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Although our findings point to a metabolic origin of the pathogenesis of these conditions, it is important to stress that our observations do not negate the importance of bacterial infection in the evolution of the lesions. However, we submit that the pathogens play a critical role only in the terminal stages of lesion development.

2.3 Digestion and genetics in broilers

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Poultry production will increase in the future to meet the feed demand of the growing human population. This will increase the pressure on land use to produce cereals and proteins for poultry diets and also the environmental pressure due to the increase of poultry manure discharge. Selecting birds able to digest more varied and less optimal diets could be a way to minimize these negative impacts of poultry production. Projects developed at INRA to reach this goal were focused on three different axes.

We first demonstrated that selection for digestive efficiency was possible by creating divergent lines selected for high (D+) or low (D-) digestive efficiency using a diet difficult to digest. We also showed that the success of the selection is diet-dependent. We also identified several genomic regions having an effect on digestive efficiency that should soon be confirmed by gene expression analyses.

In a second step, we studied the physiological consequences of selection on digestibility to understand which mechanisms were affected. The development of the digestive tract is a key factor in differences observed between the D+ and D-. Major differences have also been observed on feed retention time, excretion traits and microbiota composition. D+ birds expressed higher behavioural inhibition in novel environments but reduced food neophobia compared to D- birds.

In a third step, we tried to assess the impact of this selection on a wide range of traits related to the economic, social and environmental pillars of sustainability. The D+ birds have a positive impact on economic and environmental traits, with better efficiency, lower consumption, and lower manure production. The two lines were not different on general activity and health traits, apart from a better bone yield and resistance to colibacillosis in D+ line. The D- birds were more sensitive to the diet than D+ birds.