

Pigs that are resistant to incurable disease developed

December 8 2015



Porcine Reproductive and Respiratory Virus can have devastating effects on pigs, including mortality. Credit: Nic Benner/University of Missouri

Porcine Reproductive and Respiratory Syndrome (PRRS) virus was first detected in the U.S. in 1987. Pigs who contract the disease have extreme difficulty reproducing, don't gain weight and have a high mortality rate. To date, no vaccine has been effective, and the disease costs North American farmers more than \$660 million annually. Now, a team of researchers from the University of Missouri, Kansas State University, and Genus plc have bred pigs that are not harmed by the disease.

"Once inside the [pigs](#), PRRS needs some help to spread; it gets that help from a [protein](#) called CD163," said Randall Prather, distinguished professor of animal sciences in the College of Agriculture, Food and Natural Resources. "We were able to breed a litter of pigs that do not produce this protein, and as a result, the [virus](#) doesn't spread. When we exposed the pigs to PRRS, they did not get sick and continued to gain weight normally."

For years, scientists have been trying to determine how the virus infected pigs and how to stop it. Previously, researchers believed that the virus entered pigs by being inhaled into the lungs, where it attached to a protein known as sialoadhesin on the surface of [white blood cells](#) in the lungs. However, two years ago Prather's group showed that elimination of sialoadhesin had no effect on susceptibility to PRRS. A second protein, called CD163, was thought to "uncoat" the virus and allow it to infect the pigs. In their current study, Prather's team worked to stop the pigs from producing CD163.

"We edited the gene that makes the CD163 protein so the pigs could no longer produce it," said Kristin Whitworth, co-author on the study and a research scientist in MU's Division of Animal Sciences. "We then infected these pigs and control pigs; the pigs without CD163 never got sick. This discovery could have enormous implications for pig producers and the food industry throughout the world."

While the pigs that didn't produce CD163 didn't get sick, scientists also observed no other changes in their development compared to pigs that produce the protein.

The early-stage results of this research are promising. The University of Missouri has signed an exclusive global licensing deal for potential future commercialization of virus resistant pigs with the Genus, plc. If the development stage is successful, the commercial partner will seek any necessary approvals and registration from governments before a wider market release.



(From Left) Kristin Whitworth, research scientist in MU's Division of Animal Sciences; Randall Prather, distinguished professor of animal sciences; and Kevin Wells, assistant professor of animal sciences; worked to breed pigs that are not harmed by PRRS. Credit: Nic Benner/University of Missouri

"The demonstration of genetic resistance to the PRRS virus by gene editing is a potential game-changer for the pork industry," said Jonathan Lightner, Chief Scientific Officer and Head of R&D of Genus. "There are several critical challenges ahead as we develop and commercialize this technology; however, the promise is clear, and Genus is committed to developing its potential. Genus is dedicated to the responsible exploration of new innovations that benefit the well-being of animals, farmers, and ultimately consumers."

"At the end of our study, we had been able to make pigs that are resistant to an incurable, untreatable disease," said Kevin Wells, co-author of the study and assistant professor of [animal sciences](#) at MU. "This discovery could save the swine industry hundreds of millions of dollars every year. It also could have an impact on how we address other substantial diseases in other species."

In addition to Whitworth and Wells, Prather's research team included collaborators at Genus plc, and Kansas State University. The study, 'Gene-edited pigs are protected from porcine reproductive and respiratory syndrome virus' is being published in *Nature Biotechnology* this month.

Provided by University of Missouri-Columbia

Citation: Pigs that are resistant to incurable disease developed (2015, December 8) retrieved 19 April 2024 from <https://phys.org/news/2015-12-pigs-resistant-incurable-disease.html>

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