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AU professor develops first egg-injected poultry vaccination against avian influenza

An Auburn University veterinary professor in collaboration with researchers at Vaxin Inc. of Birmingham has developed the first "in ovo," or egg-injected, vaccine to protect chickens against avian influenza, a virus threatening human health and global poultry populations.

Dr. Haroldo Toro, whose research is in press in the scientific journal, *Vaccine*, says it would provide 100 percent protection once an outbreak's strain is determined.

"We have proven the principle, which is the major step in leading to commercially produced vaccine that could be vital to the poultry industry," Dr. Toro said. "When an outbreak occurs, we would determine the strain and quickly create a vaccine within three months specifically for it."

The researchers inserted a gene from a low pathogenic avian flu virus strain (H5N9) into a non-replicating human virus, a Vaxin proprietary technology, which was then injected into developing chicken embryos still in the egg. When protection induced by the vaccine was tested against two highly pathogenic avian flu viruses, a Vietnam H5N1 strain and a Mexican H5N2 strain, the results showed 68 percent and 100 percent protection, respectively.

"These strains have slightly different genetic makeups which account for the different percentages in protection," said Dr. Toro, who is also collaborating on this project with the Southeast Poultry Research Laboratory in Athens, Ga. "Our results indicate that we can provide effective protection against any strain after incorporating the gene of the field strain into our vaccine construct."

The disease has decimated poultry populations in Asia in recent years. Dr. Toro says United States health officials are continuously monitoring both chicken flocks and migratory birds that might bring new, highly pathogenic strains of the disease and infect poultry flocks, possibly killing between 90 percent to 100 percent in affected areas.

The current policy of health officials during an outbreak of highly pathogenic avian flu is mass euthanasia and disposal of infected birds, and strict biosecurity measures. Mass vaccination programs around the perimeter region would help to reduce the risk of further dissemination of the field virus to neighboring areas. Because this vaccine also allows easy differentiation between naturally infected birds and vaccinated birds, this new vaccine could also be used to prevent outbreaks of disease in case of immediate risk from a known strain affecting, for example, neighboring countries.

“We can vaccinate lots of birds in a quick, cost- and labor-saving manner which otherwise would not be possible,” Dr. Toro said. “Most poultry operations already have automated injection machines to vaccinate against Marek’s disease, injecting up to 40,000 eggs per minute. Our vaccine is produced through cell cultures, so we can easily make enough vaccine for thousands of birds.”

He says this procedure is much easier than producing inactivated, or killed, vaccines, which require replicating the live avian influenza virus in egg embryos and individual delivery by injection. In addition, naturally infected chickens cannot be differentiated from those vaccinated if the strain used for vaccination is the same as the one acting in the field. Currently available recombinant vaccines, using fowlpox vectors, are injected into the chicken and have been shown to be less effective in birds pre-exposed to the fowlpox vector. Pre-exposure to the vector used in this novel vaccine is extremely unlikely in chicken populations.

“Both of the current methods are difficult and labor intensive, and are too time consuming, when time is critical,” he said. “The in-egg vaccine is easy to produce, easy to administer and very effective.”

He adds, “The vaccine would, in turn, reduce the risk for human exposure to avian influenza.” Even though the risk to people is low, there have been confirmed cases among humans reported since 1997, primarily in Asia as a result of contact with infected chicken, ducks and turkeys.

Dr. Toro’s research is funded through a USDA program set up in 2004 for universities to study avian influenza. The next step is gaining federal approval to commercially produce the vaccine.

“We are looking at two or three years for federal approval, but it might be much sooner if an outbreak occurs,” he said. “We have a very good tool against avian flu. No one has done this before.”