The mission of Wageningen University and Research is "To explore the potential of nature to improve the quality of life". Under the banner Wageningen University & Research, Wageningen University and the specialised research institutes of the Wageningen Research Foundation have joined forces in contributing to finding solutions to important questions in the domain of healthy food and living environment. With its roughly 30 branches, 5,000 employees and 10,000 students, Wageningen University & Research is one of the leading organisations in its domain. The unique Wageningen approach lies in its integrated approach to issues and the collaboration between different disciplines.

Microbiota analysis
We investigate the microbiota in parallel with various intestinal and/or systemic parameters in animal and human studies to identify correlations between abundance of specific microbial groups or functions and health and disease. We use changes in these parameters during an intervention (dietary or other) to construct mechanistic models to discover the working mechanism underlying the physiological intervention effects observed.

Zebrafish: a model to study dysbiosis
We investigate the effect of feed, antibiotics and other water pollutants during this development on the host as well as its microbiota and aim to understand what processes might underly increased intestinal disease susceptibility.

Improving lactic acid bacteria performance
In collaboration with various (inter-)national research groups we employ experimental and modelling approaches to unravel the mechanisms of natural gene transfer and metabolic performance in lactic acid bacteria, which play an important role in industrial fermentation processes and as ingredients in functional foods such as probiotics.

Pesticides, microbes and hosts
Pesticides are omnipresent in our environment, our food, our drinks (even our beer!) and house dust. Unknowingly we are exposed to very small doses of multiple pesticides on a daily basis. We investigate how this exposure impacts our gut microbiome, our gut health and our lung health.

Internship opportunities

Thesis projects
If you are interested in one of our research topics and are looking for a bachelor or master thesis project, please contact Peter van Baarlen (peter.vanbaarlen@wur.nl) or visit our website.

In-silico research
If you are primarily interested in biology, but would like to improve you bioinformatics and / or data analysis skills: most of our research has an important computational component, exploring for example large metagenomics datasets in relation to host health. We also offer a range of projects that do not have a wet-lab component.

Improving lactic acid bacteria performance
In collaboration with various (inter-)national research groups we employ experimental and modelling approaches to unravel the mechanisms of natural gene transfer and metabolic performance in lactic acid bacteria, which play an important role in industrial fermentation processes and as ingredients in functional foods such as probiotics.

Pesticides, microbes and hosts
Pesticides are omnipresent in our environment, our food, our drinks (even our beer!) and house dust. Unknowingly we are exposed to very small doses of multiple pesticides on a daily basis. We investigate how this exposure impacts our gut microbiome, our gut health and our lung health.

Microbiota analysis
We investigate the microbiota in parallel with various intestinal and/or systemic parameters in animal and human studies to identify correlations between abundance of specific microbial groups or functions and health and disease. We use changes in these parameters during an intervention (dietary or other) to construct mechanistic models to discover the working mechanism underlying the physiological intervention effects observed.

Zebrafish: a model to study dysbiosis
We investigate the effect of feed, antibiotics and other water pollutants during this development on the host as well as its microbiota and aim to understand what processes might underly increased intestinal disease susceptibility.

Improving lactic acid bacteria performance
In collaboration with various (inter-)national research groups we employ experimental and modelling approaches to unravel the mechanisms of natural gene transfer and metabolic performance in lactic acid bacteria, which play an important role in industrial fermentation processes and as ingredients in functional foods such as probiotics.

Pesticides, microbes and hosts
Pesticides are omnipresent in our environment, our food, our drinks (even our beer!) and house dust. Unknowingly we are exposed to very small doses of multiple pesticides on a daily basis. We investigate how this exposure impacts our gut microbiome, our gut health and our lung health.

Internship opportunities

Thesis projects
If you are interested in one of our research topics and are looking for a bachelor or master thesis project, please contact Peter van Baarlen (peter.vanbaarlen@wur.nl) or visit our website.

In-silico research
If you are primarily interested in biology, but would like to improve you bioinformatics and / or data analysis skills: most of our research has an important computational component, exploring for example large metagenomics datasets in relation to host health. We also offer a range of projects that do not have a wet-lab component.
Bacteria play a key role in human and animal development and health. The Host-Microbe Interactomics Group (HMI) aims to decipher the molecular mechanisms that underlie the interplay between specific pathogens or microbiota and the human or animal host, including the influence of diet. The group combines expertise in cell biology, immunology, microbiology, microbiome analysis and functional (meta-) genomics to unravel molecular interactions that impact on health and disease.

Our activities

HMI develops expert knowledge and provides teaching and practical training in:
- Molecular mechanisms of microbial diseases;
- Interactions between bacteria and their human or animal hosts;
- Analysis of gut microbiota and the effect on host health and resilience.

This expert knowledge is applied in the areas of:
- Animal health and welfare;
- Combating infectious diseases, vaccination and development of antimicrobials;
- Microbiota-host interactions and gut health.

Research

The HMI Group works at the heart of host-pathogen and host-microbiota research in health and disease, and performs research on vaccines and antimicrobials. These topics are highly relevant to fundamental science, medicine and society. The main research lines are:

**Innate defence mechanisms in the small intestine**

We study the molecular mechanisms by which bacteria (including probiotics), their metabolites and dietary components influence epithelial functions, and how this may contribute to epithelial integrity and prevent inflammation. To decipher these interactions, we perform in vivo (human and animal) studies in combination with in vitro cell line -, and 2D and 3D organoid models.

**Bacterial interactions with immune cells**

One of our main interests is the interaction of bacteria and their metabolites with immune cells which regulate tolerance, and adaptive responses in mucosal tissues. This work involves a variety of in vivo and in vitro models that contribute to our mechanistic insight in the immunomodulatory capacity of bacteria.

**Discovery of novel antimicrobials**

We are part of the Dutch National Centre of One Health - Antimicrobial Resistance network where we identify and develop novel antibacterials and anti-infectives against a range of bacterial pathogens, including *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Streptococcus suis* and *Enterococcus faecalis*.

**Virulence and pathogenesis of Streptococcus suis**

Together with partners at Cambridge Veterinary School UK, we investigate virulence and pathogenesis, genomics and new vaccines against *S. suis*.

**Organoids on-a-chip**

Micromanufacturing techniques originally designed for the use in microelectronic chips can also be used to develop micrometer-scale architectures that support multiple cellular populations relevant for disease modelling. By implanting organoids into these microfluidic chips and introducing the cells to shear stresses from fluid flow, we map cell-cell and cell-host interaction mechanisms, simulate disease pathogenesis, and study developmental biology.

Education

HMI provides education and training at BSc, MSc and PhD level for students with an interest in infectious diseases, beneficial host-microbe interactions, approaches to combat infectious diseases and antimicrobials. HMI teaches students the principles of microbiota functions, host responses and pathology.

**Commensal and Pathogen Host-Microbe Interactions in the Intestine (HMI-30306)**

This course aims to teach students the concepts involved in the science of host-microbe interactomics. The lecture series deals with model systems in the field of intestinal host-microbe interactions, including (germ-free) animals and human volunteer models, and includes a computer practical in which public and in-house datasets and software modules to analyse them are exploited, aiming for hands-on experience in data analysis and extraction of biological understanding.

**Microbial Disease Mechanisms (HMI-50306)**

Pathogenic microbes pose a constant threat to human and animal health. In this course the molecular mechanisms of the interactions of humans and animals with causal agents of diseases will be addressed, with a focus on bacterial pathogens. The course consists of lectures, tutorials and practicals.

**Microbes and health (HMI-20306)**

This course is aimed at teaching students the fundamentals of microbiome function, emphasising the major contributions of the collective of commensal bacteria (the microbiota) to host physiology and health. It will provide insights on how the microbiota affects the host immune system from newborn to adult and influences host behaviour via the gut-brain axis and it will explain the concepts of (co-)infections, emerging diseases and antimicrobial resistance. The course consist of lectures, tutorials and practicals.