

# PhD School on Agriculture, Environment and Bioenergy

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(XL cycle, 2024-27)

## Project draft

**1. Field of interest:** *AGR/19 – Zootechnia speciale; INF/01 – Informatica*

**2. Project title:** *Exploring emotions through bioacoustic and behavioural analysis to enhance farm animal welfare*

**3. Tutor:** *Dr. Monica Battini*; **co-tutor:** *Prof. Stavros Ntalampiras*

### 4. Relevance of the topic and state of the art

The concept of animal welfare and its corresponding definition have evolved since the birth of the field of animal welfare sciences established by the Brambell Report in 1965 (Brambell Rogers, 1965). Since this report, which addresses animal welfare mainly as the avoidance of unnecessary suffering in animals, there has been an increasing interest in the understanding of affective states (i.e., emotions, moods) in animals (Mendl et al., 2010). A more recent shift is towards the investigation, assessment, and promotion of ‘positive experiences’ in animals (Ahloy-Dallaire et al., 2018). Positive animal welfare is a relatively novel concept, marking a shift in animal welfare science from a primary focus on minimising negative (mental) experiences in farm animal lives, towards promoting positive experiences. Several recent funded projects (European Partnership for Animal Health and Welfare; [www.eupahw.eu/pdf/projects/priority-%20area-2-blue/JIPs\\_SOA13.pdf](http://www.eupahw.eu/pdf/projects/priority-%20area-2-blue/JIPs_SOA13.pdf)) and COST actions (LIFT; <https://liftanimalwelfare.eu>) are prioritising the development of animal-based indicators of affective states to be included in welfare assessment protocols. However, much empirical work remains before having validated indicators to assess positive affective states. The validation process of indicators of positive affective states in farm animals should start with the determination of environments and situations that animals prefer and value, then use these contexts to induce positive states and collect behaviour, cognitive and physiological indicators. Studies conducted so far show that vocalizations and some behaviours, including body posture, and facial expressions, may be candidate indicators of positive affective states (Briefer et al., 2015; Padilla de la Torre et al., 2015). As to our knowledge, low frequency calls in ruminants are related to low arousal states, potentially with positive valence (Laurijs et al., 2021), as well as hanging ears and semi-closed eyes (Battini et al., 2019) that are usually expressed in relaxing and pleasant situations. Further research is needed to clarify some aspects of acoustic features related to affective states and body postures and facial expressions in ruminants require further investigation. The analysis of these indicators cannot be manually performed. Although the validation process involves an intensive human labelling, AI techniques are strongly needed to gather reliable and massive data (Ntalampiras et al., 2023).

Aim of this project is to explore the emotions of ruminants by collecting vocalizations and behaviours (e.g., body postures, tail movements, ear position and eye aperture) expressed in different contexts potentially related to positive affective states (e.g., maternal bond, food reward, affiliative social contacts).

### 5. Layout of the project (draft)

### 5.1. Materials & Methods

The research will be conducted on dairy ruminants, particularly goats and cows.

Farms: three cow farms are already involved in the national funded PRIN project “The caring dairy”, while four goat farms were included in a previous project (VOCAPRA).

Context: some contexts potentially related to positive (e.g., eating preferred feed, mother-kid reunion), neutral (e.g., routine feed) and negative (e.g., delay in feed distribution, mother-kid separation) affective states will be selected.

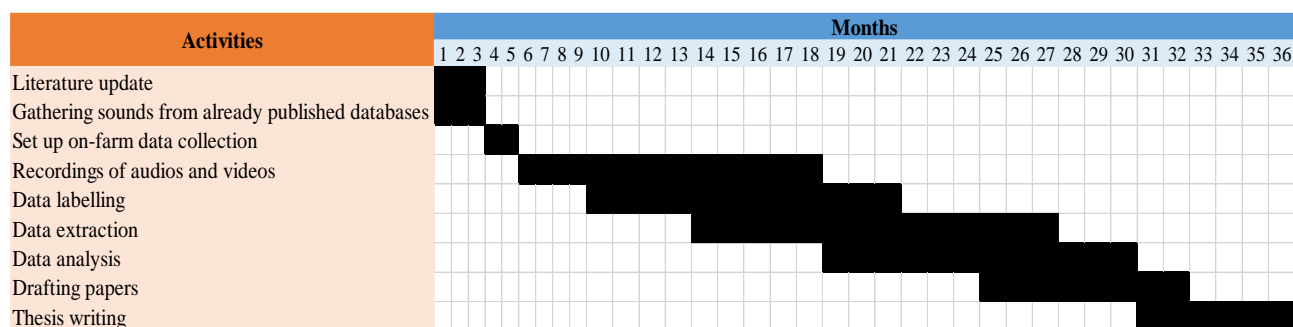
Recordings: audio- and video-recordings for dairy cows will be collected on farm, while for dairy goats, audio- and video recordings from VOCAPRA project will be made available, but further audio- and video-recordings will be performed on farm. Much of the huge amount of data from VOCAPRA has not been analysed yet, especially concerning the focus on positive contexts. Data will be collected by installing cameras on top of the pens and by mounting individual microphones Song Meter Micro for dairy cows and Sound Meter Acousting Recorder for goats (group recording).

Data labelling: the labelling of audio- and video-recordings will consist in manually annotating the context of emission of sounds (using Audacity software) and the behaviour and postures expressed (using BORIS software) to complete the ground truth.

Data extraction: a machine learning system will be trained to automatically recognize and extract vocalizations; behaviours observed will be used to train a deep neural network (e.g., DeepLabCut) will be trained to track behaviours and postures, increasing data collection details.

Data analysis: acoustic features will be analysed using specific softwares (e.g., PRAAT) together with behaviours to complement the two pieces of information and gather better insights into animal emotions.

### 5.2. Schedule and major steps (3 years)



### 6. Available funds (to support research):

European Partnership for Animal Health & Welfare (project funded and started on 1<sup>st</sup> January 2024, although the funds have not been uploaded yet): € 472,037.50 (total funding)

PRIN The caring dairy € 109,507.77 (total funding)

### 7. Co-Financing (to support the bourse): No

### 8. Literature:

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