



ANNUAL REPORT

2015  
2016

Facilitating  
Research  
for the Swine  
Sector



Swine Innovation Porc



## Swine Innovation Porc

**Swine Innovation Porc increases  
Canadian swine industry competitiveness  
through a national R&D structure**

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Canadian Pork Council  
Conseil canadien du porc

[www.swineinnovationporc.ca](http://www.swineinnovationporc.ca)

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This report is dedicated  
to the memory of  
Dr. Kees de Lange  
1961-2016



## Message from the Chair

The year 2015-2016 marks the half-way point of Swine Cluster 2, a national five-year, \$17.3 million research program that includes 18 research projects and over 95 researchers. This investment in research has been made possible through contributions from Agriculture and Agri-food Canada (AAFC), eight provincial pork organizations, as well as from multiple industry partners from the private sector. The program focuses on reducing production and feed input costs, increasing product attributes and prices, as well as enhancing the adaptability and sustainability of the swine sector.

### New strategies for funding

While Swine Cluster 2 remains the core of Swine Innovation Porc's operations, our organization has also been working on developing new strategies to leverage more pork producer dollars for research that will increase the competitiveness of the pork industry. This past year, we have expressed our support for the Canadian Pork Promotion and Research Agency, which proposes a levy on imported pork and has the potential to bring more funding to the national pool of research dollars.

Opportunities such as this one would allow us to greater utilize existing resources to manage our research portfolio and on an annual basis respond to priorities in a timely fashion providing tangible outcomes for producers.

### Collaboration and consultation

The subject of research priorities was another primary focus of 2015-2016. In order to be prepared for possible short and long term funding opportunities, Swine Innovation Porc has consulted with industry and the research community through various working groups as well as through a public survey. We look forward to communicating later in 2016 the main priorities that have come out of these consultations. All of this input has allowed us to put together a framework of national priorities in swine research that will ensure the sustained success of the Canadian pork sector.

In addition, we are proud of our continued collaboration with our government partners at AAFC as well as with other agri-clusters. These partnerships are essential in order to ensure that we continue to facilitate research as effectively and as efficiently as possible.

### Partnerships throughout the swine sector

We are also pleased to welcome our newest provincial partner, BC Pork, to the organization. BC Pork joins seven other provincial pork organizations in providing 2.5 cents per market hog to go towards research from 2013-2018: Alberta Pork, Les Éleveurs de porcs du Québec, Manitoba Pork, Porc NB Pork, Ontario Pork, PEI Pork and Sask Pork. This year, the investment from provincial pork organizations has totaled \$543 575. In 2015, these organizations also joined the Canadian Pork Council as members of Swine Innovation Porc, ensuring their continued input on our Board of Directors.

### Acknowledgements

All that has been accomplished this year would not have been possible without the hard work and commitment of the Board of Directors and the management team. I would like to take this opportunity to thank all of those that have allowed Swine Innovation Porc to continue fulfilling its role as the national facilitator of swine research in Canada.

**Stewart Cressman**  
Chair



# Board of Directors

From left to right:

**Daryl Possberg**  
Director  
Alberta Pork

**Neil Ketilson**  
Treasurer  
Sask Pork

**Mike Teillet**  
Director  
Manitoba Pork

**Raphaël Bertinotti**  
Director  
Quebec Pork Sector

**Arno Schober**  
Director  
Ontario Pork

**Stewart Cressman**  
Chair  
Ontario Pork Sector

**Jean-Paul Laforest**  
Director  
Chair of the  
Science Advisory  
Body

**Normand Martineau**  
Vice-Chair  
Les Éleveurs de porcs  
du Québec

**Tim Seeber**  
Director  
Prince Edward Island Pork  
& Porc NB Pork

**John Webb**  
Director  
Pork Value Chain



Swine Innovation Porc

## Our Vision

Swine Innovation Porc increases Canadian swine industry competitiveness through a national R&D structure

## Our Mission

Swine Innovation Porc is committed to provide national leadership in coordinating and facilitating research, knowledge transfer and commercialization initiatives to enhance the competitiveness of the Canadian swine industry



# Management Report

**Our organization has been hard at work this year managing the Swine Cluster 2 research program as well as developing new strategies for research to the benefit of the Canadian pork value chain. Implementing the flexibility to rapidly respond to emerging issues is another important focus of the past year. In fact, two new projects were added in 2015 using a special budget allocated to addressing emerging issues in the swine sector: one project addresses how to effectively clean pig trailers and another is working on developing technologies to evaluate meat quality. These types of feasibility studies are essential for helping the industry move pressing issues forward and having increased flexibility is seen to be a key element of Swine Innovation Porc's success in the future.**

The management team has also been busy ensuring the management and coordination of research activities in 2015-2016. Since the beginning of the program, we have put in place twenty-five agreements with universities and research centres, and this year alone we have analyzed approximately 60 activity reports and 50 financial reports. Some of the projects within Swine Cluster 2 are starting to report results; we invite you to review the Research and Development section of this annual report for more details.

The success of nationally coordinating research has been another highlight of this past year. We have brought researchers together, in person, from various projects within Swine Cluster 2, allowing them to share information, develop partnerships and enhance overall collaboration.

## Governance

Our Board members have been very active once again this year. Five Board of Directors meetings have been held, along with three Executive Committee meetings, one joint Finance-Executive Committee meeting, one Audit Committee meeting, as well as numerous conference calls held by the Research Priorities Subgroup. Researchers came to meet and present their projects to the Board on three separate occasions, including researchers from University of Guelph, Sherbrooke Research and Development Centre (AAFC), Saint-Hyacinthe Research and Development Centre (AAFC) and from the Canadian Centre for Swine Improvement.

## Knowledge transfer program

One of our roles as a national facilitator of swine research is to ensure that the knowledge developed from projects is transferred to producers. Swine Innovation Porc has put a partnership in place with Prairie Swine Centre and the Centre du développement du porc du Québec to develop its national program to increase the adoption of new findings by the end users. We look forward to seeing some development on this file in the near future.

## Strategy for communications

In order to ensure that essential information is getting out to our partners, Swine Innovation Porc developed a communication strategy in 2015-2016 and is in the process of implementing it. We also reworked our image in order to be more visible and accessible, as can be seen on our website and banners used for public events.

We have been again proactive this year in communicating with our partners. We produced multiple communication materials and have built strong partnerships with existing events and conferences throughout Canada, such as the Banff Pork Seminar and London Swine Conference.

## Strategies for the future

Working on developing new avenues of funding and new ways for Swine Innovation Porc to better facilitate research is a key theme for the future. With Swine Cluster 2 soon coming to an end, we are preparing for possible future research programs in the short and long term. Research priority setting is of course part of this and we look forward to widely communicating the main national priority areas later in 2016.

Finally, I would like to express my thanks to the management team for their hard work and dedication this year. I would also like to thank the Board of Directors for their guidance and commitment in making Swine Innovation Porc even more effective in delivering its mandate as being the "go-to" facilitator of swine research in Canada.



**Pierre Falardeau**  
General Manager



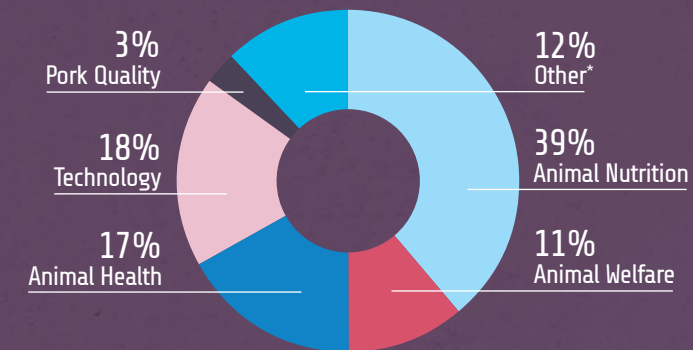
# RESEARCH & DEVELOPMENT

**18** PROJECTS

**+95** RESEARCHERS

## FUNDING ALLOCATION

\*Includes management fees and Adaptability theme activities



**+40** INDUSTRY PARTNERS

**30** RESEARCH ORGANIZATIONS across Canada and around the world

**+110** MEDIA REPORTS AND ARTICLES published on Swine Cluster 2

**21** Peer-reviewed PUBLICATIONS

**+50** Masters and PhD candidates involved

**87** PRESENTATIONS given by researchers at regional, national and international events

## Swine Cluster 2 Driving Results Through Innovation

Swine Cluster 2 is a five-year research program (2013-2018) that includes eighteen research projects within five areas of research:

- Animal nutrition
- Animal welfare
- Animal health
- Technology
- Pork quality



These projects fall within two themes:

- 1) reducing production and feed input costs, and
- 2) increasing product attributes and prices.

In addition to research and development projects, a third theme, "enhancing the adaptability and sustainability of the swine sector," allows Swine Innovation Porc to carry out activities to enhance collaboration between researchers and find ways to address emerging issues in the swine sector.

The total budget for this program is \$17.3 million: Agriculture and Agri-food Canada, through its AgriInnovation Program, has contributed \$13 million and \$4.3 million is provided by provincial pork producer organizations and private partners.

## Innovative piglet management strategies for optimum performance up to slaughter weight and profitable pork production

- ▶ Denise Beaulieu, University of Saskatchewan
  - ▶ Frédéric Guay, Laval University
- ▶ Kees de Lange, Jim Squires, Julang Li, Niel Karrow, Vahab Farzan, Robert Friendship, University of Guelph
  - ▶ J. Jacques Matte, Sherbrooke Research and Development Centre, AAFC
  - ▶ Martin Nyachoti, University of Manitoba
- ▶ Andrew Van Kessel, University of Saskatchewan
  - ▶ Ruurd Zijlstra, University of Alberta



Source: Sherbrooke Research and Development Centre, AAFC

### Overview

The swine industry will face a number of challenges in the foreseeable future. Among these is the high cost of feed ingredients, which has historically represented the largest portion of operating costs. Furthermore, increasing public demand and regulatory restrictions on antibiotic use are also anticipated. Therefore, novel nutritional strategies must, in addition to minimizing costs, maintain or even possibly promote animal health and resistance to infectious challenges. To address these challenges researchers are working on three focus areas:

- 1) Nutritional strategies for newborn piglets
- 2) Low cost post-weaning nutritional strategies
- 3) Novel bioactive feed supplements

### Highlights

#### 1 Nutritional strategies for newborn piglets (J. Matte and F. Guay)

Previous research, supported by Swine Innovation Porc (Swine Cluster 1), has demonstrated that, as for iron, piglets are likely to suffer from a deficit in vitamin A, vitamin D, and copper shortly after birth

and until weaning. Results from a first trial have showed that, among the tested supplementations, oral supplementation of copper and vitamins A and D was the best way to increase the status of these micronutrients in piglets. Exposure to UV light was also an efficient method for increasing vitamin D in piglets. Two other trials, one in a research barn and one in commercial conditions, started in 2015-2016. Their aim is to study the impact of the oral supplementation of copper and vitamins A and D or exposure to UV light combined with a supplement of colostrum whey on piglets' oxidative status, immune system, gut microflora and growth.

Station for exposing piglets to UV radiation, which was measured by placing a device next to the piglet. Source: Sherbrooke Research and Development Centre, AAFC



Preservation jars are being used for small-scale screening of various acids and bacterial inoculants on the preservation and chemical composition of high moisture barley and wheat. Source: University of Saskatchewan

#### 2 Low cost post-weaning nutritional strategies

##### - Pre-treatment of feed ingredients to enhance value (D. Beaulieu, A. Van Kessel, M. Nyachoti)

A series of experiments are underway to establish the efficacy of ensiling or direct acidification of high moisture cereal grains and protein co-products to reduce anti-nutritional factors and improve nutritive value, health and performance of pigs. First results have showed that ensiling allowed the effective conservation of high moisture barley and wheat. *In vitro* experiments, where the high moisture barley and wheat were acidified, have showed that the use of propionic acid reduced the pH more than the use of a commercial blend of acids. Feeding trials using the ensiled grains are underway and the ones with acidified grains will follow. Another feeding study has been conducted on comparing different fermented soy bean meal to a standard one. Surprisingly, the standard soybean meal performed equal to or better than the fermented soybean meals. Analysis is ongoing to try to explain these results.

##### - High residual protein and fermentable carbohydrates (R. Zijlstra and A. Van Kessel)

Several Canadian crops and plant-based co-products may serve as an alternative to soybean meal in nursery pig feed. However, due to their lower protein digestibility, the residual protein content in the gut lumen and the abundance of toxic fermentation products will increase. It is hypothesized that such protein alternatives will increase disease susceptibility and reduce growth performance, especially in diets without antibiotics.

Preliminary results have showed that the inclusion of 15% chickpea (by substituting soybean meal and wheat grain) in weaned piglets' diets increased feed intake, growth performance and sustained feed efficiency. However, increasing the inclusion of up to 30% chickpea reduced piglets' growth performance. Initial results also showed that replacing wheat by hulled and hull-less barley in diets for weaned pigs did not affect growth or feed efficiency.

Preservation of inoculated moisture grain in barrels. Source: University of Manitoba



Inoculation of high moisture cereal grain with two types of lactic acid. Source: University of Manitoba



- **Simple versus complex post-weaning diets** (K. de Lange, V. Farzan and M. Nyachoti)

**Ability to deal with disease stress**

Researchers are performing a number of studies to evaluate the impact of feeding inexpensive nursery diets on the piglet's ability to deal with disease stress and on how to improve their robustness.

**Wheat bran**

Previous studies have showed that the incorporation of wheat bran in the weaner pigs' diets enhances gut health. Initial results of this trial suggest that improved volatile fatty acids production may be a contributing factor to this better gut health. Indeed, including 4% of coarsely milled wheat bran in piglets' diets has improved the production of total volatile fatty acids in the piglet gut.

**Algae meal**

Researchers have found that including 3.12% of algae meal in a nursery pig diet had no effect on the palatability of the feed, but provided omega-3 fatty acid enrichment, promoted normal growth and improved piglets' health status. As more research is conducted, algae meal, compared to fish oil, may become a more cost-effective way to boost nursery diet quality without having to use expensive protein sources.

**Epidemiology study: impact of simple nursery diet under commercial farming conditions**

Eight farrow-to-finish farms with different health statuses are currently involved in this study. On each farm two cohorts of piglets are selected. One cohort is assigned with a simple nursery diet, i.e. low-level animal protein without in-feed antibiotics, and one cohort to a conventional feed. Up to now, a total of 832 pigs have been studied. Preliminary results suggest no difference regarding body weight, carcass characteristics, *Salmonella* shedding or colonization between pigs being fed the simple diet and the ones receiving conventional feed. However further research is required to ensure that the pigs' ability to face disease is not compromised by the simple nursery diets.



Source: University of Guelph



Source: University of Guelph

**3 Novel bioactive feed supplements**

- **Epidermal growth factor (J. Li)**

Researchers have refined a methodology to produce porcine epidermal growth factor (EGF) using yeast, which is a powerful bioactive peptide that stimulates gut health and development in newly-weaned piglets. This novel yeast strain will allow commercial production of EGF without encountering intellectual property issues.

- **Probiotics and oral vaccination (R. Friendship)**

Experimental challenge studies have been conducted to determine the efficacy of plant-based vaccines against enterotoxigenic *Escherichia coli* (ETEC), which causes porcine post-weaning diarrhea. A first ETEC vaccine has been produced and evaluated but has not provided protection for the piglets. Research is continuing.

**Implications for the swine industry**

Effective feeding strategies will be developed for newborn and newly weaned piglets that:

- Maximize profits based on performance up to market weight
- Minimize reliance on in-feed antibiotics
- Improve pig robustness and health.

**Collaborators**

<b>Nathalie Bissonnette</b>	Sherbrooke Research and Development
<b>Jérôme Lapointe</b>	Centre, AAFC
<b>Martin Lessard</b>	
<b>Guylaine Talbot</b>	



Source: University of Guelph

# Increasing sow milk yield and piglet growth via low-cost feeding and management strategies during gestation and/or lactation

## Overview

Pork producers are required to restrict gestating sows' feed intake in order to prevent excessive body weight gain and the associated negative consequences on mammary development, locomotion, farrowing and feed intake during lactation. Aggression and stereotypies (repetitive, rhythmic or invariable behaviours that may indicate discomfort) associated with restricted feeding particularly become a welfare and production concern when sows are housed in groups. Another challenge is that sows do not produce enough milk to sustain optimal growth for their piglets. This is a problem that has been amplified in recent years due to hyperprolific sow lines. Therefore, researchers are working on developing low-cost feeding and management strategies for gestating sows as a way to reduce aggression, maintain optimum production and increase sow milk yield during lactation.

- ▶ Denise Beaulieu, University of Saskatchewan
- ▶ Chantal Farmer, Sherbrooke Research and Development Centre, AAFC

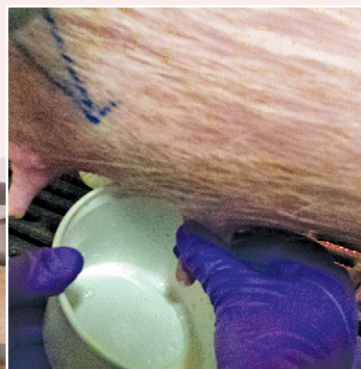
## Highlights

In order to reduce aggression and maintain optimum production in gestating sows, researchers are investigating if processing straw in feed can improve its satiating effect by altering its fibre content and structure. Samples of wheat and oat straw were processed under varying conditions and subjected to *in vitro* digestibility and fermentation. Results showed that fermentability of oat and wheat straw was affected the most by steam explosion.

Surprisingly, the addition of yeast provided similar results as the steam explosion. An experiment to measure the net energy content of the processed fibres and effect on satiety in gestating sows will be carried out in 2016-2017 to continue this investigation.

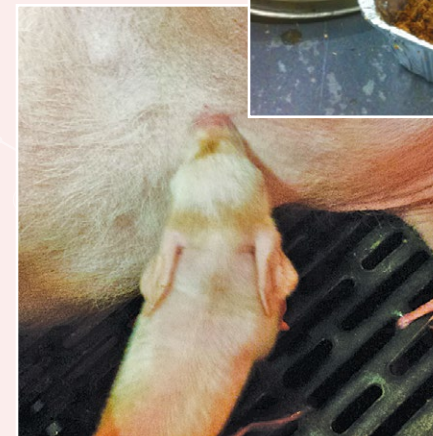
A series of studies were also conducted to improve milk yield and piglet growth. Results from two of these studies confirmed that body condition has an impact on mammary gland development in gilts.

Milking a teat.  
Source: Sherbrooke Research and Development Centre, AAFC



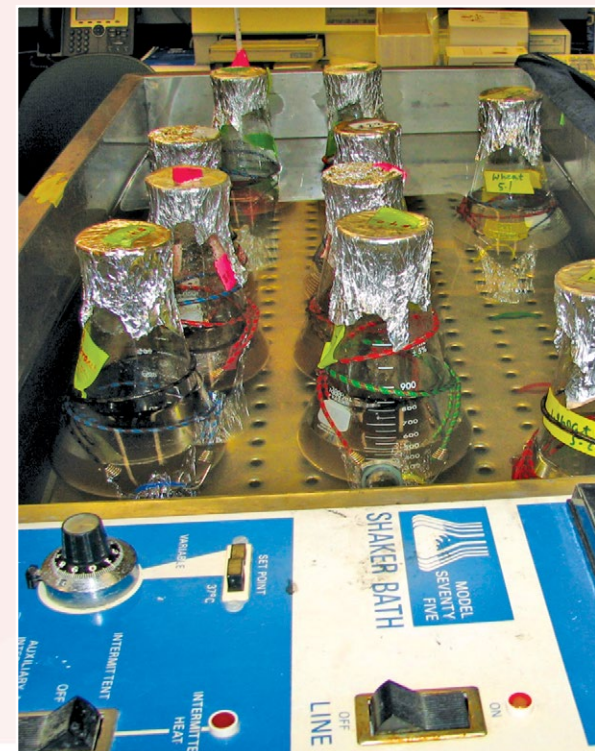
Newborn piglets.  
Source: Sherbrooke Research and Development Centre, AAFC

Pressure cooked straw.  
Source: Prairie Swine Centre



Piglet suckling.  
Source: Sherbrooke Research and Development Centre, AAFC

*In vitro* pepsin pancreatin digestion. Source: Prairie Swine Centre



## Impact of variations in body condition in late gestation

Gilts of similar body weight and backfat thickness (16 mm) at mating were fed to obtain three groups of sows having differing backfat thickness at the end of gestation: low (12-15 mm), medium (17-19 mm), and high (21-26 mm.) Results showed that being too thin at the end of gestation (12-15 mm backfat) had a negative impact on mammary development in gilts, whereas having backfat varying from 17 to 26 mm seemed to have no detrimental effects on their mammary development.

## Impact of maintaining body conditions that differ at mating until the end of gestation

Based on backfat thickness at mating, gilts were separated into three groups: low backfat (12-15 mm), medium (17-19 mm), and high (22-26 mm). During gestation, gilts were fed to maintain these differences in their body condition. Results showed that gilts can be bred with as low as 12-15 mm backfat without any detrimental effect on mammary development. Furthermore, results also demonstrate the importance of considering both body weight and body condition of gilts at mating in order to achieve optimal mammary development. This suggests that nutrition in gestation is more important than body condition at mating for mammary development in late gestation.

## Implications for the swine industry

Low-cost feeding and management strategies will be developed to increase sow milk yield and piglet growth while ensuring maximum animal welfare.

## Collaborators

Jennifer Brown	Prairie Swine Centre
Jérôme Lapointe Marie-France Palin	Sherbrooke Research and Development Centre, AAFC

## Feeding programs for growing-finishing pigs to enhance global competitiveness: Opportunities across Canada

- ▶ Denise Beaulieu, University of Saskatchewan
- ▶ Eduardo Beltranena, Alberta Agriculture and Rural Development
- ▶ François Dubeau, University of Sherbrooke
- ▶ Marie-Pierre Létourneau-Montminy et Frédéric Guay, Laval University
- ▶ Martin Nyachoti, University of Manitoba
- ▶ Candido Pomar, Sherbrooke Research and Development Centre, AAFC
- ▶ James Squires, Kees de Lange et Julang Li, Ira Mandell, Bob Friendship, University of Guelph
- ▶ Ruurd Zijlstra, University of Alberta

### Overview

Feed cost is by far the greatest cost of pig production (65-70%) and growing-finishing pigs account for about 80% of feed consumed. The continued high cost of feed demonstrates the need to develop cost-effective feeding strategies for growing-finishing pigs to ensure the long term competitiveness of the Canadian pork industry. Researchers are working on these four strategic areas to address this issue:

- 1) Novel feedstuffs and enhanced nutritional values
- 2) Precision feeding of individual pigs
- 3) Validation of feeding strategies
- 4) Optimizing feeding strategies for groups of pigs

This report highlights activities from three of these strategic areas.

### Highlights

#### 1 Novel feedstuffs and enhanced nutritional values

The nutrient content of emerging ingredients will be characterized in detail to develop unique Canadian databases. This will build on the NRC (2012) and develop precision feeding systems to allow rapid prediction of the feeding value of feedstuffs of varying quality. Researchers will also explore different means to maximize nutrient utilization from such ingredients and dietary inclusion levels.

#### - Characterize the nutritive value of emerging feedstuffs (M. Nyachoti, K. de Lange, and R. Zijlstra)

##### Low-fat corn Dried Distillers Grains with Solubles (DDGS)

Low-fat corn DDGS is a new product from the biofuel industry. Nutrient analysis and digestibility trials were carried out to determine its nutritive value. Preliminary results from animal trial indicate that the novel low-fat corn DDGS may be used in swine diets. Growth performance similar to the ones obtained with standard DDGS may be expected. More work has been completed to determine if there are differences in nutrient digestibility.

#### Faba bean, field pea and chick pea

Studies to evaluate the digestibility of starch, energy and amino acids of three cereal grains (wheat, barley, and corn) and three pulses (faba bean, field pea and chick pea) and the impact of processing (grounding, steam pelleting and extruding) are underway.

#### Hemp co-product

Nutrient analysis and digestibility trials were carried out to determine nutritive value of hemp hulls and products containing hemp hull (hemp hull + pea and extruded hemp hull + soybean meal). Preliminary results have showed that hemp hulls and products containing this ingredient may be used as a feedstuff in pig diets. However, their use as alternative protein ingredients could be limited because of their high content

in dietary fiber and the low digestibility of their amino acids. It was noted though that amino acid digestibility is moderately improved when hemp hull is combined with pea or soybean meal.

#### Flaxmeal and oat hulls

A study was carried out comparing the performance of growing pigs fed either a flaxmeal-enriched diet, a oat hull-containing diet or a standard corn-soybean meal-based diet. Preliminary results have showed that the inclusion of flaxmeal in growing pig diets at 12% reduced pig performance and fat digestibility. Including oat hulls at 10% did not have negative impact on pig performance. These results are showing the effect of different fibre types.

#### - Means to enhance nutrient utilization and maximum inclusion rates (K. de Lange, J. Li)

##### Soybean meal

Fermentation using food grade bacteria may be a cost effective means to decrease levels of allergens and anti-nutritional factors and improve the protein profile of soybean meal (SBM). Compared to previous fermentation procedures, researchers have found that the protein profile of fermented SBM was improved when the SBM was pre-soaked in water before the fermentation.

##### DDGS

Feeds including DDGS fermented with enzymes and silage inoculant had no negative effect on piglets' body weight or feed intake and even improved, during few days, the growth rates of piglets with light initial body weight. Pigs fed fermented DDGS had more bacteria of probiotic classes in their gut, however, the population of bacteria was very different in the various parts of the gut.



Oat hulls.  
Source:  
University  
of Manitoba



Ground  
oat hulls.  
Source:  
University  
of Manitoba



Defatted  
flaxseed meal.  
Source:  
University  
of Manitoba

**- Nutrition and gut health** (R. Friendship)

Two of the most important pathogens affecting growth performance in the grower-finisher barn are *Brachyspira* and *Salmonella*.

In order to determine the pattern of spread of swine dysentery caused by *Brachyspira*, treatment records of 19 cohorts from a 1500-head grower-finisher barn have been analyzed. Mathematical models were also created to describe *Brachyspira* infection and swine dysentery clinical disease within a herd. These models include disease treatments and production costs to identify the most cost-effective treatment protocol for this disease.

A clinical trial was also conducted using pigs naturally infected with *Salmonella*. In the first three weeks of the grower stage, all pigs were shedding *Salmonella* and several pigs continued to shed it in their feces for over eight 8 weeks. Including the antibiotic Flavomycin in the feed (4 ppm) was shown to be ineffective in controlling *Salmonella*.

**Implications for the swine industry**

Precise information will be provided to the industry about:

- Existing and novel feedstuffs
- Growth models reflecting nutrient utilization in growing pigs
- Decision support systems and precision feeding systems based on changing financial conditions and nutrient requirements
- Validated production strategies

**Collaborator**

**Jean-Pierre Dussault** University of Sherbrooke

**2 Precision feeding of individual pigs**

**- Optimal management of farm resources** (F. Dubeau)

A feed formulation method aiming at minimizing feeding cost and excretion of nitrogen and phosphorus is being developed. Several mathematical models for minimum feeding cost have been obtained. Up to now, the most interesting model has been obtained when using two premixes. That mathematical model allows feeding costs to be reduced by 4.1%, phosphorus excretion by 3.3%, and nitrogen excretion by 14.8%. It may be possible to further reduce nutrient excretion, but reductions in feeding cost would be less significant.

**3 Validation of feeding strategies**

**- Model validation and entire males** (I. Mandell and J. Squires)

An initial evaluation was carried out on the potential of certain feed additives to control boar taint, therefore improve the quality of meat produced by intact male pigs. *In vitro* results have showed that diatomaceous earth, bentonite, spent filter aid, and Jumpstart 360 were the most effective in isolating androstenone and skatole, two compounds responsible for boar taint in intact male pigs. Results of a first feeding trial have showed that spent filter aids and Jumpstart 360 were the most effective in reducing androstenone and skatole in the fat and blood of animals, while, at the same time, not affecting their gains and feed conversion.

# Feeding organic minerals to gilts and sows: effects on milk quality and litter performance

► Chantal Farmer, Sherbrooke Research and Development Centre, AAFC

**Overview**

Researchers are studying the impact of including 50% of organic minerals in gilt and sow diets on their milk composition and on the growth of their suckling piglets. The premix Availa®Sow, which contains organic trace minerals, is being given to gilts during the growing phase and then over their first and second gestation and lactation periods. Experiments with animals started in 2015-2016.

**Implications for the swine industry**

Feeding strategies using organic minerals for gilts and sow will be developed and the impact of these strategies on sows and on their offspring will be established.

**Collaborators**

<b>Mark E. Wilson</b>	Zinpro Corporation
<b>Dan Bussi�eres</b>	Groupe C�eres



## Determining the optimum space allowance for nursery pigs

► Jennifer Brown, Prairie Swine Centre

### Overview

Very few research results are available on the effects of space allowances on nursery pigs, even if the quantity of space provided for pigs substantially affects animal welfare by influencing behaviour, stress and social interactions. Space allowance also has a significant economic impact on productivity and the total pig throughput possible on a farm.

### Highlights

This study examines six different space allowances for nursery pigs ( $k = 0.0230, 0.0265, 0.0300, 0.0335, 0.0370, \text{ and } 0.0390$ ) and is being carried out in two phases. Phase I is being done at a research barn and Phase II at two commercial farm sites. Data have been collected on productivity, piglet postures, injury, as well as on room climate and the data are now being analyzed.

For Phase I space allowances were compared over large and small pen group sizes and over four seasons. Additional data on piglet stress physiology and immune competence have also been collected.

Preliminary results indicate that pigs gained an average of 0.394 kg per day. There were no differences in average daily gain and feed to gain ratios between tested densities. These preliminary results may suggest that housing pigs at tighter stocking densities may not negatively affect growth. Results on other data collected and from Phase 2 are to come.



Piglet pen during the nursery density trial.  
Source: Prairie Swine Centre

### Implications for the swine industry

A precise value will be produced for the minimum space allowance for nursery pigs. This would allow an optimal and scientifically defensible balance to be reached between profitability and animal welfare.

### Collaborators

<b>Denise Beaulieu</b>	University of Saskatchewan
<b>Yolande Seddon</b>	Groupe Cérés
<b>Dan Bussièrès</b>	Newcastle University, United Kingdom
<b>Sandra Edwards</b>	



Hog-Tied Farms, Ontario.  
Source: Prairie Swine Centre

### Overview

Canadian pork producers are being required to transition to group sow housing in order to meet consumer and retailer demands as well as to comply with the revised Code of Practice for the Care and Handling of Pigs (2014). However, this change requires major renovations to existing buildings, or replacement with new buildings, as well as significant changes to daily management. The cost and uncertainty involved are daunting. This project aims to gather the best possible information by documenting four barn conversions as they go through the process of conversion. Information from ten sites that have already converted to group sow housing is also being collected.

The project's website [www.groupsowhousing.com](http://www.groupsowhousing.com) offers producers immediate access to comprehensive and sound information.

### Highlights

Interest in group sow housing is increasing as producers begin planning for the transition. The majority of producers making the transition have selected electronic sow feeding (ESF) systems. However, many producers are not well informed on the need for a separate training area or how to manage gilts during the training period.

Arguably, producers who have already implemented group sow housing successfully are potentially the best resource to provide other producers with creditable information on what is needed for the transition. Up to now, nine farm sites across the country have been identified and these producers' experiences have been documented in the form of interviews, photos and video footage of barns, housing plans, management and staff training and detailed

## National sow housing conversion project

► Jennifer Brown, Prairie Swine Centre

costs of the transition. Scientific research on the management of group housing is also being collated and distributed to producers via the project's website and newsletter as well as in presentations.

### Implications for the swine industry

Accurate information and resources will be produced in order to achieve a smoother, more efficient transition towards group sow housing. Producers will be given the information necessary to be able to manage sows effectively in groups while maintaining or improving productivity.

### Collaborators

<b>Laurie Connor</b>	University of Manitoba
<b>Murray Elliott</b>	FGC Groenestage Construction Ltd
<b>Mark Fynn</b>	Manitoba Pork
<b>Sébastien Turcotte</b>	Centre de développement du porc du Québec
<b>Lee Whittington</b>	Prairie Swine Centre
<b>Qiang Zhang</b>	University of Manitoba

## Optimizing flooring and social management of group housed gestating sows

► Laurie Connor, University of Manitoba



Saliva sampling for measuring cortisol. Lindsey Lippens. Source: University of Manitoba.

### Overview

This project addresses three specific knowledge gaps related to the management of gestating sows in groups as recommended in the revised Code of Practice for the Care and Handling of Pigs (2014).

### Highlights

#### 1 What are the most effective concrete floor slat and gap width ratios for comfort and well-being of sows as well as ease of manure management?

Results from a pre-test showed that slats of 105 mm (4") separated by gaps of 19 mm (3/4") affected the sow's gait the least among tested slat widths (85, 105 and 125 mm) and gap widths (19, 22 and 25 mm). Sows' gaits were also modified less when slats were parallel with the walking direction compared to a perpendicular orientation.

Two flooring types will be evaluated in group pens holding sows over two gestation periods: slats at 105 mm with a gap of 19 mm and slats at 125 mm (5") with a gap of 25 mm (1"), the latter often being used in commercial barns.

#### 2 What sow mixing strategies after weaning provide the best results for reproductive performance, low economic risk and sow well-being?

The research examined the mixing of sows into gestation groups at three different times:

- At weaning
- Post-insemination
- Late mixing (at four weeks post-breeding and after confirmation of pregnancy).

Taking backfat measurements. Noel Generoso. Source: University of Manitoba.



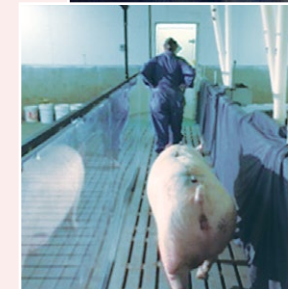
#### 3 What environmental enrichment strategies can be incorporated into slatted-floor pen systems for sow groups?

There are three phases involved and the associated data collection is on-going:

##### Phase I: Screening a selection of five enrichment devices which included:

- Wood blocks hung horizontally or hung at an angle touching the floor
- Three items hung together (chain, rope and wood block)
- Straw in a metal rack or on the floor.

Tests were carried out using three different housing system variations: partially-slatted floors with Electronic Sow Feeding (ESF) systems, straw-bedded floors with ESF systems, as well as in fully slatted floors with walk-in/lock-in free access stalls. Data collection has been completed and analyses are underway.



Kinematic corridor, pre-test slat orientation. Source: University of Manitoba



Laying test flooring. Farhoud Delijani and Deanne Fulawaka. Source: University of Manitoba



Assessing sow foot health. Source: University of Manitoba



Sow using rope enrichment. Source: University of Manitoba

##### Phase II: Examining the effectiveness of enrichment devices in reducing aggression, stress and stereotypic behaviors as well as increasing sow activity and productivity through:

- Constant provision of a single enrichment device
- Thrice-weekly rotation of three enrichment devices
- Thrice-weekly rotation of three enrichment devices, with an associative stimulus (e.g. bell rung prior to enrichment delivery)
- No enrichment.

##### Phase III: Exploring the effect of enrichment devices on increasing the use of loafing areas in the free-access stall housing system.

### Implications for the swine industry

Practical and scientifically validated recommendations and guidelines will be provided about flooring, mixing and enrichment strategies in order to help pork producers remain productive, proactive and profitable when making the transition to sow group housing.

### Collaborators

<b>Derek Brewin</b>	University of Manitoba
<b>Qiang Zhang</b>	University of Manitoba
<b>Jennifer Brown</b>	Prairie Swine Centre
<b>Nicolas Devillers</b>	Sherbrooke Research and Development Centre, AAFC
<b>Yolande Seddon</b>	University of Saskatchewan

## Monitoring the effects of transport on the behaviour, physiology, carcass and meat quality of pigs through the study of truck micro-climate, vibrations and cooling systems

### Overview

This study is working on evaluating the impacts of ventilation, in warm conditions and combined with water misting, on the behaviour, physiology, carcass and meat quality of pigs waiting to be unloaded at the slaughterhouse. Researchers are also looking into assessing the impacts of vibration during transport to the slaughterhouse on the posture of the pigs (for example, standing, sitting or lying down).



Ventilation system.  
Source: Sherbrooke Research and Development Centre, AAFC

### Highlights

During the summer of 2015, and using two pot-belly trailers, fourteen loads of 230 pigs each (seven loads per trailer) were transported over a two-hour period to the slaughter plant. On arrival at the plant, the trailers remained stationary for 30 minutes before unloading. During this period, one trailer was exposed to external forced ventilation and misting using fan-mister banks located near the unloading dock, while the other (the control) was not exposed to any cooling procedure at all.

Preliminary results have showed that the cooling procedure applied before unloading at the slaughter plant appears to improve the thermal comfort and reduce the dehydration of the pigs. More details will be available when all analyses are completed.

► Luigi Faucitano,  
Sherbrooke Research and  
Development Centre, AAFC

### Implications for the swine industry

A practical procedure will be provided to apply to trucks in warm conditions. New knowledge will be developed about vehicle design features in order to limit animal losses during transport and to improve pork quality.

### Collaborators

<b>Trevar Crowe</b>	University of Saskatchewan
<b>Nicolas Devillers</b>	Sherbrooke Research and Development Centre, AAFC



Combined water sprinkling and ventilation system.  
Source: Sherbrooke Research and Development Centre, AAFC

## Epidemiology of porcine reproductive and respiratory syndrome virus (PRRSv) among swine herds, an applied research program supporting PRRS control projects



Suckling piglets.  
Source: University of Montreal

### Overview

Porcine reproductive and respiratory syndrome (PRRS) has a major economic impact on the swine industry. The important diversity observed in PRRS North-American strains, combined with the multiple different ways it can be transmitted between herds, make the control of the disease very difficult. Virus sequencing is now viewed as an essential tool to better manage PRRS in Canada and, to help interpret results on sequences for surveillance purposes, a PRRS classification system is under development. This system will allow strains to be grouped to better observe their movements over time and help detect emerging strains. Moreover, through an improved integration of these laboratory results and epidemiological data, the most likely sources of infection of breeding herds will be identified to provide essential information to improve control strategies.

### Highlights

#### Centralized PRRS Sequence Database

In 2015-2016, more than 475 sequences from herds in Quebec, along with information about locations, were validated and included in the centralized PRRS sequence database, in near real-time. PRRSv reference strains from North America and Europe, as well as foreign wild-type strains, were also included in the database. Getting a large diversity of these strains is essential to detecting the introduction and/or the emergence of foreign strains.

#### PRRS Control Projects

This project aims to support already ongoing PRRS Area Regional Control and Elimination (ARC&E) projects. In particular, the diversity of PRRSv within and outside some of these ARC&E projects is being studied. In a preliminary analysis, the diversity appears generally lower in ARC&E than in non-ARC&E herds. This is probably due to PRRS

► Sylvie D'Allaire, University of Montreal

vaccination and, to a lesser extent, to circulating wild-type strains, but this needs to be confirmed. More analyses will be performed using other indicators of genetic diversity and to evaluate the influence of in-herd systematic sampling of the same strain on regional diversity results.

#### Most likely source of virus introduction into a herd

When a new strain is detected following genomic analysis, the veterinarian and the producer are rapidly contacted to be involved in the study and investigate the case. To increase the likelihood of identifying links between herds and therefore possible sources of contamination, herds having similar strains are also identified in the centralized database and enrolled. Until now, 111 cases have been investigated by our research team. Participation has been excellent (90%), especially considering the time and precision level required to gather all the information on the different factors related to PRRSv transmission. Preliminary results show that a large proportion of newly diagnosed cases originated from high-density areas. Further cases will be investigated as additional herds are enrolled and a methodological framework will be developed to determine the most likely source of PRRSv.

### Implications for the swine industry

A new methodology, integrating traditional and molecular data, will be provided to better assess how PRRSv is transmitted, ultimately helping the swine industry to reduce transmission rates.

### Collaborators

<b>Julie Arsenault</b>	University of Montreal
<b>Marie-Ève Lambert</b>	University of Guelph
<b>Zvonimir Poljak</b>	University of Guelph

## Towards the development of a method for determining the antimicrobial susceptibility of *Brachyspira*

► Joseph E Rubin, University of Saskatchewan

### Overview

Since 2008, *Brachyspira*-associated disease has re-emerged as a serious cause of morbidity and economic loss to the Canadian swine industry. The identification of a novel species of *Brachyspira*, named *Brachyspira hampsonii*, which causes severe disease in pigs, is also concerning. Through this research, laboratory tools are being developed to allow the Canadian swine industry to effectively combat *Brachyspira*-associated disease.

### Highlights

The *Brachyspira* Research Group at University of Saskatchewan has worked to develop standardized methods for conducting tests to determine if antibiotics are effective against this type of bacteria. Since beginning this investigation, researchers have successfully addressed some basic questions about the growth characteristics of *Brachyspira* which need to be understood before clinical laboratory testing can begin. To date, the research team has achieved the following:

- Described the growth characteristics of these bacteria
- Developed methods for quantifying their density within a culture (*in vitro*)
- Measured the effect of antibiotics on the bacteria's ability to multiply (*in vitro*)
- Identified phenotypic variabilities among the isolates tested, which suggests that there may be some microbial resistance present.

Researchers are now focusing on determining the effectiveness of antibiotics on a collection of *Brachyspira* isolated from sick pigs.

### Implications for the swine industry

As a service to the Canadian swine industry, the *Brachyspira* Research Group at University of Saskatchewan aims to implement a program of testing the effectiveness of antibiotics against *Brachyspira* in order to enhance already-provided diagnostic services. This program will provide swine veterinarians with additional information to help them select the most effective and appropriate therapy to treat swine herds.

### Collaborators

<b>John Harding</b>	University of Saskatchewan
<b>Janet Hill</b>	Saskatchewan

## New tools to enable effective genomic selection for disease resilience

► Graham Plastow, University of Alberta

### Highlights

Researchers have been studying fetuses from gilts infected by PRRS using transcriptomic analysis (to determine the genes that are active). Initial results, which compared "susceptible" and "resistant" fetuses, have showed that the expression of genes from 18 pre-identified regions of the genome is different and associated with fetal PRRS infection. Seven of these regions overlapped with previously reported QTLs involved in fetal health and its associated ability to respond to infections. Moreover, within these regions, genes involved in a variety of processes to combat diseases were found. These results may provide new evidence to help explain the genetic basis of the fetal response to PRRS infection and may eventually lead to the development of alternative strategies to control the spread of infection.

### Implications for the swine industry

Ultimately, genomic tools will be delivered to enable the selection of commercial pigs that are more resilient to diseases while maintaining reproductive and production performance.

### Collaborators

<b>John Harding</b>	University of Saskatchewan
<b>Jamie Wilkinson</b>	University of Alberta
<b>Benny Mote</b>	PigGen Canada



The team involved in collecting detailed phenotypic information and samples from the reproductive PRRS model being investigated in the project. Source: University of Saskatchewan

### Overview

Using traditional breeding approaches to improve pig health is very challenging due to the fact that health traits can be quite difficult to measure. Therefore, genomics offers the opportunity to increase the effectiveness of improving health through breeding and to eventually be able to select for animals that are more resilient to disease.

Increasing genetic variation in pigs in order to have better resistance from specific pathogens has been demonstrated in commercial pig production. Building on previous projects and focusing on PRRS (porcine reproductive and respirator syndrome), researchers are working on identifying:

- Regions of the genome that have an impact on fetal resilience to PRRS
- Gene expression biomarkers for disease resilience
- SNP markers, genomic regions and quantitative trait locus (QTLs) affecting sow lifetime productivity in commercial environments

Researchers are also analyzing data from high health status pigs that have been challenged by being exposed to multiple diseases in a test-barn. This will help researchers to identify genetic variations and their ability to face diseases (disease resilience). Up to now, data from 380 pigs have been collected.

## Bio-exclusion and bio-containment strategies to control epidemics resulting from airborne viral and bacterial transmission

► Caroline Duchaine, Centre de recherche de l'Institut universitaire de cardiologie et de pneumologie de Québec – affiliated with Laval University

### Overview

The airborne transmission of pathogens among pig herds can be an economic burden for producers and it is not always completely stopped by biosecurity measures. HEPA filter systems have proven to be an efficient tool against pathogen transmission, but are expensive. Therefore, the effectiveness of less expensive filter systems in preventing the transmission of airborne viruses and bacteria need to be studied in an environmentally controlled and standardized environment.

### Highlights

A new platform has been designed and built to evaluate the capture efficiency of different pre-filter and filter combinations for influenza, PRRSv and virulent *Streptococcus suis* serotype 2 models. Specifically, the new platform consists of:

- A test duct complying with the Standard 52.2 of the American Society of Heating, Refrigerating & Air-Conditioning Engineers (ASHRAE)
- A mixing chamber where two aerosol generators are connected for the co-aerosolisation of standard dust and microorganisms
- Sampling probes suitable for collecting viable/infectious microorganisms
- A data acquisition system to continuously record temperature, relative humidity and pressure of the platform

The capture efficiency of different pre-filters and filters are currently being evaluated.

### Implications for the swine industry

The new platform will be used to design affordable filtration systems and to evaluate the capture efficiencies of commercial filters against airborne virus and bacteria which are not mentioned or unknown by the manufacturers. Moreover, in the future, the platform could help pig producers to choose economically suitable air filtration systems and to determine if used filters (e.g. 6-month old filters) are still as efficient as new ones to capture airborne viruses (e.g. PRRSv). Finally, it has been hypothesized that old filters may be a source of airborne viruses and bacteria by the re-emission of collected dust into the environment. This "particle re-emission" hypothesis might be studied using the new platform.

### Collaborators

<b>Laura Batista</b>	Batista & Asociados
<b>Stéphane Godbout</b>	Institut de recherche et de développement en agroenvironnement (IRDA)
<b>Marie-Aude Ricard</b>	Centre de développement du porc du Québec
<b>Jean-Gabriel Turgeon</b>	

## Development of a multiplex Luminex immunoassay for serologic diagnosis and subtyping of swine influenza virus (SIV) infections

► Yohannes Berhane, National Centre for Foreign Animal Diseases, CFIA

### Overview

For serologic diagnosis of swine influenza, most laboratories use ELISA (enzyme-linked immunosorbent assay) based assays. However, the currently used ELISA-based assays don't have the capability to diagnose and, at the same time, subtype different swine influenza infections. The assay to be developed in this project is a triplex fluorescent microsphere immunoassay to be used to identify the antibody response to SIV infections and classify this antibody response as either a H1 or H3 subtype.

### Highlights

Three singleplex assays have first been developed: one to detect antibodies to any infection with all known influenza A subtypes (H1 to H16), a second one to detect the H1 subtype and a third one to detect the H3 subtype. These three new assays have then been compared to those currently used in diagnostic labs. Finally, after these three assays were optimized in singleplex formats, the multiplex (triplex) format has been developed and will be validated.

### Implications for the swine industry

A multiplex immunoassay will be developed to 1) rapidly and cost-effectively identify antibody responses to SIV infections and 2) subtype this antibody response to either a H1 or H3 subtype.

### Collaborators

<b>Shawn Babiuk</b>	Centre for Foreign Animal Diseases, CFIA
<b>John Pasick</b>	
<b>André Broes</b>	Biovet
<b>Davor Ojkic</b>	University of Guelph

## Dynamics of influenza infection in swine populations

► Zvonimir Poljak, University of Guelph

### Overview

Sow and nursery herds with animals originating from single or multiple sources are being studied to describe patterns of the circulation of the influenza virus over time and to identify risk factors for recurrent infection. In order to better understand the dynamics of infection, researchers are investigating viruses that have circulated at different times through molecular methods in order to determine whether recurrently infected animals are being reinfected with the same virus.

Researchers are also working on developing a real-time outbreak detection system.

### Highlights

Results obtained so far indicate that nursery pigs in multi-source nurseries could be infected with the same strain of the virus over a relatively short period of time, and that subsequent batches of nursery pigs could be affected with different viral subtypes. Recurrent infections were linked with the level of heterologous maternal immunity. Current results from sow herds have shown that multiple subtypes of influenza viruses endemically circulate in sow herds and, most commonly, the virus circulates in the nursery. Sows were also detected to be positive for influenza viruses in farrowing rooms and in gestation areas, while piglets have been frequently identified as influenza positive during the nursing phase in the farrowing rooms.

Part of this research is also focused on processing and summarizing the laboratory swine influenza information in a user-friendly report for producers, swine veterinarians, and regulatory experts. Different approaches have been used to display trends, detect weeks and months where more samples have been submitted to laboratories and/or results of laboratory analysis have showed more positive samples to swine influenza. Different statistical models have been tested for short-term forecasting. Among all those tested, the statistical model based on "random forest" showed the highest accuracy.

### Implications for the swine industry

Strategies will be designed for the optimal control for swine influenza viruses at the herd level. Better understanding of current influenza strains in Canada have been gained, which could also be utilized in infection control. A near real-time analysis and reporting system based on laboratory data has been implemented, and will be extended to other pathogens.

### Collaborators

<b>Helena Grgic</b>	University of Guelph
<b>Robert Friendship</b>	University of Guelph
<b>Eva Nagy</b>	University of Guelph
<b>Rob Deardon</b>	University of Calgary



## Technology and methodology development for improved biosecurity in livestock transport vehicles – Phase 2: Preliminary system development and data acquisition

► Terry Fonstad, University of Saskatchewan

### Overview

The health of pigs during transport is mainly compromised by the spreading of pathogens due to the insufficient cleaning of livestock transport trailers. Currently, cleaning these vehicles is accomplished manually by hosing down and scrubbing the inside of a trailer. This process can take up to eight hours and still provide questionable results. To combat this problem, a vacuum wash system is being developed in order to clean transport trailers to a higher standard. Additionally, to ensure that all dangerous pathogens are deactivated, the effect of heating trailers to high temperatures is being investigated. The combination of both processes will lead to an overall higher quality of swine health, a quicker cleaning of transport trailers, as well as environmental benefits from using less water to clean them.

### Highlights

#### Cleaning

The trailer wash system (vacuum and pressure wash) is currently at the proof of concept stage with testing is ongoing. An inventory is also underway to document any obstacles found in transport trailers that the wash system may encounter, such as lips, gaps and ribs as well as documentation of the various trailer configurations common in the Canadian swine transport system.

#### Disinfecting

Pathogen inactivation by heat treatment is currently being investigated in the laboratory and field tests will begin in 2016-2017. The structural effect of heating transport trailers is also being studied. In order to ensure the structural integrity of the trailers, the stresses caused by thermal expansion must be fully understood. Also, certain parts of the transport trailers that are exceptionally vulnerable to heat, such as light lenses, brake lines and rivets, must be identified.



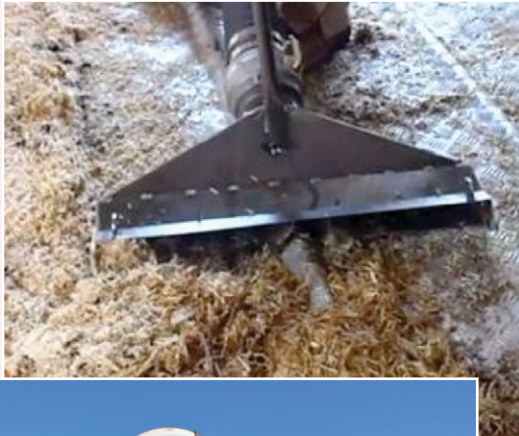
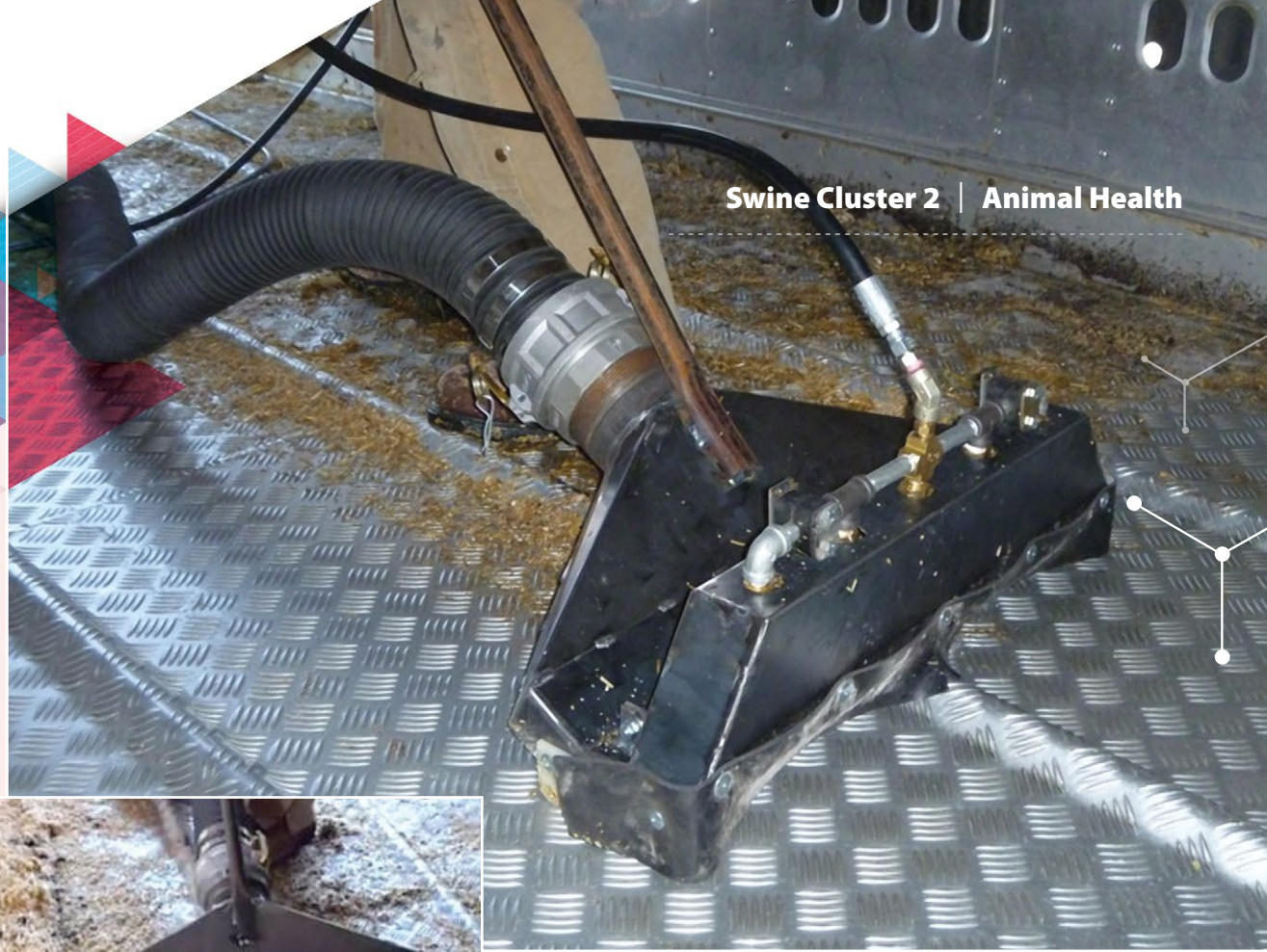
Trailer wash facility. Source: PAMI



Inside of trailer. Source: PAMI



Condition of floor after flood wash. Source: PAMI



Dry vacuuming the bulk material on the trailer floor.  
Source: PAMI

Second pass with the wet attachment to perform a pressure wash combined with vacuuming.  
Source: PAMI



Truck wash equipment.  
Source: PAMI

### Implications for the swine industry

To prevent the spread of disease through the transportation of pigs, a more effective and quicker means of cleaning and disinfecting transport trailers will be developed. Cleaning will be achieved by a vacuum wash system and transport trailers will then be heated in order to kill any pathogens.

### Collaborators

<b>Jennifer Brown</b>	Prairie Swine Centre
<b>Hubert Landry</b>	Prairie Agricultural Machinery Institute (PAMI)
<b>Volker Gerdts</b>	VIDO-InterVac

## Use of novel technologies to optimize pig performance, welfare and carcass value

► Brian Sullivan, Canadian Centre for Swine Improvement (CCSI)

### Overview

Certain economically important traits, such as growth, feed efficiency, welfare and carcass quality, are difficult or expensive to measure in pig farms and slaughter plants. Recent technological developments have provided new opportunities to collect information on live pigs and carcasses.

This project looks at validating some of the new technologies available to provide objective indicators of performance, welfare and carcass value.

### Highlights

Eight pilot studies are ongoing, covering the following areas:

#### 1 Automated recording of feed/water intake and weight/conformation

(Centre de Développement du Porc du Québec (CDPQ))

##### - Individual water recording systems

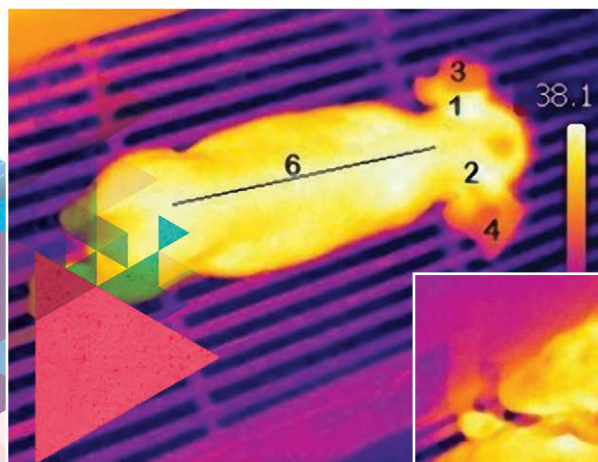
All pens in the finishing area of the Deschambault swine testing station are now equipped with individual water intake recording systems. There are still some potential improvements to the system, especially pertaining to data management, but individual water intake is now part of the standard station testing protocol. Measuring individual water intake is valuable in commercial trials as well as in research projects and represents a major step toward precision livestock farming.

##### - Vision systems to predict animal weight and conformation

Based on work done in 2014-2015, a 3D vision system to predict pig weight and conformation was developed by CDPQ. The scanning by three Kinect cameras has been automated and takes only one minute per pig. Image reconstruction is used to build a 3D model of the live pig. Analyses are underway to correlate measurements on the 3D model with live weight, carcass weight, primal cuts, weights and yields. More automation will be required for image and data analysis in the coming year.

Water dispenser.  
Source: CCSI

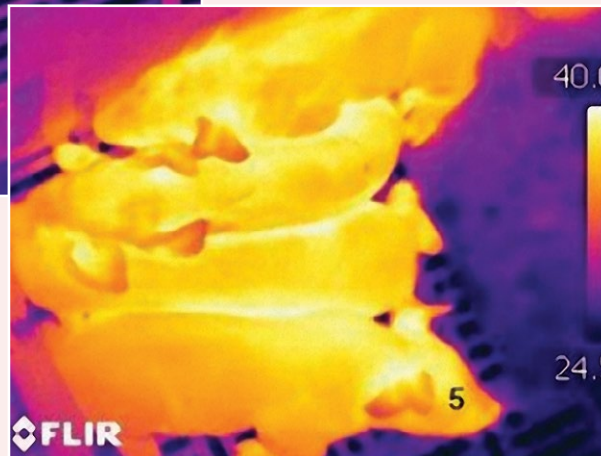




Swine Cluster 2 | Technology

**2 Infrared thermography diagnostic platform for swine**  
(Lacombe Research and Development Centre, AAFC)

Changes in metabolic rate can be monitored using infrared thermography. A series of trials on animals to assess the potential of infrared thermography on illness detection and feed efficiency were conducted in 2015-2016. With the aim of identifying potential relationships between feed efficiency and carcass traits, the composition of carcasses from a sub-group of pigs has been evaluated. Analyses are underway.



Infrared imagery.  
Source: CDPQ

**3 Use of accelerometers to automatically assess pig behaviour and welfare**  
(Laval University, Sherbrooke Research and Development Centre, AAFC and University of Guelph)

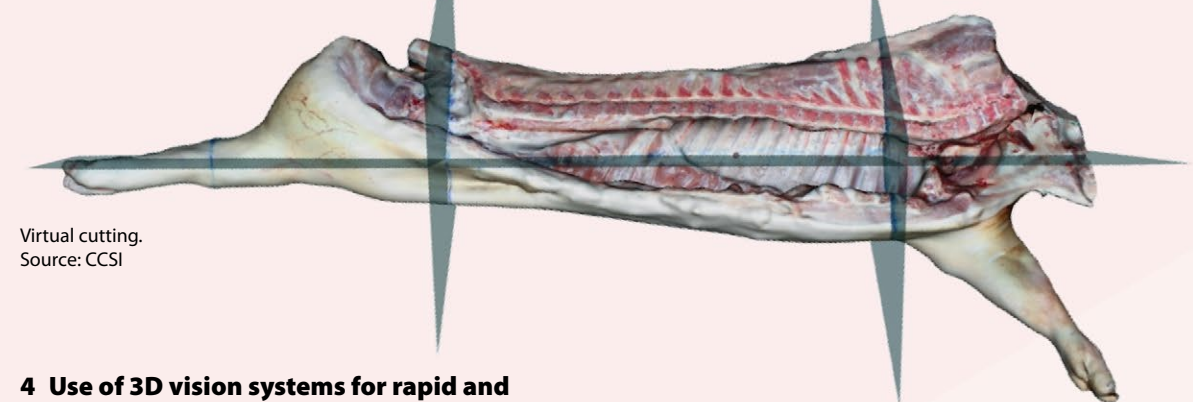
The use of live or video observation to measure behaviour and welfare in animals is time consuming and tends to be subject to human error. This study proposes to validate the use of accelerometers as tools to investigate pig behaviour as they interact with their environment. Throughout 2015-2016, accelerometers were successfully fitted to different types of objects. In some cases, important modifications to objects were needed to make sure that the accelerometers would stay out of reach of the animals. Results from preliminary trials have showed that accelerometers fitted on objects can clearly indicate if animals are manipulating these objects. Trials will begin in 2016-2017 to see if accelerometers may be used to automatically measure exploratory behaviour and to determine the occupational value of enrichment objects according to their degree of cleanliness.



Enrichment objects.  
Source: CCSI



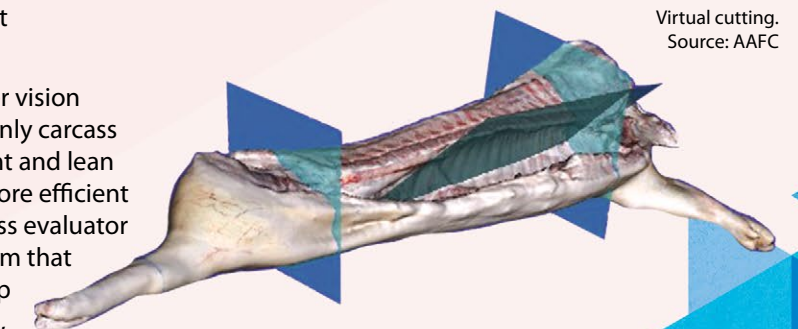
Carcass evaluator.  
Source: CCSI



Virtual cutting.  
Source: CCSI

**4 Use of 3D vision systems for rapid and objective hog carcass quality assessment**  
(Sherbrooke Research and Development Centre, AAFC)

There are opportunities to use computer vision systems to more accurately assess not only carcass weight and leanness, but also the weight and lean yield of each carcass cut, allowing for more efficient carcass sorting and assessment. A carcass evaluator prototype, which includes a vision system that will scan cold half-carcasses and develop 3D carcass models within a few minutes, has been designed, built and then improved. The prototype is now installed at the Sherbrooke Research and Development Centre (AAFC) and will be tested for accuracy in 2016-2017.



Virtual cutting.  
Source: AAFC



Near-infrared reflectance spectroscopy (NIRS).  
Source: AAFC

**5 Rapid in vivo prediction of composition and quality traits using near-infrared spectroscopy**  
(Lacombe Research and Development Centre, AAFC)

Near-infrared reflectance spectroscopy (NIRS) has been proven to be one of the most efficient and advanced tools for the estimation of quality attributes in meat and meat products. The potential of NIRS to predict pork carcass and meat quality is being assessed. Using NIRS, pig ears and carcasses have been scanned after slaughter. Based on this information, mathematical models have been developed in order to predict carcass composition and fatty acid profile in live pigs. NIRS measurements have also been collected on the ears of live pigs a few days before slaughter. This information will be analyzed alongside measurements collected on ears after slaughter and of carcass composition.

**6 Determination of age of bruises at slaughter**  
(Sherbrooke Research and Development Centre, AAFC)

The objective of this study is to develop objective methods to count, categorize and determine the age of bruises on pork carcasses on the slaughter line. A trial involving animals has been carried out, including mixing of pens at four different times (one and two days before slaughter, in the truck and while waiting at the plant). The lesion healing process is being studied via histological and histochemical analyses of lesions at different stages. Digital image analysis is also being performed to be able to count and classify bruises according to their origin and age.

**7 Application of rapid methods for non-invasive assessment of pork quality** (Saint Hyacinthe Research and Development Centre, AAFC and McGill University)

There is a need for non-invasive, reliable, objective methods that are able to determine the entire array of quality parameters while preserving the integrity of meat cuts. Two technologies, nuclear magnetic resonance (NMR) and hyperspectral imaging (HSI), are being assessed for this purpose.

Up to now, reference measures of composition, fatty acid profiles and shear force have been carried out on two batches of meat samples. Their correlation with NMR measurements will be studied.

A line-scan hyperspectral imaging system was designed at McGill University to mimic commercial conditions and was used to scan loin samples. Results have been compared with reference measurements and data analysis is underway.



Nuclear Magnetic Resonance (NMR) equipment.  
Source: AAFC

**8 Quick, non-invasive technology for prediction of marbling in fresh loins**  
(Centre de Développement du Porc du Québec)

Pork marbling is a key trait for slaughter plants but is not easy to predict accurately without cutting the loin muscle. Recent results indicate that induced current and resistance measurements could provide good predictions for loin marbling. Tests were carried out to develop a small-scale contactless prototype. However, some technological issues were faced when testing meat samples. Therefore, standard measurements of marbling scores and drip loss were collected on meat samples presenting a wide range of marbling. These samples were then analyzed in an induced current measurement cell and sent to a commercial lab for chemical analysis of intramuscular fat. Results should be available shortly.

**Implications for the swine industry**

Standard operating procedures will be provided for using novel technologies to objectively and accurately measure phenotypes for pigs' growth, feed efficiency, welfare, carcass value and meat quality. These new traits will be useful for research projects, selection programs and/or commercial operations when applicable.

**Collaborators**

<b>Renée Bergeron</b>	University of Guelph
<b>Nicolas Devillers</b> <b>Luigi Faucitano</b> <b>Candido Pomar</b>	Sherbrooke Research and Development Centre, AAFC
<b>Frédéric Fortin</b> <b>Patrick Gagnon</b>	Centre de développement du porc du Québec
<b>Claude Gariépy</b> <b>Marie-Rose Van Calsteren</b>	Saint Hyacinthe Research and Development Centre, AAFC
<b>Manuel Juarez</b>	Lacombe Research and Development Centre, AAFC
<b>Jean-Paul Laforest</b>	Laval University
<b>Michael Ngadi</b>	McGill University
<b>Tim Nelson</b>	PigGen Canada

## Increasing Canadian pork consumption, market share and competitiveness through enhanced nutritional values and overall quality with a functional molecule in pork meat

- ▶ Claude Gariépy, Saint-Hyacinthe Research and Development Centre, AAFC
- ▶ Brian Sullivan, Canadian Centre for Swine Improvement

### Overview

The levels of a functional molecule are being measured in purebred pigs in Canada and a study is being done to look at the effect of this molecule on meat quality traits. Further analyses will be carried out to identify genetic reasons why some animals have a higher content of this molecule by looking at important genes related to its metabolism.

A test will be carried out on live pigs to find out whether levels of this functional molecule can be enhanced through feeding. Meat quality as well as sensory analyses will be done on pork samples from these animals. Surveys will be carried out to gauge the public's perception and interest in this new product and the latter information will be used to create strategies to motivate the consumption of enhanced pork by health-conscious consumers.

### Highlights

Researchers have carried out gene expression analyses related to the presence of the functional molecule in pig skeletal muscle. They also searched for genetic variations in order to identify genetic reasons why some animals have a higher muscle content of this molecule than others. Also, to see if levels of this functional molecule can be enhanced in pork meat through feeding, a nutritional test has been carried out involving 80 pigs. Analysis of this test is in progress.

### Implications for the swine industry

This project offers an opportunity to differentiate Canadian pork by increasing the content of the functional molecule in meat. It also provides a chance for consumers to reap the benefits of including this molecule in their diet naturally through habitual pork consumption.

### Collaborators

<b>Marie-Ann Binnie</b>	Canadian Pork Council
<b>Frédéric Fortin</b>	Centre de développement du porc du Québec
<b>Ellen Goddard</b>	University of Alberta
<b>Marie-France Palin</b>	Sherbrooke Research and Development Centre, AAFC
<b>Candido Pomar</b>	Sherbrooke Research and Development Centre, AAFC
<b>Jacques Pomerleau</b>	Canada Pork International
<b>Michael Young</b>	Canada Pork International

## Objective methods for the evaluation of marbling and other meat quality traits

- ▶ Laurence Maignel, Canadian Centre for Swine Improvement (CCSI)

### Overview

Marbling, or the visible intramuscular fat found in pork meat, is a major contributor to the natural flavours and juiciness of cooked pork. Marbling as well as other quality attributes, such as colour, drip loss and tenderness, is considered or required by customers in Canada and abroad when buying pork meat. In most Canadian packing plants, meat quality (including colour and marbling) is evaluated using visual assessment, which has many drawbacks in terms of time, consistency and subjectivity. Therefore, there is a need to develop new technology to objectively assess meat quality traits in order to provide consistent, quantifiable differentiation points useful for pork grading and product sorting. The main challenge is to find which technologies would provide an accurate prediction of the quality of the loin without cutting it.

### Highlights

Before conducting trials to compare different technologies, a literature review is first being carried out on methods available to predict marbling and other traits, including novel technologies that might already be ready for application. Contacts were also made with experts in research laboratories and packing plants in order to obtain the most up-to-date research and technical results. The National Working Group on Pork Carcass and Meat Quality Standards, which is coordinated by CCSI and Canada Pork International, plays a critical role in this part of the project through its huge network of meat quality experts in Canada and internationally. Tools that are under development or already available in other industries and other animal production sectors (beef, lamb, poultry, fish, etc.) are also being reviewed, as technologies developed for another product might be easily adapted to be used on pork.

### Implications for the swine industry

Recommendations will be provided to primary processing plants about objective, quick and accurate methods and technologies for the evaluation of marbling and other pork quality attributes. The focus of these recommendations will be on pork grading and product sorting.

### Collaborator

**Michael Young** Canada Pork International



Source:  
Canada Pork  
International  
& CCSI



Handing out surveys at the Banff Pork Seminar in January 2016. Source: Swine Innovation Porc

# Communication & Collaboration

## Networking meetings

Swine Innovation Porc continued to organize project networking meetings in 2015-2016. These meetings were implemented as a way to allow researchers, particularly those who work at different institutions and provinces, to come together and better collaborate. The vast majority of the research projects in the Swine Cluster 2 program includes researchers from at least two different institutions and, subsequently, researchers that are involved in multiple institutions and in multi-disciplinary projects have expressed their appreciation of this initiative taken on by Swine Innovation Porc. Two networking sessions were organized last year and we look forward to holding more of these in the coming year.

## Setting priorities for national pork research

In 2015-2016, we consulted a subgroup of industry representatives on three different occasions to have their input and feedback regarding national research priorities. These consultations were part of a larger process that included an in-depth review of current issues affecting the Canadian pork industry and how research can help solve these problems. Participants of the Banff Park Seminar were also surveyed to have their input on priorities. Two workshops were also planned for June 2016 to have a wider consultation to include researchers, industry and producer representatives as well as government partners.

## Partnerships with national swine conferences

Swine Innovation Porc partnered with the Banff Pork Seminar and the London Swine Conference again this year. We also had kiosks at other events such as the Quebec Porc Show and Red Deer Technology Workshop and we look forward to continuing our participation in these events next year.

## Communications with our partners

Keeping our valued partners updated on Swine Innovation Porc activities is an important part of our role as a national coordinator of swine research. Our representatives have attended various provincial pork producer organization meetings, national meetings, such as the Canadian Pork Council Fall Forum and meetings of the Pork Value Chain Round Table, as well as a number of other organization meetings.



Board members and researchers listen to presentations on Swine Cluster 2 projects at the University of Guelph in June 2016. Source: Swine Innovation Porc

## Farmscape

Farmscape Online is a website that includes reports and interviews with pork industry people as well as with researchers. Swine Innovation Porc has continued to collaborate with Bruce Cochrane, the author of the website, to ensure updates on Swine Cluster 2 are being communicated. Highlights from reports are also broadcast via

radio in certain regions. There were 40 different reports published last year and we invite you to visit the "Publication" section of our website ([www.swineinnovationporc.ca](http://www.swineinnovationporc.ca)) to find the links to these reports and listen to interviews. Many of these have also been translated in French and are available on [www.innovationporc.ca](http://www.innovationporc.ca).

Participants of the networking meeting held in Montreal in June 2015 for the projects on piglets and growing/finishing nutrition. Source: Swine Innovation Porc

## A few numbers:

**2** NETWORKING MEETINGS HELD involving 19 different researchers

**40** Farmscape online REPORTS

**13** different Swine Innovation Porc CORPORATE COMMUNICATION ACTIVITIES

**16** other swine organization's meetings where Swine Innovation Porc PARTICIPATED

**5** SWINE CONFERENCES where Swine Innovation Porc was present



# Science Advisory Body

The Science Advisory Body (SAB) is a committee that evaluates the scientific integrity of research proposals submitted to Swine Innovation Porc. Members of the SAB are recognized professionals who are well-known in their fields and represent a diverse range of expertise within swine research. This committee reviews research proposals, offers scientific expertise, gives technical advice and ultimately provides the Board of Directors with their recommendations. The following individuals are the current members of the Science Advisory Body:

## Jean-Paul Laforest

Chair  
Professor  
Laval University

## Brad Chappell

Veterinarian  
Swine Health  
Professionals Ltd

## Graham Plastow

Professor  
University of Alberta

## Neil Ferguson

Swine Nutrition  
Research Manager  
Nutreco Canada

## Serge Pommier

Scientific Advisor  
Olymel

## Catherine Templeton

Veterinarian  
Synergy Services Inc.

# Management Team

## Pierre Falardeau

General Manager

## Abida Ouyed

Assistant Manager

## Marie Vachon

Research Coordinator

## Leslie Walsh

Executive Secretary

## Pierre-Dominique Munger

Assistant Accountant



# Partners in Research

## Canadian Partners

- Alberta Agriculture and Rural Development
- Batista & Asociados
- Biovet
- Canada Pork International
- Canadian Centre for Swine Improvement
- Canadian Pork Council
- Centre de développement du porc du Québec
- Centre de recherche de l'Institut Universitaire de Cardiologie et de Pneumologie de Québec, associated with Laval University
- FGC Groenenstage Construction Ltd
- Group Cérés
- Guelph Research and Development Centre, AAFC
- Health Canada, Nutrition Research Division
- Institut de recherche et de développement en agroenvironnement
- Lacombe Research and Development Centre, AAFC
- Manitoba Pork
- McGill University
- National Centre for Foreign Animal Diseases, Canadian Food Inspection Agency
- PigGen Canada
- Prairie Agricultural Machinery Institute
- Prairie Swine Centre
- Saint Hyacinthe Research and Development Centre, AAFC
- Sherbrooke Research and Development Centre, AAFC
- University of Montreal
- University of Sherbrooke
- Laval University
- University of Alberta
- University of Calgary
- University of Guelph
- University of Manitoba
- University of Saskatchewan
- VIDO-InterVac
- Zinpro

## International Partners

- Leibniz Institute for Farm Animal Biology, Research Unit Muscle Biology and Growth (Germany)
- Newcastle University (United Kingdom)

## Financial Partners



Canadian Pork Council  
Conseil canadien du porc

Swine Innovation Porc est une société du Conseil canadien du porc.

## Financial Partners



# Financial Partners

## Organizations Collaborating in Certain Projects

- Bureau vétérinaire Dr Jean Brochu
- Bureau vétérinaire Jean-François Doyon
  - Bureau vétérinaire Vaillancourt
    - Conestoga Meat Packers
    - Demeter Services vétérinaires
      - Dr Alain Ricard, Isoporc
  - Dr Frédéric Beaulac, services vétérinaires
    - Dre Julie Ménard, F. Ménard
  - Dre Marie-Claude Germain, Shur-Gain
    - Les Consultants Avi-Porc
  - Services vétérinaires St-Bernard



[swineinnovationporc.ca](http://swineinnovationporc.ca)