

## Toward Decoding Sub-Fertility in Boars

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It is well understood within human and livestock species on the importance of semen assessment prior to the production of semen doses for use in artificial insemination (AI). When preparing semen doses for AI there are several methods and assays used to accept or decline a semen collection that will proffer enough functional sperm to achieve fertilization. Nevertheless, even though a semen collection can be accepted based on established semen quality thresholds (i.e. concentration, motility, morphology) the assays are unable to identify the sub-fertile male. Towards a better understanding of the sub-fertile boar, there is, assumedly, a transition period during which the animal moves from a healthy or “wellness” state to an unhealthy state wherein the production of functioning sperm is compromised and yet passes all assays suggesting normality and functional. The notion of identifying a sub-fertile male at the time of sexual maturation via semen evaluation or breeding soundness exam is already too late assuming sub-fertility to be the ‘tip of the iceberg’. Albeit a hurdle will be to quantify and characterize an individual male’s wellness state. And yet perhaps leveraging the application of omics could provide molecular signatures and biomarker reference values over the course of a male’s life as associated with wellness allowing abnormal states detectable months and/or weeks ahead of breeding age. As a boar grows from a piglet to a weaned pig, to a grower, to adult, and to older adult he progresses through *phenomes* at various times so the male phenome is continuously changing over time. Phenomics measure three elements (genome, behavior, and environment) that come together to form a phenome at a given point in time. These three fundamental elements could be characterized in boars by looking at proteins, metabolites, lipids, and blood biomarkers per a longitudinal approach from newborn to sexual maturation and beyond. Studying the phenome would provide a reference as to what is normal/healthy/functional versus what is unhealthy/abnormal/low functional. The notion to collate omics towards characterizing a boar’s wellness over an 18-month period is proposed. Establishing reference values for various metabolites, lipids, hematology is a step in the direction of a future approach that would identify boars possessing biomarkers that are counter-productive to being a fully functional breeding male having acceptable fertility.