

State of the art in understanding interorgan crosstalk and physiology in farm animals

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One of the challenges for livestock production is to manage phenotypic traits associated with health and production performance across diverse production systems in a wide range of climatic conditions and agro-ecological practices. Such a management requires a better understanding of the physiology of key tissues and organs involved in these traits. Therefore, it is important to determine the mechanisms behind the traits (feed efficiency, body composition, meat quality) and their regulation along physiological states (lactation, reproduction, growth) and in changing environments (robustness), and to get an integrated view at the level of the animal. Inter-organ communication, so called organ crosstalk, is required to regulate the different physiological functions, and to orchestrate multiple signalling molecules to maintain body homeostasis. In this review, we will show that tremendous opportunities are now offered for ruminants and pigs with the recent advances in: (1) omics (transcriptomics, proteomics, lipidomics) technologies for the profiling of organs and biofluids, and the knowledge of mediators in extracellular communication (e.g. microvesicles/exosomes); (2) *in silico* analysis with bio-informatics prediction tools (secretome/surfaceome, interaction networks); (3) integration of heterogeneous data (including multivariate analyses, clustering, network inference, graphs); (4) biosensing technologies; and (5) organ-on-chip systems. This will be helpful to get a holistic view for production and adaptation traits (incl. symbiotic interactions with resident microbiota), and to discover biomarkers to develop minimally invasive phenotyping tools to qualify these traits and assess the impact of rearing practices.
