre-filled syringes and vials that likely could go out in a matter of weeks, if needed, federal health officials say.

They also say they have bulk antigen that could generate nearly 10 million more doses that could be filled, finished and distributed in a matter of a few months. CSL Seqirus, which manufactures cell-based flu vaccine, this week announced that the government hired it to fill and finish about 4.8 million of those doses. The work could be done by late summer, U.S. health officials said this week.

But the production lines for flu vaccines are already working on this fall's seasonal shots—work that would have to be interrupted to produce millions more doses of bird flu vaccine. So the government has been pursuing another, quicker approach: the mRNA technology used to produce the primary vaccines deployed against COVID-19.

These messenger RNA vaccines are made using a small section of genetic material from the virus. The genetic blueprint is designed to teach the body how to make a protein used to build immunity.

The pharmaceutical company Moderna already has a bird flu mRNA vaccine in very early-stage human testing. In a statement, Moderna confirmed that "we are in discussions with the U.S. government on advancing our pandemic flu candidate."

Similar work has been going on at Pfizer. Company researchers in December gave human volunteers an mRNA vaccine against a bird flu strain that's similar to—but not exactly the same as—the one in cows. Since then, researchers have performed a lab experiment exposing blood samples from those volunteers to the strain seen in dairy farms, and saw a "notable increases in antibody responses," Pfizer said in a statement.

As for the vaccine for cows, Penn immunologist Scott Hensley worked with mRNA pioneer and Nobel laureate Drew Weissman to produce the experimental doses. Hensley said that the vaccine is similar to the Moderna one for people.

In first-step testing, mice and ferrets produced high levels of bird flu virus-fighting antibodies after vaccination.

In another experiment, researchers vaccinated one group of ferrets and deliberately infected them, and then compared what happened to ferrets that hadn't been vaccinated. All the vaccinated animals survived and the unvaccinated did not, Hensley said.

"The vaccine was really successful," said Webby, whose lab did that work last year in collaboration with Hensley.

The cow study will be akin to the first-step testing initially done in

smaller animals. The plan is initially for about 10 calves to be vaccinated, half with one dose and half with another. Then their blood will be drawn and examined to look for how much bird flu-fighting antibodies were produced.

The USDA study first will have to determine the right dose for such a large animal, Hensley said, before testing if it protects them like it did smaller animals.

What "scares me the most is the amount of interaction between cattle and humans," Hensley said.

"We're not talking about an animal that lives on a mountain top," he said. "If this was a bobcat outbreak I'd feel bad for the bobcats, but that's not a big human risk."

If a vaccine reduces the amount of virus in the cow, "then ultimately we reduce the chance that a mutant virus that spreads in humans is going to emerge," he said.