



# SOLUTIONS THROUGH RESEARCH

# SWINE DISEASES



VACCINE AND INFECTIOUS DISEASE ORGANIZATION



The Vaccine and Infectious Disease Organization (VIDO) is a world leader in infectious disease research and vaccine development.

Collaborating with national and international partners from government, academia, and industry, we aim to improve animal health, protect Canadian herds and ensure food safety by:

- Understanding how pathogens cause disease,
- Developing novel vaccines and therapeutics, and
- Improving vaccine formulations and delivery methods.

Our work has resulted in vaccines for porcine epidemic diarrhea virus and *Actinobacillus pleuropneumoniae*, as well as several others for cattle and poultry.

We have also developed more potent adjuvants that enhance the immune response of vaccines, and novel approaches for needle-free delivery.

## AREAS OF CURRENT RESEARCH

### VACCINATING AGAINST PORCINE EPIDEMIC DIARRHEA VIRUS (PEDV)

PEDV continues to be a threat to the Canadian swine industry. It is highly infectious and survives well in the environment, which makes it difficult to control through biosecurity and good management practices alone.

We have developed a novel prototype vaccine and are currently developing a next-generation vaccine. Due to the nature of the virus, PEDV variants continue to emerge. Our team is working on vaccines that will be effective against multiple PEDV strains, and that will allow us to distinguish between animals that have been infected and those that have been vaccinated (DIVA vaccines).

In addition to vaccine development, we are working with the swine industry to help improve biosecurity to reduce the risk of PEDV infections. For example, we have developed better techniques for washing and baking transport trailers.

### PROTECTING THE CANADIAN PORK INDUSTRY FROM AFRICAN SWINE FEVER (ASF)

African swine fever (ASF) is an incurable contagious viral disease of pigs, with a near-100% mortality rate. This disease is currently found in parts of Asia, Africa, and Europe and in 2021 spread to the Dominican Republic and Haiti.

The recent ASF outbreaks have increased global efforts to stop the spread of the virus. As part of this, we are developing a viral vectored vaccine that incorporates several ASF genes. As a two-pronged approach, our team is also identifying antiviral compounds that could be administered to pigs to prevent viral replication and to stop the spread of the virus.

To facilitate this research the team is developing a continuous porcine cell line to evaluate virus-host interactions that could be used to produce live attenuated ASF vaccines. We are also developing a challenge model for ASF to assess the effectiveness of vaccines, antivirals and other treatments in pigs, and exploring diagnostic methods.

## PREVENTION RATHER THAN TREATMENT TO FIGHT ILEITIS

Ileitis, caused by the bacteria *Lawsonia intracellularis*, is a common gastrointestinal disease in pigs that can cause death (acute form of the disease), but more commonly increases the time it takes for pigs to reach market weight (chronic form of the disease). Ileitis is primarily transmitted through fecal shedding and has a high transmission rate—even sub-clinically infected pigs can shed the organism for several weeks, leading to new infections.

We are developing a multi-subunit vaccine that will provide protection and allow us to differentiate between infected and vaccinated animals (DIVA vaccine). Subunit vaccines are very safe because they cannot revert to disease.

We are validating that our ileitis subunit vaccine is effective in the presence of maternal antibodies, so it can be given to very young piglets prior to weaning. Our team is also determining if the vaccine is protective against both chronic and acute forms of the disease and whether it prevents transmission via bacteria shedding. Importantly, a protective vaccine will reduce the need for antibiotics which will, in turn, greatly benefit producers around the globe.

## ADDRESSING THE CHALLENGES OF PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME VIRUS (PRRSV)

PRRSV causes porcine abortions, weak piglets, and respiratory disease in weaned and growing pigs. It is a significant cause of production losses worldwide, costing producers in North America hundreds of millions of dollars every year.

Current vaccines against PRRSV fail to provide complete protection against the wide range of virus strains and come with safety risks. Global swine producers urgently need a more effective vaccine.

Our ongoing research aims to develop a novel PRRSV vaccine that induces strong immunity along with considerable cross-protection against multiple PRRSV strains.





## IMPROVING PROTECTION AGAINST SWINE INFLUENZA VIRUS (WHICH CAN ALSO INFECT HUMANS)

Swine influenza is an acute and highly contagious respiratory disease among pigs. Not only does infection cause large economic losses for the swine industry, but some new strains can also affect people, too—raising significant human health concerns.

We have already developed H1N1-, H1N2-, and H3N2-based vaccines that show promising results, even providing protection for young piglets in the presence of maternal antibodies. We are now working to improve this vaccine by broadening its protection spectrum to include field strains from farms in western Canada.

## EXPLORING INNOVATIVE WAYS OF ADMINISTERING VACCINES

As an alternative immunization route, we are exploring administering vaccines during artificial insemination. Some of the most important swine diseases impact reproduction or newborn pigs. A vaccine administered to the uterus could prevent bacterial colonization and viral invasion directly at the site where many infections start.

Our team developed and tested a vaccine against porcine epidemic diarrhea virus. Study results indicate the intrauterine-vaccinated sows farrowed healthy piglets with no adverse effects on fertility or piglet growth. We are now working on improving the vaccine formulation so that piglets will be fully protected against PEDV.

This approach could offer a method of vaccination that eliminates the use of needles and integrates well with existing insemination practices.



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