

Gut genomics in pigs, its contribution to human health

By Marcel Hulst (ASG)

The gastrointestinal (GI) tract is a complex ecosystem. Interactions between food components, the cells that absorb nutrients (epithelial cells), and the permanent bacterial residents of the intestines (the micro flora) that help to digest food, are important for its proper function. Imbalance in this ecosystem may provoke the loss of the GI tract natural barrier function against pathogens and against harmful components in our diet, resulting in malfunction and consequently lead to illness.

At the Animal sciences Group (ASG) the complex interactions between the GI tract, microflora and food components are studied using the genomics technique cDNA microarrays. What microarrays actually do is measure the expression level of several thousands of genes in a biological system in a single experiment...For monitoring gene expression in the GI tract of pigs ASG developed a set of probes (cDNAs) .. With this array, gene expression in the small intestine of pigs was monitored in several experimental animal models. For example, after feeding pigs with specific diets and/or feed components, and after challenging of pigs with enteric viral (rotavirus) and bacterial pathogens (*Salmonella* or enterotoxigenic *E. coli*). These experiments detected several clusters of "response genes". Among them genes whose expression are crucial for the function of the local (innate) immune defense of the pig's intestine. Particularly, our Small Intestinal Segment Perfusion (SISP) model proved to be a reliable model for monitoring gene expression in the pig's intestine. This SISP model allows us to generate multiple physically separated segments from the pig's intestine and separately expose these segments to different compounds or pathogens for a maximum period of 24 hours. Because up to ten segments can be applied in the pig's long small intestine many variables can be tested and analyzed by microarray analysis in a single pig. Thus, measurements in this model are isogenic, that means without natural occurring variation in gene expression between animals.

The awareness of consumers about the principle, "what you eat affects your health", has increased tremendously during the last decade. This has urged food industries to develop and produce more functional and health improving food products. Nowadays, in almost every commercial break on TV, special food products are recommended for staying healthy. Among them many products that are supplemented with biological active additives, e.g. "good" bacteria or unsaturated fatty acids. However, how these interact with the gastrointestinal (GI) tract, is often unknown. How can genomic research in the pig's GI tract contribute to human intestinal health? Believe it or not, with respect to feed intake, digestion of feed, and its physiology, the pig resembles man. Testing of (potential) biological active components of functional foods in the pig's GI tract in combination with gene expression analysis may unravel the mechanism of how such food additives work. This may lead to the development of new functional foods that improves human (intestinal) health.

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In the picture

Dirk-Jan de Koning was born in September 1970 in the 'green heart' of Holland. Before completing his animal science degree at Wageningen University in 1996, he fulfilled his conscription duties as a sergeant with the artillery and was involved in running a student bar.



Following a temporary research appointment in Finland, he started his PhD research at Wageningen University on the identification of QTL in a large resource population of pigs. At the same time he maintained links with Asko Mäki-Tanila's group in Finland on QTL research applied to poultry and cattle.

He received his PhD in September 2001 and subsequently moved to Roslin to take up a post-doctoral position, again focussing on QTL analysis, this time in commercial broilers.

From October 2003 onwards he has been working as a project leader and he is currently supervising 4 PhD students and 1 Post-Doc. His main research interest is the combination of QTL studies with microarray analyses in an attempt to unravel how a certain QTL affects a certain trait. The research projects span a number of species and traits but QTL remains a central theme.

Within EADGENE, Dirk-Jan is work package leader for WP1.4 "Analytical Tools", which aims to define 'best practice' for statistical analyses through training and workshops. He enjoys the collaboration and the enthusiasm of some (!) of his EADGENE colleagues. He would very much like legal paperwork never to exceed two pages but this is just one of his many delusions.

He lives with his Finnish wife Tytti in the 'wet and wonderful' Borders of Scotland and their household includes three cats, two Muscovy ducks and a horse. Although Dirk-Jan has a much greater appetite for good food than for exercise, both he and Tytti enjoy riding the family horse and can be persuaded to run, especially when money can be raised for charity (see picture). They have also been spotted hill walking, but with a generous picnic! Dirk-Jan is pretty content with his life as it is, but would not mind winning the lottery.



The Disease In Birds: Impact And Control Measures

Source: www.birdflu.org.cn

Avian influenza is an infectious disease of birds caused by strains of influenza virus. Avian Influenza mostly affects birds and sometimes pigs. The disease, which was first identified in Italy more than 100 years ago, occurs worldwide. All birds are thought to be susceptible to infection with avian influenza, though some species are more resistant to infection than others. Infection can cause a wide spectrum of symptoms in birds, ranging from mild illness to a highly contagious and rapidly fatal disease resulting in severe epidemics. The latter is known as "highly pathogenic avian influenza". This form is characterised by sudden onset, severe illness, and rapid death, with a mortality that can approach 100%. Migratory waterfowl – most notably wild ducks – are the natural reservoir of avian influenza viruses.... Direct or indirect contact of domestic flocks with wild migratory waterfowl has been implicated as a frequent cause of epidemics. Live bird markets have also played an important role in the spread of epidemics. In

case a virus would mutate into a form that could circulate in humans, there is a risk of a pandemic....

The quarantining of infected farms and destruction of infected or potentially exposed flocks are standard control measures aimed at preventing the spread to other farms and eventual establishment of the virus in a country's poultry population. Stringent sanitary measures on farms can also confer some degree of protection.

As we cannot predict the future it is important to stay watchful.

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Although Avian influenza is currently not within the portfolio of diseases that EADGENE focuses on, it is clearly very important and EADGENE partners are exploring ways of contributing to ongoing research in this disease. In particular they are exploring ways of applying resources and techniques to the study of host-virus interactions in birds infected with the avian influenza virus.

