Research uncovers genetic marker that could help control, eliminate PRRS virus

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A collaborative discovery involving Kansas State University researchers may improve animal health and save the U.S. pork industry millions of dollars each year.

Raymond "Bob" Rowland, a virologist and professor of diagnostic medicine and pathobiology, was part of the collaborative effort that discovered a genetic marker that identifies pigs with reduced susceptibility to porcine reproductive and respiratory syndrome, or PRRS. This virus costs the U.S. pork industry more than $600 million each year.

"This discovery is what you call a first-first," Rowland said. "This discovery is the first of its kind for PRRS but also for any large food animal infectious disease. I have worked in the field for 20 years and this is one of the biggest advances I have seen."

Rowland and researchers Jack Dekkers from Iowa State University and Joan Lunney from the Agricultural Research Service discovered a genetic marker called a quantitative trait locus, or QTL, which is associated with porcine reproductive and respiratory syndrome virus susceptibility. This discovery is a first step in controlling and eliminating the virus.

The research recently appeared in the Journal of Animal Science. The project's beginning and future center around Kansas State University, Rowland said.

It begins at the university because Rowland is involved with an organization called the PRRS Host Genetics Consortium, or PHGC, which initiated and provided more than $5 million for the research. Rowland is co-director of the consortium, which is a collaboration among the United States Department of Agriculture, the National Pork Board and Genome Canada as well as universities and industry members. Rowland is also director of the USDA-funded PRRS Coordinated Agriculture Project, known as PRRS CAP.

"The PRRS Host Genetics Consortium takes fundamental science and turns it into utility," Rowland said.

Kansas State University's new Large Animal Research Center is the site of much of the project's experimental work. The researchers obtain multiple measurements -- including growth, weight gain, performance and virus measurements -- over time. They have collected samples from more than 2,000 pigs since they began the study in 2007, for a total of more than 100,000 samples that are stored or distributed to the consortium's collaborators.

The university shipped samples to the Agricultural Research Service for genomic DNA preparations to identify differences among more than 60,000 genes. The data was transferred to Iowa State University for genetic analysis that led to the discovery of the QTL.

The collaborators at Iowa State University created a common database so that all the data collected during the project can be accessed at multiple locations by researchers and the breeding industry for the next several decades.

"A unique aspect of this project is that we have been looking at genes that may provide long-term resistance to a lot of infections," Rowland said. "This is very important for animal health because there are a lot of

diseases for which there are no cures and no vaccines. Now we have a tool to study these diseases."

These findings open new possibilities with Kansas State University's Biosecurity Research Institute and the future National Bio and Agro-defense Facility. Scientists can take this new genetic tool and study different infectious diseases in these world-class research facilities.

The discovery plays a role in nearly every aspect of animal health and is a large economic driver, Rowland said. Industry members are especially interested in how it opens new possibilities with vaccines. The next step is to find which genes contribute to the best vaccine response.

"We're not only making healthier animals, but we're also understanding the fundamental biological relationship between a host and a pathogen," Rowland said. "This has direct applications to human medicine because the same type of science and relationships applies to humans."

In addition to providing a better model for the porcine reproductive and respiratory syndrome virus, the research has led to several spin-offs:

* The Kansas State University researchers are able to collect thousands of samples that companies need to validate and develop the next generation of diagnostic tests. One such test is the use of oral fluids -- a noninvasive diagnostic test in which pigs chew on a rope and scientists analyze the saliva left on the rope.

* The research led to the discovery of pigs with severe combined immunodeficiency, or SCID. This research should enable researchers to better study the syndrome and apply its use to the study of human cancer and anti-cancer drugs.

The project has also proved to be very valuable for education because it

has involved more than 20 veterinary medicine, pre-veterinary medicine and graduate students at Kansas State University.

"This is an incredible opportunity for students to come in, learn how to work with animals, learn basic biosecurity and have the opportunity to do research," Rowland said. "It provides them with a lot of practical hands-on knowledge."

Provided by Kansas State University