



Where Does the Gut Go From Here?

By Geoff Geddes, for Swine Innovation Porc

If we had a crystal ball, those burning questions would be answered: Will we end world hunger? Will we save the planet? What is the future of pig gut health? Though no one can predict tomorrow, assessing the pig microbiome today and where it goes from here was the focus of the final speaker at an information session held by Swine Innovation Porc prior to the 2020 Banff Pork Seminar. He may lack a crystal ball, but Dr. Andrew Van Kessel has the credentials as a professor in the Department of Animal and Poultry Science, College of Agriculture and Bioresources at the University of Saskatchewan.

Before you can analyze something, of course, you need to define it.

“Science struggles for a definition of gut health. I bring it back to the role of the gut as a barrier to pathogens that might enter the gastrointestinal (GI) tract. The gut also efficiently assimilates and digests nutrients that support lean tissue growth.”

Gut health is measured by how effectively it fills those dual roles of a barrier and assimilator of nutrients.

Factors affecting the microbiome

“I tell my students that the microbiome is abundant with diverse, redundant and dynamic members. It sounds like a superhero squad, which may be fitting as it contains several hundred species and about two million genes versus about 30,000 in your own genome.”

Though the ability of the gut’s diverse community to produce metabolites is immense, its composition, which determines effectiveness,

is constantly changing based on a range of factors.

One influence is age, as a pig’s microbiome is sterile at birth but rapidly increases in diversity. Diet also plays a key role, with ingredient choices like corn versus wheat having a demonstrable impact on the microbiome.

Perhaps the most intriguing influence comes from the pig’s environment. Non-litter mates in the same pen will look more alike than



Dr Andrew Van Kessel presents at SIP's 2020 Swine Health Session. Photo: SIP





litter mates housed in different pens. Clearly, surroundings early in life seem to play a bigger part than the mother, notwithstanding that the sow is almost certainly a major source of inoculating microorganisms.

Microbial crosstalk

In this complex world, communication is vital for success, and the same applies to the microbiome. Gut health is not just about the microbial and chemical composition of the GI tract; it also relies on crosstalk. There are a number of pathways by which the host recognizes changes in the GI tract and responds. It does this in a number of ways, such as changing its secretion of mucins [a gel-forming glycoprotein layer] and antimicrobial peptides [short chains of amino acids that can kill bacteria], or changing the rate of cell replacement.

Gut health and performance

In exploring therapies that could use the microbiome to improve gut health, Dr. Van Kessel sees the “sweet spot pig” as the ultimate goal.

“I once looked at germ-free pigs raised in isolated facilities. They were very happy and actively growing, with high digestive and absorptive capacity and low nutrient requirements. At the same time, they had low barrier function and no activation of the immune response. This contrasts with clinically sick pigs that show loss of appetite, inflammation, poor digestive capacity and high nutrient requirements.”

Lying in the middle of these two extremes is the sweet spot pig, which is the animal producers should aim for to comprise their herd. It has

exposure to an ideal set of microorganisms that drive development of the intestine. In seeking this ideal, however, there is a fundamental question: How far do you want to push manipulation of the microbiome so it is more capable of responding to pathogens that enter the environment? As part of this query, it’s important to recognize that a microbiome and gut response that is more protective may also cost more nutrients (feed efficiency) to support protective responses like increased cell replacement and mucin secretion.

“We have to think in terms of prevention rather than treatment in regard to the microbiome. This is about preparing pigs so that if they are exposed to a natural infection, they have a better chance of clearing it, and you

Producers should aim for the “sweet spot pig”:
an animal that would have exposure to an ideal set of microorganisms that drive the development of the intestine

wind up with fewer sick animals. If you are hit with a major pathogen exposure, this won't save you, as the focus is on prophylactic treatment to minimize disease impact."

New directions for microbiome research

A growing trend is the promotion of gut modifier products and prophylactic antibiotic alternatives such as probiotics and prebiotics. In scrutinizing these options, you should look at how they will alter the microbiome and assess which products might be effective in certain environments.

"Those promoting such products often take a 'one size fits all' approach, and that's just not realistic."

There is also an increasing focus on sow and piglet management. Since early life colonization patterns have long term implications for the microbiome, producers only have the first few days of life to change a pig's course.

It may seem an odd question at first glance, but another line of inquiry is whether we are too clean with our pigs. Have the high sanitation levels in modern production systems excluded a key microbial species? Is there something in the microbiome of wild pigs that we have bred away in our domestic/commercial population? Food for thought!

Pig Gut Microbiome Project (PGmp)

To gain a better understanding of the ideal pig microbiome, Swine Innovation Porc is funding the PGmp Project.

"We are looking at sows and sampling their vaginal and fecal flora [microbiota], as well as taking fecal samples for piglets from birth through to slaughter. This involves herds across Canada and only in commercial settings rather than labs."

Researchers plan to maximize the number of pigs sampled to counter pig-to-pig and facility-to-facility variation. They will confine their work to fecal sampling as it represents the only practical option on farm.

In the process, they hope to determine whether core members of the microbiome vary with region, growth rate, feed efficiency and health score, and if core members found in the piglet or weaned pig are predictive of performance and health. Answering these questions could help design new diagnostic tools to assess the microbiome and help target management practices or aid in developing and assessing new technologies to improve gut health.

True, these studies are more expensive than a crystal ball, but in both cases, you get what you pay for. 

Video available!

[Click here to see a video](#) of Dr. Van Kessel's talk given at Swine Innovation Porc's health session that took place on January 7, 2020 in Banff, Alberta.