

European Network on Livestock Phenomics (EU-LI-PHE): an international initiative aimed at facilitating the application of phenomics in animal breeding

Fontanesi Luca^{*[1]}, Norton Tomas^[2]

[1] University of Bologna, [2] KU Leuven

Phenomics is an emerging field in applied biology, including animal husbandry and breeding, that aims to comprehensively characterize the phenome, defined as the full set of physical and molecular traits of an animal. It involves diverse methods and technologies to collect, analyze, and use high-dimensional phenotypic data at the whole-animal level. In livestock production, accurate phenotypic data support the definition of breeding goals, improve selection programs, and guide management decisions related to reproduction, health, and welfare. Consequently, phenomics is increasingly viewed as a key driver of sustainable animal production. The scale and complexity of phenotyping data place phenomics within big data science, requiring advanced analytical methods. Precision livestock farming (PLF) technologies have improved monitoring of health, welfare, and performance, though robust farm-ready solutions across species remain challenging. There is strong overlap between PLF and breeding phenotyping approaches. The European Network on Livestock Phenomics (EU-LI-PHE, COST Action CA22112) promotes interdisciplinary collaboration and training through four thematic working groups and one cross-cutting group.

Several key challenges in livestock phenomics research and innovation remain largely unaddressed or only partially resolved. These challenges are organized into four main thematic areas, which correspond to the working group (WG) structure of the EU-LI-PHE COST Action: WG1, Phenotyping technologies; WG2, Genome-to-phenome integration; WG3, Computational resources and data analysis methodologies; WG4, Economic impact, regulation, policy, and societal aspects. In addition to these four technical pillars that form the scientific foundation of the initiative, a fifth working group, WG5 (Stakeholder engagement, communication, and dissemination), plays a cross-cutting role within EU-LI-PHE.

EU-LI-PHE encompasses approximately 500 WG members from over 50 different countries, who are experts in a variety of disciplines. The limited availability of high-quality phenotypic data is a key bottleneck in animal breeding. The European Network on Livestock Phenomics (EU-LI-PHE) brings together multidisciplinary experts to foster collaboration, innovation, and training in this field. It aims to advance phenotyping tools, integrate genomic and phenomic data, develop analytical resources, address ethical aspects, and support sustainable, competitive livestock production.