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Participating INRAE units
GABI
GenPhySE
IHAP
MaIAGE

Partner
LABÉO (France)

MUCINET

Evaluating the predictive power of the mucin–microbiome interaction in livestock

Our central hypothesis is that the mucin–microbiome interaction is crucial in keeping the mucosa healthy and protecting the host from pathogens. Accordingly, any changes in interactions with mucins and the composition and activity of the microbial community in the gut or respiratory tract could increase the risk of infectious disease. To complement the network's activities, we will develop a proof-of-concept approach using two clinically relevant livestock models (pigs and calves) and the intestinal and respiratory tracts, where epithelial cells are covered in mucus. The mucin–microbiome interaction in these areas is of key importance in preventing complex gastrointestinal and respiratory diseases.

Two major conceptual issues will be addressed:

1. What is the spatial distribution, type and abundance of mucins in the mucus of calves and pigs?

2. What is the composition and diversity of the microbiota associated with mucins in each mucosal niche?

The temporal variation of the mucin–microbiome interaction and the resulting host physiology will also be tested before and after a challenge (e.g. antibiotic and weaning).

This conceptually innovative exploratory project is an opportunity to gain new knowledge and make a significant impact on the health and welfare of holobionts, one of the cornerstones of HOLOFLUX.

Objectives

Infectious respiratory and gastrointestinal diseases in pigs and calves are one of the livestock industry's biggest challenges. They cause major economic losses and are detrimental to animal health and welfare, the environment and public health. One of the first lines of defence against respiratory and enteric pathogens combines the mucus layer, a highly viscous material made up mainly of mucins, and the multi-kingdom microbial ecosystems that thrive in mucus. The mucin–microbiome interaction is a double-edged sword: while its usual function is to protect the host from pathogens and foreign substances, its dysfunction can indicate microbial infection and disease onset. However, this process has not been studied in livestock. To understand the complex mucin–microbiome interactions in the respiratory tract and gut of two major livestock species (pigs and ruminants), and then determine which mucin–microbiota interactions are essential for holobiont health and

resilience, we drew on the diverse knowledge and expertise from various scientific disciplines.

This interdisciplinary approach supports collaboration and adopts a holistic scientific perspective to develop effective pathogen prevention and appropriate strategies to reduce infectious diseases in livestock animals.

Partners

INRAE unit	Expertise	INRAE division
GABI	Pig genetics; genomics; metagenomics; animal health; bioinformatics; immunology; immunogenetics	GA
GenPhySE	Nutrition; physiology; ethics; metagenomics	/
IHAP	Metagenomics; data integration; animal physiology; bioinformatics; infectiology; virology; molecular microbiology; veterinary clinical trials	SA
MaIAGE	Bioinformatics; biostatistics	MICA, MATHNUM
Partner	**Expertise**	
LABÉO (France)	Clinical biology; immunology; biochemistry	