## Microbiome studies in swine systems: Challenges and opportunities (Part 2)

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Key Points:

- Due to the nature of microbiome it cannot be studied separated from other relevant information and should be studied together with metabolomics, genomics, immunity and nutrition.
- Development of models at different levels are needed to evaluate the effect on microbiome of different strategies and to evaluate the impact of microbiome changes on the pig gut health.

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As discussed in the previous Science Page, the gut microbiome plays many integral roles in energy harvesting, nutrient synthesis, and gut health. The field of swine microbiome studies is still very new, and carries a lot of potential for improving production and health. Ultimately, the goal is to be able to manipulate the pig's microbiome through nutritional and environmental interventions, to improve performance and health. To get to a point where that manipulation is possible, there are several critical areas of focus that need further research. As stated in the previous Science Page, the first two of these are 1) Funding large-scale, hypothesis generating microbiome research projects in swine production systems, and 2) Moving from compositional to functional surveys of the gut microbiome of swine. Two other areas are also of particular importance. These are:

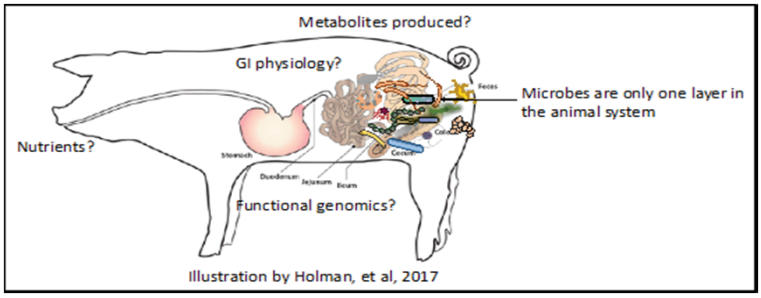


**Figure 1.** The pig is a highly complex physiological and anatomical system

**3) Studying the swine gut microbiome as one part of a highly integrated and complex animal system.** Data on the microbiome is only a layer of a complex swine system- As such, to understand the impact of the microbiome on physiology and health, it is necessary to integrate data on metabolomics, functional genomics, immunity and nutrition (**Figure 1**).

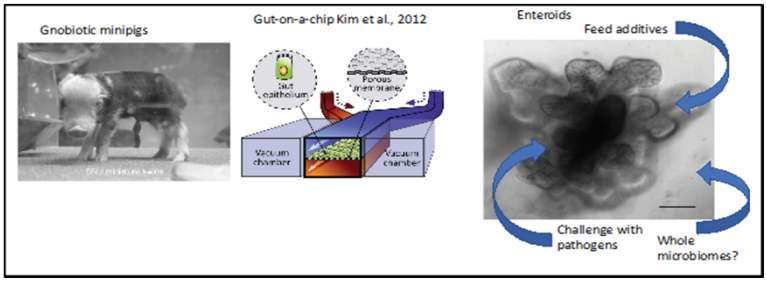


**Figure 2.** In vitro models tom test mechanistic hypotheses on the relationships between microbiome and physiology

**4) Implementing mechanistic (*in vitro/ex vivo*) models to understand the structure and function of the swine gut microbiome.** Mechanistic models are necessary to test the effect of specific microbiomes in swine physiology and health. Gnobiotic minipigs, in vitro gut systems and enteroids are of great promise as in vitro/ex vivo, cause-effect models (**Figure 5**). These strategies will be critical to tackle some of the most pressing challenges faced by the animal production field today, such as exploring alternative to antibiotics through modulation of the gut microbiome, and sustainable, environmentally friendly animal production for a demanding consumer.

**References:**

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