Biotech Pigs

By Joe Zimmermann

Yearly vaccinations help keep the flu at bay, but one university researcher hopes to go one step further toward eradicating the disease with the help from unlikely candidates: genetically altered pigs.

The U.S. Department of Agriculture's National Institute of Food and Agriculture granted $1.6 million to Bhanu Telugu, an animal and avian sciences professor at the University of Maryland, to study pigs' resistance to the flu.

"We humans knew about the flu since 370 B.C., so Hippocrates, one of the first to write about medicine, described the flu," Telugu said. "In all these years, we have yet to defeat this disease. Every year you have to go out and get vaccinations."

Unlike smallpox and other diseases scientists have been able to eliminate, the flu remains elusive in part because of its extreme variety, Telugu said, and because it can easily proliferate in animal species such as birds and pigs.

As a first step toward disease resistance, Telugu plans to genetically alter pigs to become resistant to the flu. Like traditional breeding, genetic engineering selects specific traits the scientists are looking for and selectively breeds them.

"But sometimes then [with traditional breeding] when you're mixing all the traits, you get bad traits as well as good traits," Telugu said. "So then when we go into the genome, we can change exactly what we want and nothing else."

Telugu will use TALENs and CRISPRs — synthetically generated genetic material that splices DNA at specific points on the genome — to go into single-celled pig embryos and cut out the genome's nucleotides that code for influenza virus receptors.

Without these nucleotides, if all goes according to plan, the pigs will grow up without receptors to the virus, Telugu said. Without these receptors where the virus can foster an attack, the pigs cannot get infected with the flu.

Liqing Yu, an animal and avian sciences professor at the University of Maryland, said genetic engineering allows scientists to study things they would otherwise be unable to observe. Similar methods to Telugu's research have successfully prevented the disease from spreading in poultry, he said.

"If you give a chicken the flu, it could die, but it won't pass on the virus," Yu said.

Telugu also plans to introduce decoys — RNA fragments that appear similar to the influenza virus — that would replicate in the pigs and prevent the actual virus from breeding in animal cells.

Telugu said he is hopeful that because the pig is a large animal, his research can help scientists learn about the flu in humans. Though genetic engineering of humans is illegal, he said, scientists might be able to develop drugs to block human receptors to the virus, based on how it works for the pigs.

“To this day you can basically cure cancer in a mouse, you can cure a mouse of diabetes, but if you use a mouse as a model, you can’t always apply those findings to people. … When you think about it, we are becoming pigs,” Telugu said, noting shared food preferences between humans and pigs. “They’re also single-stomach animals like us, and they have a similar physiology to us.”

While government regulators do not always specify where genetically modified animals stand in the research world, Telugu said, he argues these pigs should not be considered genetically modified.

“What he’s proposing is more like gene editing, so by definition, it’s not transgenic,” said Carol Keefer, an animal and avian sciences professor at the University of Maryland who also works with genetic and reproductive research.

This distinction seems simple, but it’s significant, Keefer said. Some animals are obviously transgenic, incorporated with a foreign gene, but Telugu’s proposed pigs are more ordinary.

“We want to use this as a model so we understand what genes are responsible, and we can develop drugs to treat the flu,” Telugu said.