CA22112 – 2023-2027

EU-LI-PHE

EUROPEAN NETWORK ON LIVESTOCK PHENOMICS

European Network on Livestock Phenomics (EU-LI-PHE): Boosting Phenotyping in Livestock Species

Funded by the European Union

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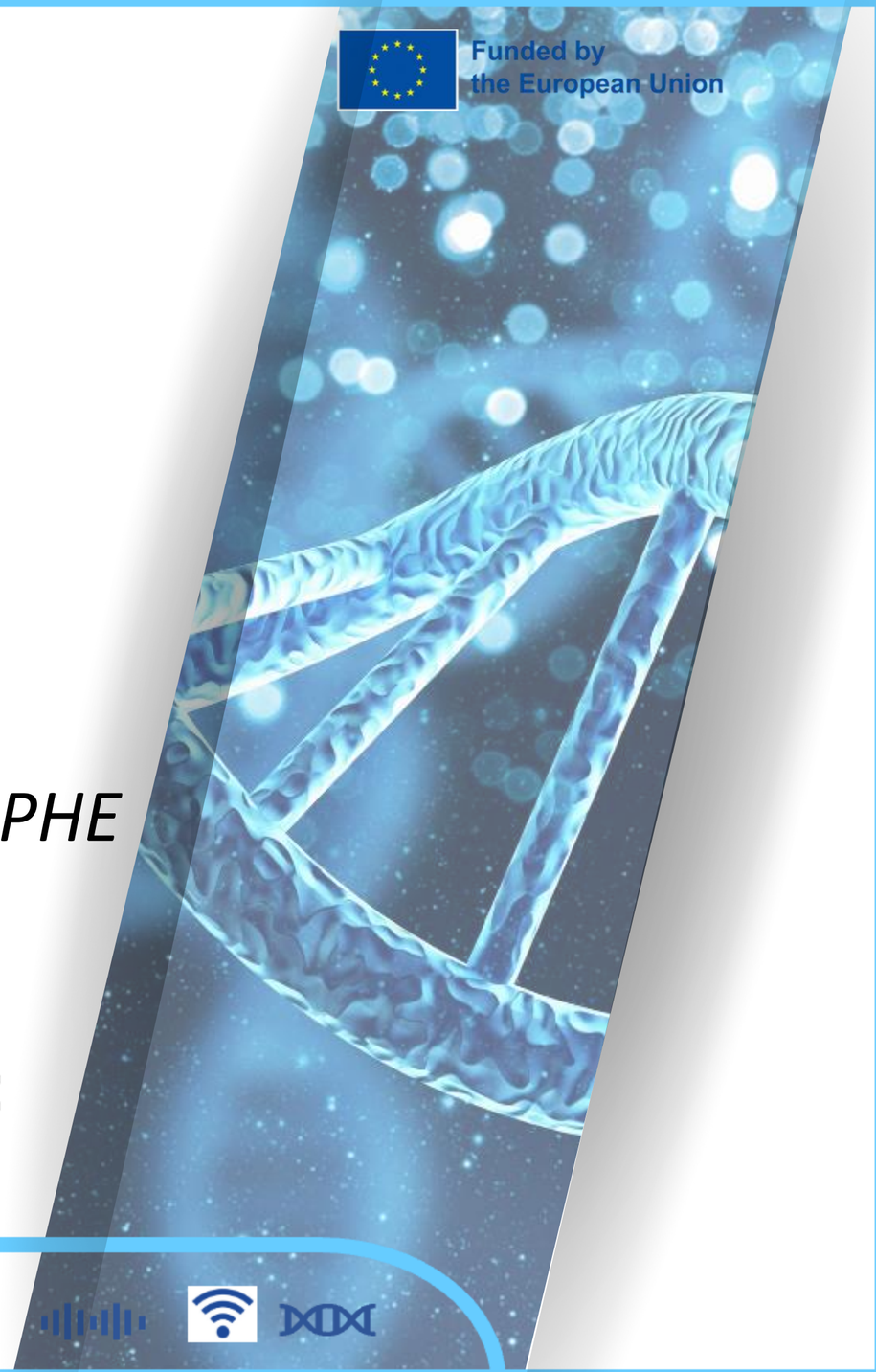

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Working Group 5 Leader

INSTITUTE

Background concepts (I)

1. Phenotyping is increasingly being recognized as a limiting factor in all applications of livestock genetics and genomics.

2. Phenotyping is fundamental to routine and daily management of livestock populations in order to optimize reproduction strategies, disease control and welfare of the animals.

We need:

- new phenotypes
- new ways to measure phenotypes
- new ways to use phenotypes

Background concepts (II)

- Phenomics is emerging as a major new technical discipline in biology.

- **Phenomics can be defined as the ensemble of methodologies and technologies for the acquisition, analysis and exploitation of high-dimensional phenotypic data on an organism-wide scale.**

Action challenge

Foster the development, integration, organization and practical implementation of technologies, tools, methods, approaches, models, expertise and resources useful to scan and interpret the **animal phenome** to pave the way for **novel scientific knowledge** and **applications** in the **livestock production sectors.**

Animal phenome:

The physical and molecular traits of an animal

Classification of the phenotypes

Animal phenotypes can be classified in different ways:

1) **according to the level in which they are measured** (e.g., cell, tissue, organ, or whole organism);
2) **the type of information that is recorded;**
3) **the temporal acquisition of the information** (e.g., a single event, a continuous event, or a combination of events);
4) **the objective of the collected parameters.**

Classification of the phenotypes

Targeted phenotypes can be:

1) **dynamic** (changing rapidly within short periods of time);
2) **stable** (minimal change across a predetermined time window).

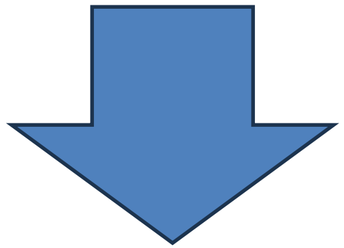
Classification of the phenotypes

Depending on the level of analysis, phenotypes can be classified as:

i) **external or final phenotypes** (e.g. performance, morphological, disease resistance and behavioral traits);
ii) **internal or molecular phenotypes (endophenotypes)** (e.g. the level or the presence/absence of different types of biomolecules, and their modifications, in animal biofluids and tissues and so on).

Final phenotypes are determined by the contribution and interplay of many molecular phenotypes (with multi-level relationships) and their interaction with environmental factors.

Broad heterogeneity in phenotype classes



A wide array of scientific approaches and technologies can be used to capture and manage phenotypic information

Research Coordination Objectives (I)

1. Advancing state-of-the-art high-throughput technologies and protocols required for deep phenotyping which can describe phenotypic information at multiple levels in farmed animals (**WG1**)
2. Providing cross-disciplinary knowledge to develop new standards in phenotyping technologies, phenome data descriptors, phenotype ontologies, databases, data structures, storage and sharing, in line with open science policies (**WG1** and **WG3**)
3. Evaluating available software and bioinformatic tools and defining methods for effective data mining, processing, summarization, integration and visualization of genome/epigenome to phenome data in livestock (**WG2** and **WG3**)
4. Exploring integrative dynamic responses and adaptations of animal phenomes to variable environmental factors (**WG2**)

…

Research Coordination Objectives (II)

5. Exploring novel data integration and fusion approaches including omics and sensor data, images, videos and animal movement and sound data for generation and visualization of complex system models of livestock populations to facilitate prediction of interventions and outcomes (**WG3**)

6. Investigating and proposing new applications for genomic selection and precision livestock farming (PLF) (**WG3**)

7. Exploring the regulatory landscape around livestock phenomics, including ownership of the data, open access data policies and intellectual property rights (**WG4**)

8. Analysing stakeholder opinions and societal perceptions of innovations in this field for the reduction of negative impacts on the animals and on the environment (e.g., to increase resistance to infectious disease, improve animal welfare and reduce environmental impacts) (**WG4**)

Capacity Building Objectives

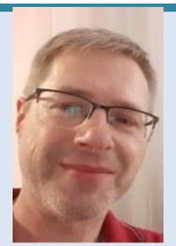
1. Providing well-trained Young Researchers and Innovators (YRI) and professionals in livestock phenomics and related disciplines that complement and complete the background and knowledge needed for the alignment of scientific progress and industry demands

2. Fostering the exploration and implementation of new training routes and methodologies, some of them based on e-learning environments, with the aim of widening career prospects of highly specialized researchers who can accumulate integrated skills on different disciplines around big data production and analysis, with an interdisciplinary vision

3. Stimulating new ideas and innovative methodologies in an open innovation framework to address new opportunities generated by livestock phenomics approaches with a comprehensive strategy of communication and dissemination and to benefit the whole scientific community, the relevant industrial sectors and all stakeholders, including policy and decision makers

4. Fostering the involvement and collaboration of teams from less research-intensive countries across Europe; promoting their inclusiveness, through the sharing of new knowledge around a network of opportunities focused on livestock phenomics generated by other COST Members and International Partner Countries (IPC) with more developed research ecosystems

Structure



- Chair: Prof. Luca Fontanesi
- Vice Chair: Prof. Tomas Norton

- **63** Management Committee members from **35** countries

- **360** Working Group members from **50** countries
  - **202 males + 158 females**
  - **136 from ITC**
  - **186 are YRI**

360 WG Members from 50 countries (01/09/2024)

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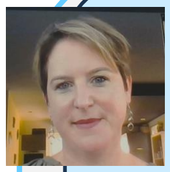


Hélène Soyeurt

Jarissa Maselyne

WG1
Phenotyping technologies

Emily Clark

Andreia Amaral

David MacHugh

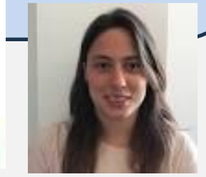
Claudia Kasper

WG2
Genome to phenome integration

WG3
Computational resources and methodologies for data analyses

Michael J. Toscano

Elma Zanaj



Cristina Casto-Rebollo

WG4
Economic impact, regulations, policies, and society

Livia Vidu

Grant Awarding Coordinators

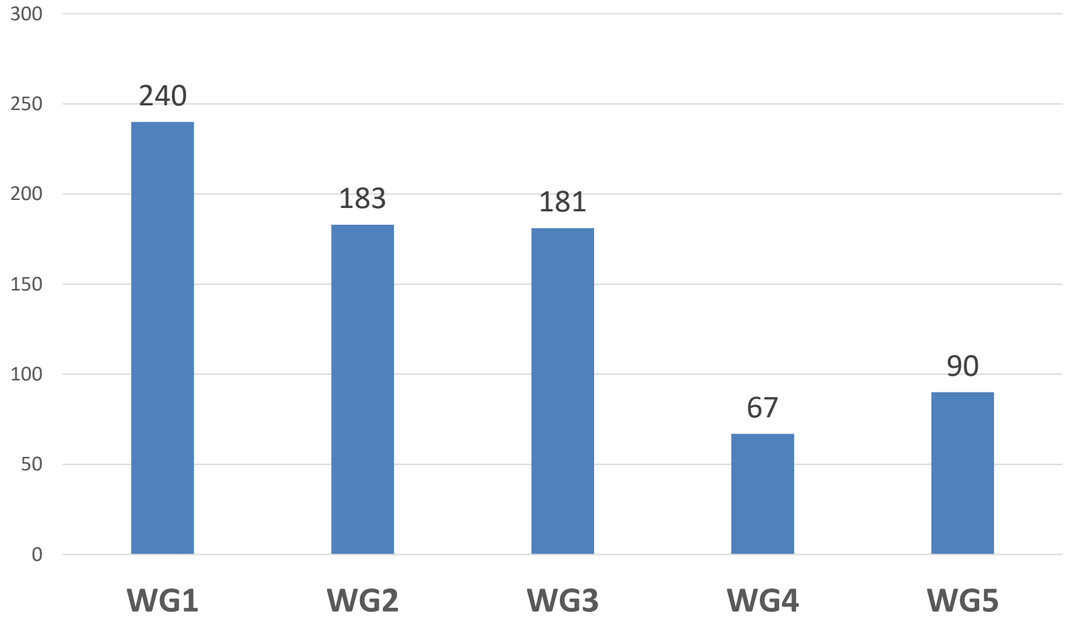
- Ivona Djurkin Kusec
- Despoina Karatosidi

WG5
Stakeholder engagement, communication, and dissemination

Adna Ašić

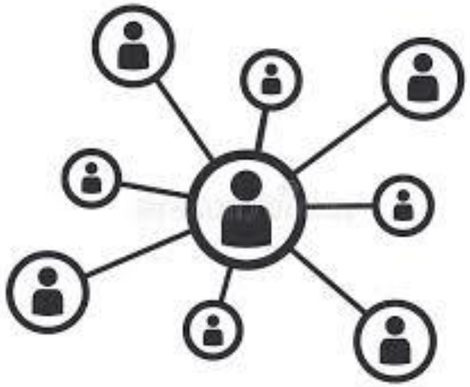
Geena Cartick

Members divided by WG (01/09/2024)



EU-LI-PHE Networking tools

- Meetings
- Grants to attend third party conferences
- Training schools (WG1-WG4)
- Short-Term Scientific Missions (STSMs)
- Virtual mobility grants
- Dissemination activities (social media)



Meetings, workshops conferences, and conference grants

Training schools

Short-term scientific missions

Dissemination activities

Virtual networking grants

- Job placement/announcement service
- Midterm stakeholder meeting
- Support service from the Enterprise Europe Network (EEN)
- Demonstration activities

WG1. Phenotyping technologies

Main aims:

i) Provide an overview of current phenotyping technologies and infrastructures that can be used for applications in livestock phenomics;

ii) Define a roadmap of the research needs to capture high-dimensional phenotypic information on an animal-wide scale.

Task 1.1. Phenotyping technology mapping.

Task 1.2. Standardization of phenotyping systems and information.

Task 1.3. R&D infrastructures.

Task 1.4. Identification of technology gaps and research needs.

Task 1.5. WG1 training school, WG1 meetings and STSMs.

WG1. Phenotyping technologies - Deliverables

WG	Deliverable number	Deliverable name	Delivery date - semester=sem	M
1	D1.1	A document/report with a list of phenotyping technologies/approaches that can be used in livestock phenomics	2nd sem, year 1	12
1	D1.2	A document/report with (a) proposal(s) to establish standardization rules and/or systems in livestock phenomics	2nd sem, year 2	24
1	D1.3	A document/report with a list/map of R&D infrastructures in different countries	2nd sem, year 1	12
1, 2, 3, 5	D1.4, D2.4, D3.4, D5.4	A white paper focused on research gaps and priorities in livestock phenomics	2nd sem, year 4	48
5 (1, 2, 3, 4)	D5.1, D5.6	A special themed issue/section of a scientific journal for submission of Action manuscripts and reviews	2nd sem, year 3 (and every year)	36

WG2. Genome to phenome integration

Main aims:

i) Provide an overview of the links between genome/epigenome variation and phenotypic variation at multiple levels in the main livestock species;

ii) Identify synergies with related initiatives on functional analyses of livestock genomes (e.g., the FAANG initiative);

iii) Identify knowledge gaps and research needs and provide a road map with a clear trajectory to new applications.

Task 2.1. Genome biology and phenome differences.

Task 2.2. Expand genome information with phenome data.

Task 2.3. Applications of genome to phenome information.

Task 2.4. Identification of knowledge gaps and research needs.

Task 2.5. WG2 training school, WG2 meetings and STSMs.

WG2. Genome to phenome integration - Deliverables

WG	Deliverable number	Deliverable name	Delivery date - semester=sem	M
2	D2.1	A document/report including information of initiatives and projects focused on genome to phenome integration in livestock species. This list is updated regularly every year (a document/report and a continuously updated web portal with links to initiatives/projects and case studies).	2nd sem, year 1	12
2	D2.2	A document/report with (a) proposal(s) to establish genome annotation systems with phenome data and information	2nd sem, year 2	24
2	D2.3	A review on the current and potential applications by integrating genome and phenome information	1st sem, year 3	30
1, 2, 3, 5	D1.4, D2.4, D3.4, D5.4	A white paper focused on research gaps and priorities in livestock phenomics	2nd sem, year 4	48
5 (1, 2, 3, 4)	D5.1, D5.6	A special themed issue/section of a scientific journal for submission of Action manuscripts and reviews	2nd sem, year 3 (and every year)	36

WG3. Computational resources and methodologies for data analyses

Main aims:

i) Provide an overview of the computational models, methods and tools available and current and future needs for development of applications in the context of livestock phenomics;

ii) Identify the needed synergies and developments in terms of cyberinfrastructures and computational capabilities.

Task 3.1. Development and application of new computational models and methods.

Task 3.2. Definition of data structure, computational standards, formats, and metadata.

Task 3.3. Computational infrastructures and computing capabilities.

Task 3.4. Identification of research needs and bottlenecks.

Task 3.5. WG3 training school, WG3 meetings and STSMs.

WG3. Computational resources and methodologies for data analyses - Deliverables

WG	Deliverable number	Deliverable name	Delivery date - semester=sem	M
3	D3.1	A document/review including an overview of computational models and methods needed to explore/exploit livestock phenomics	1st sem, year 2	18
3	D3.2	A document/report including proposals to establish standardized databases and computational procedures useful for livestock phenomics	1st sem, year 3	30
3	D3.3	A document/report with information of the existing cyberinfrastructures and computational capabilities available and those needed over the next decades, useful for livestock phenomics	2nd sem, year 3	36
1, 2, 3, 5	D1.4, D2.4, D3.4, D5.4	A white paper focused on research gaps and priorities in livestock phenomics	2nd sem, year 4	48
5 (1, 2, 3, 4)	D5.1, D5.6	A special themed issue/section of a scientific journal for submission of Action manuscripts and reviews	2nd sem, year 3 (and every year)	36

WG4. Economic impact, regulations, policies, and society

Main aims:

i) Provide an overview on the potential technological and economic impact of livestock phenomics;

ii) Summarize the regulatory frameworks around this discipline and evaluate access to information and data generated;

iii) Analyze societal perceptions of livestock phenomics.

Task 4.1. Impact analysis.

Task 4.2. Ownership of the data, regulations, and policies.

Task 4.3. Society: societal perceptions and consumer opinions.

Task 4.4. WG4 training school, WG4 meetings and STSMs.

WG4. Economic impact, regulations, policies, and society - Deliverables

WG	Deliverable number	Deliverable name	Delivery date - semester=sem	M
4	D4.1	A report or a review on the expected impacts and applications of livestock phenomics	1st sem, year 4	42
4	D4.2	A review of the regulatory framework including the major issues of concerns in livestock phenomics	1st sem, year 4	42
4	D4.3	A survey structure and a report obtained using the analyzed and evaluated data and opinions on livestock phenomics	2nd sem, year 3	36
1, 2, 3, 5	D1.4, D2.4, D3.4, D5.4	A white paper focused on research gaps and priorities in livestock phenomics	2nd sem, year 4	48
5 (1, 2, 3, 4)	D5.1, D5.6	A special themed issue/section of a scientific journal for submission of Action manuscripts and reviews	2nd sem, year 3 (and every year)	36

WG5. Stakeholder engagement, communication, and dissemination

Main aims:

i) To ensure a continuous engagement of the stakeholders;
ii) To ensure overall communication;
iii) To ensure publication of reviews, reports, surveys and establishment of a website and social medias.

Task 5.1. Stakeholder engagement and job announcement/search service.

Task 5.2. Communication and dissemination.

WG5. Stakeholder engagement, communication, and dissemination - Deliverables

WG	Deliverable number	Deliverable name	Delivery date - semester=sem	M
5	D5.2	A periodic newsletter	Every year	-
5	D5.3	A report or document that summarizes the outputs, activities, results and discussions from the stakeholder conference/demonstrations	2nd sem, year 2	24
5	D5.5	An Action website containing scientific and dissemination reports, teaching and training documents, the annual newsletters, announcements and list of scientific articles focused on livestock phenomics and related fields. This list is updated every year.	Every year, updated regularly	12
5	D.5.7	A book on livestock phenomics that will include basic and advanced chapters to benefit both experts and non-specialists	2nd sem, year 4	48
1, 2, 3, 5	D1.4, D2.4, D3.4, D5.4	A white paper focused on research gaps and priorities in livestock phenomics	2nd sem, year 4	48
5 (1, 2, 3, 4)	D5.1, D5.6	A special themed issue/section of a scientific journal for submission of Action manuscripts and reviews	2nd sem, year 3 (and every year)	36

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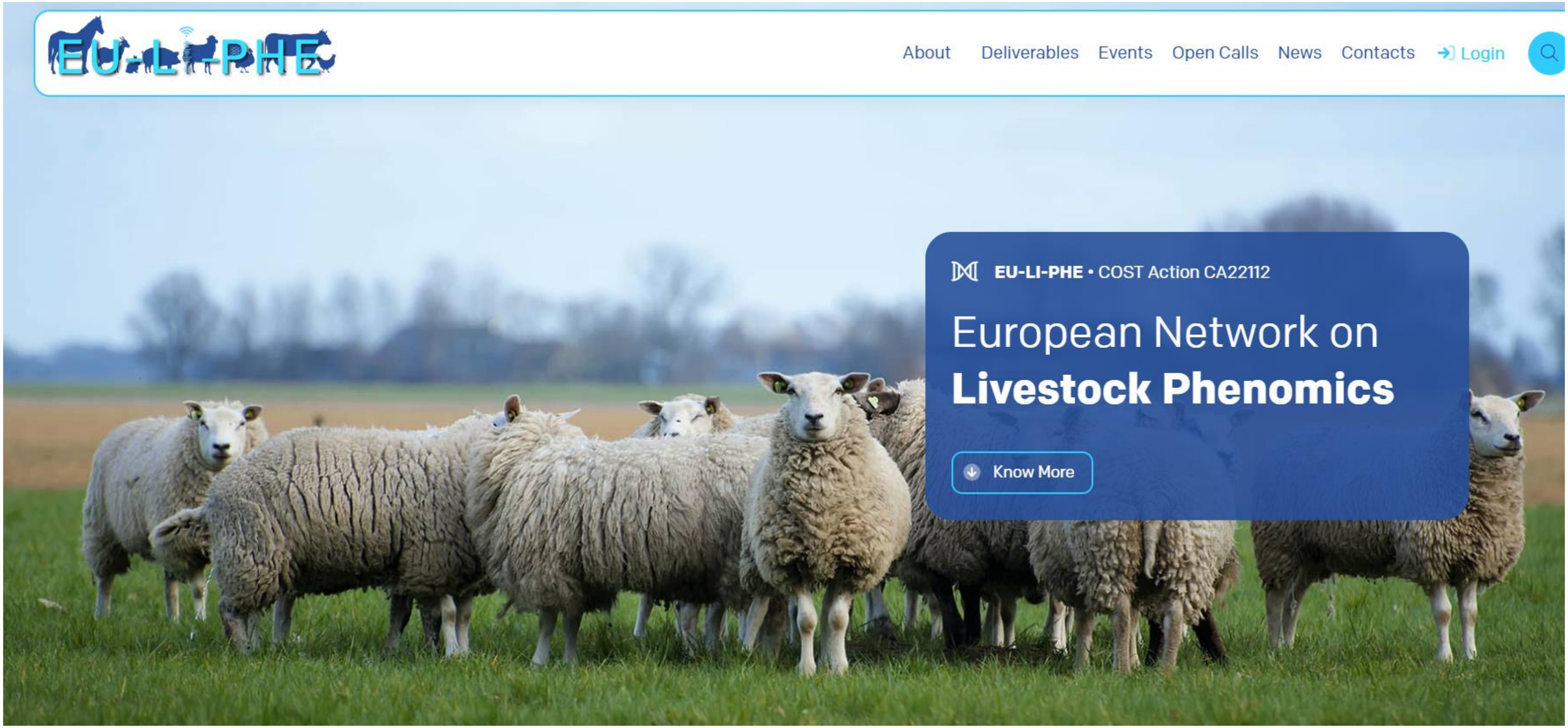

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First Annual Meeting: 11-12 June 2024

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

DEPARTMENT
OF AGRICULTURAL
AND FOOD SCIENCES

WG1 Training School: 18-21 June 2024

Phenotyping technologies in animals

ILVO
Flanders Research Institute for Agriculture, Fisheries and Food

ILVO (Merelbeke, Belgium)

YRI Committee Meeting: 5-6 September 2024

WG1 deliverables and
Action communication

University of Florence

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SCAN TO JOIN US

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SCAN TO FOLLOW US

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European Network on Livestock Phenomics (EU-LI-PHE): Boosting Phenotyping in Livestock Species

Adna Ašić

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