

Heat stress and other common features of Precision Livestock Farming (PLF)

Discussion between Israeli and Italian Experts

WG2: Animal pathophysiology and biomarkers of heat stress in dairy cows

Dr. Maya Zachut, Department of Ruminant Science, Institute of Animal Science, Agriculture Research Organization, Volcani Center, Israel.

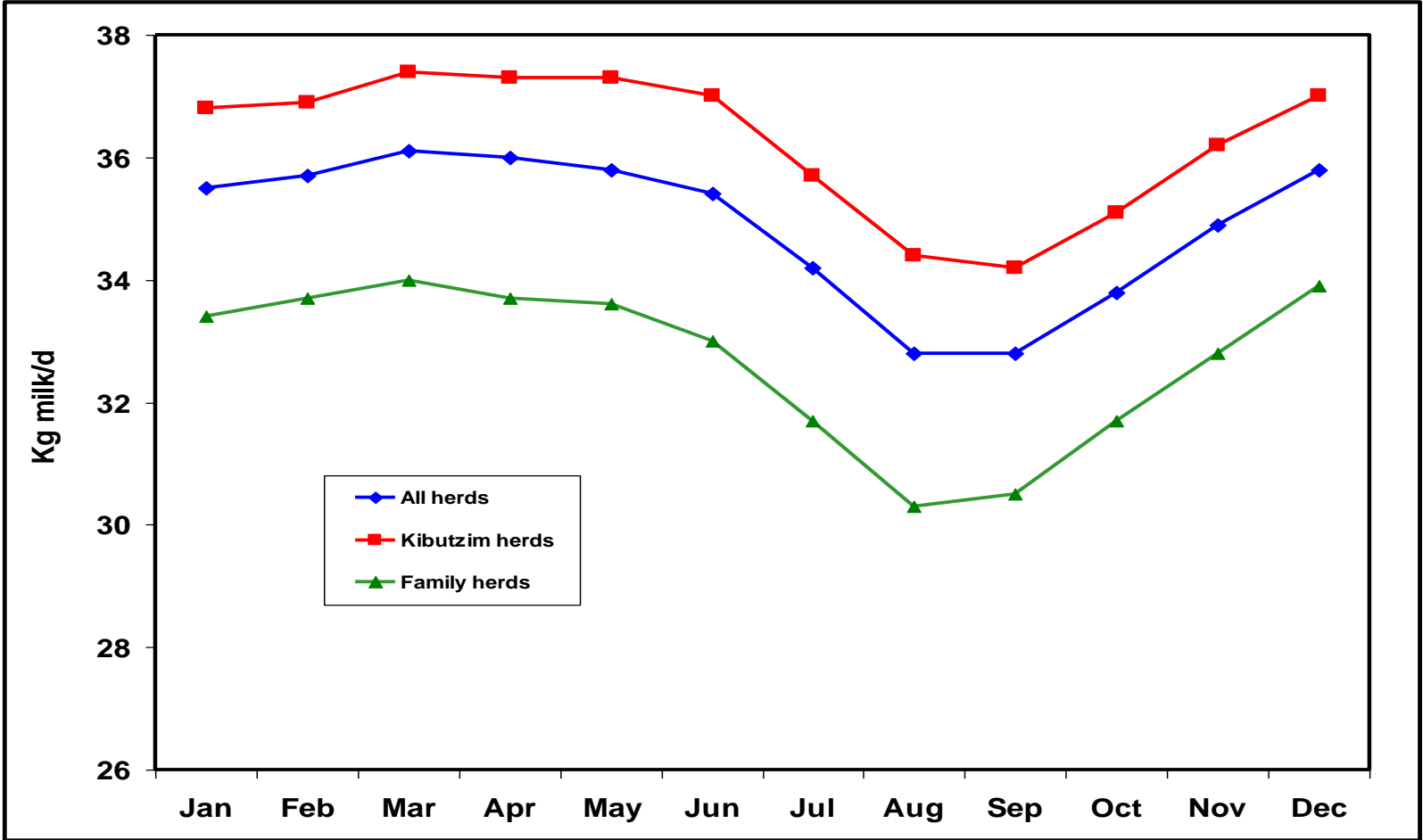
Dr. Bruno Stefanon, Department of Agrifood, Environmental and Animal Science, University of Udine, Udine, Italy.

Prof. Gianfranco Gabai, Department of Comparative Biomedicine and Food Science, University of Padova, Legnaro (PD), Italy.

Italy and Israel have a common interest in developing biomarkers of heat stress in dairy cows

- Heat stress is the main abiotic stressor that hampers production in dairy cows in both countries
- There is a need for objective, accurate and measurable biomarkers of heat stress in dairy cows – how do we define heat stress?
- Farmers in both countries need new tools to evaluate the degree of heat stress in their dairy farm to assess their heat stress management
- Scientists from both countries are working on the physiological response to heat stress in dairy cows

Heat stress decreases milk production



Heat stress reduces quality of milk for cheese industry

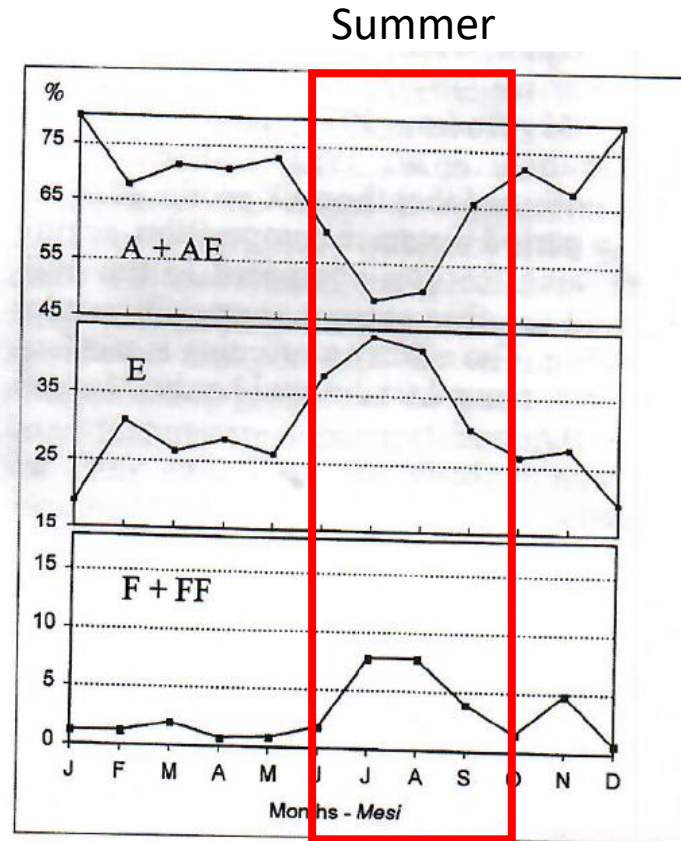
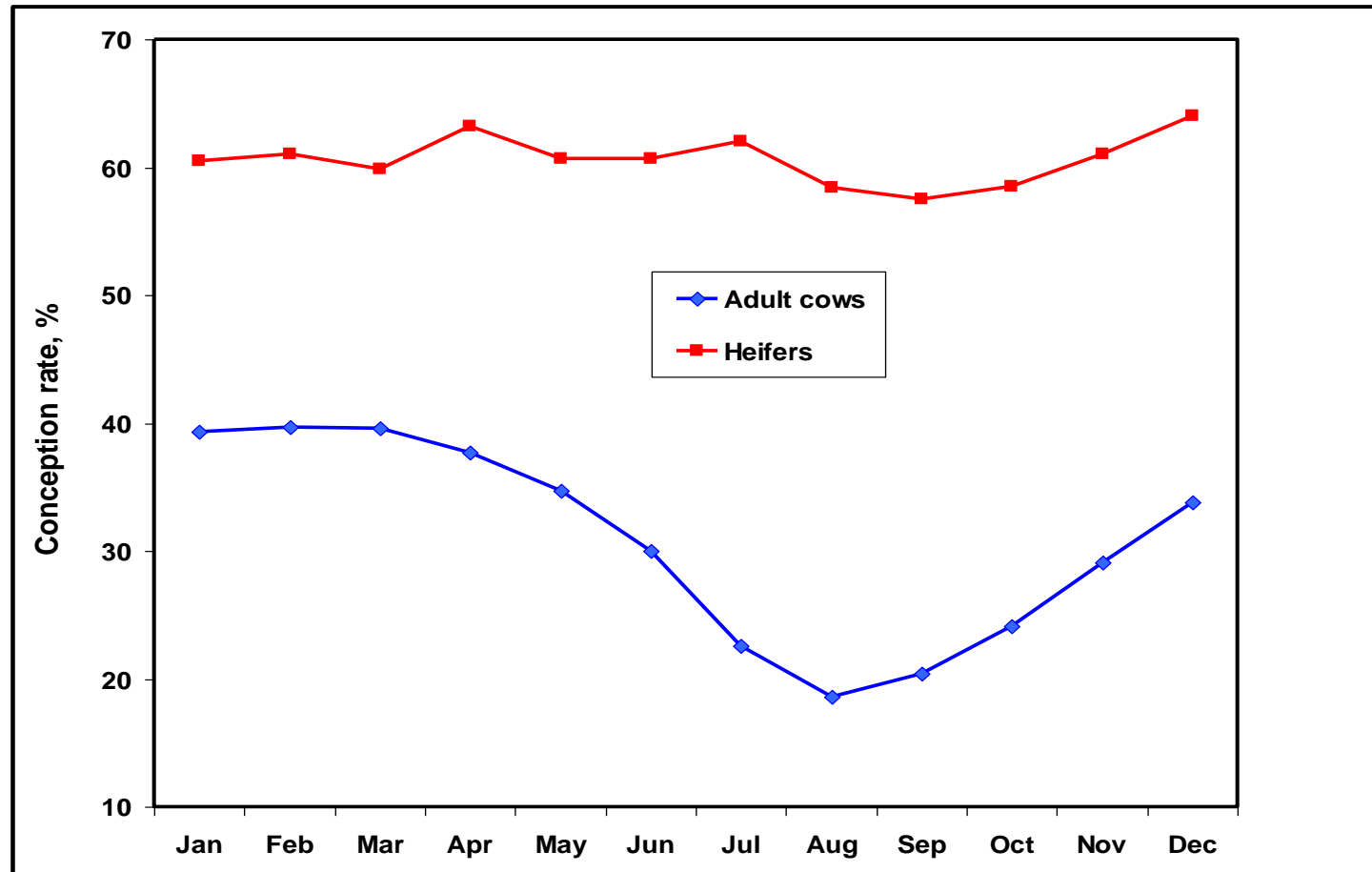
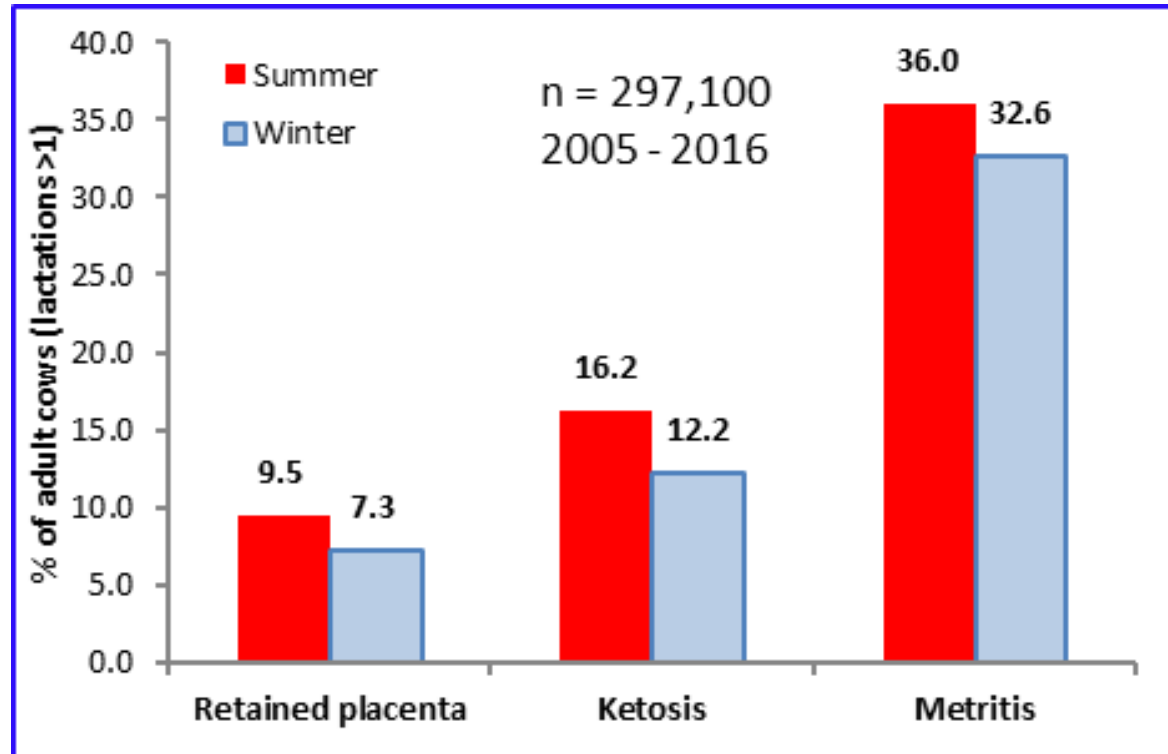


Figure 3 - Seasonal behaviour (mean of 3 years) of clotting features of milk produced in 405 herds, in Parma province, in a 3 years period (n = 11,530 bulk samples). Values as frequency % of the rennet coagulation types: A + AE = good coagulability; E = reduced coagulability; F + FF = bad and very bad coagulability (Mariani *et al.*, 1994).

Heat stress has negative effects on reproduction in dairy cows



Heat stress increases postpartum diseases in cows

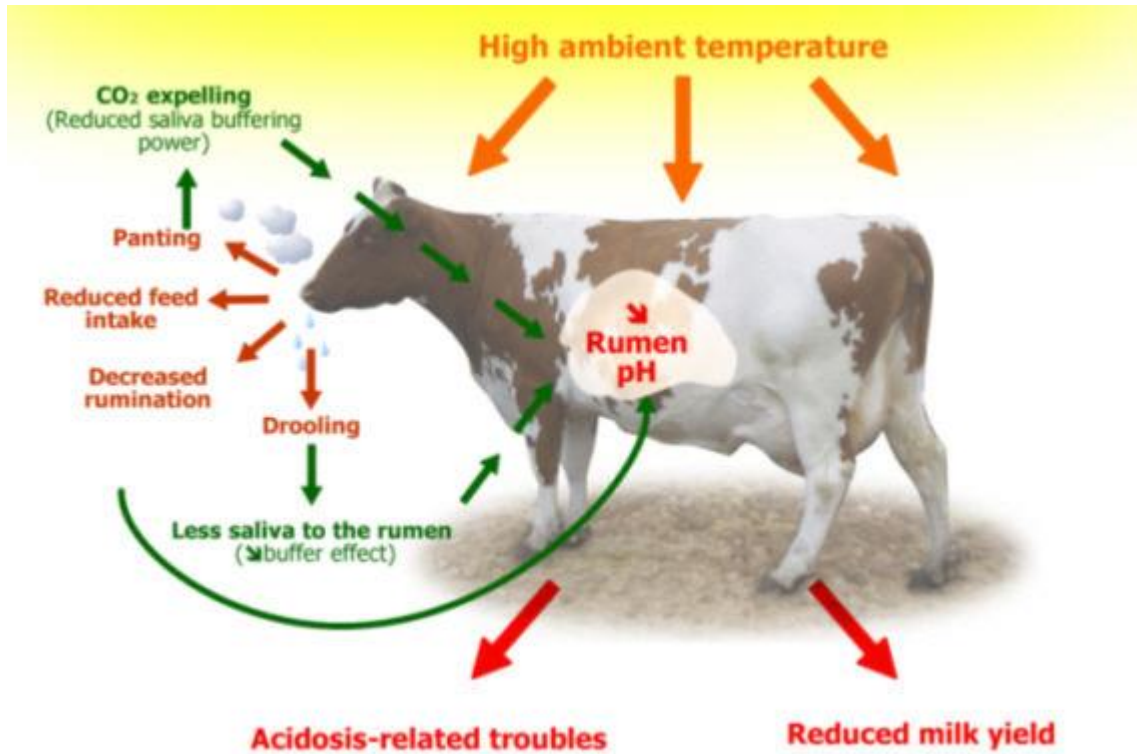


The Israeli Dairy Herd book data, Dr. Lavon

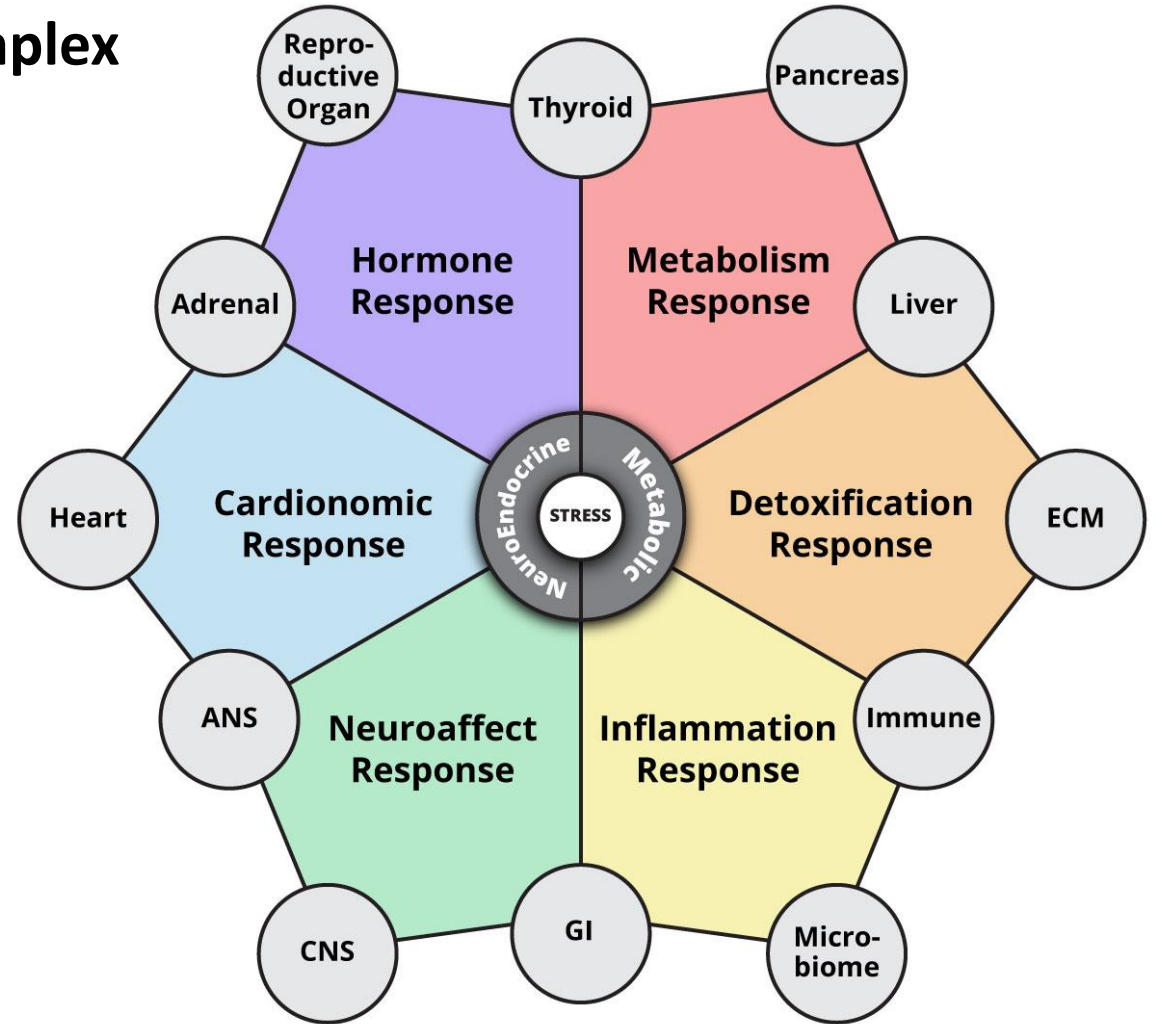
Signs of heat stress in dairy cows

- ❖ Increased body temperature over 39 degrees
- ❖ Increased respiratory rate - over 80 breathings per minute
- ❖ Drop (10% or more) in food consumption
- ❖ Drop (10% or more) in milk yield
- ❖ Decrease of rumination
- ❖ Decrease in activity and movement
- ❖ Increase in water intake
- ❖ Increase in water loss through evaporation

The physiological response to heat stress is complex



NeuroEndoMetabolic Stress ResponseSM



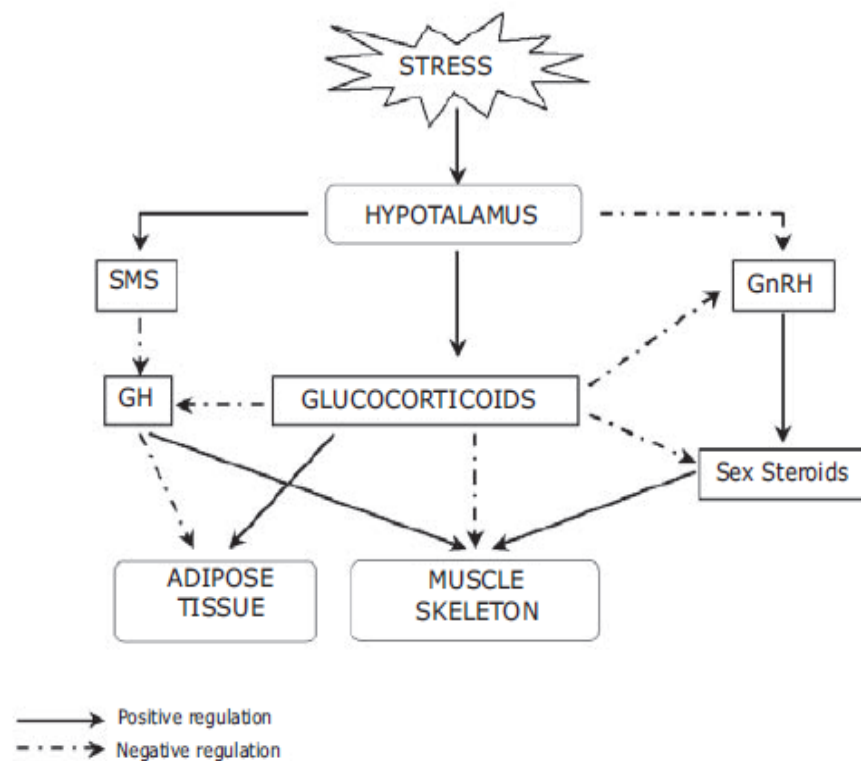
Immune system response to stress factors

Massimo Amadori¹, Bruno Stefanon², Sandy Sgorlon²,
Maura Farinacci²

¹Centro Substrati Cellulari, Brescia, Italy

²Dipartimento di Scienze Animali, Udine, Italy

Figure 2. Schematic representation of the interactions between the stress system and metabolic functions (adapted from Charmandari et al., 2005).





Review

Oxidative Stress and Nutraceuticals in the Modulation of the Immune Function: Current Knowledge in Animals of Veterinary Interest

Monica Colitti ¹ , Bruno Stefanon ¹, Gianfranco Gabai ² , Maria Elena Gelain ² and Federico Bonsembiante ^{2,*}

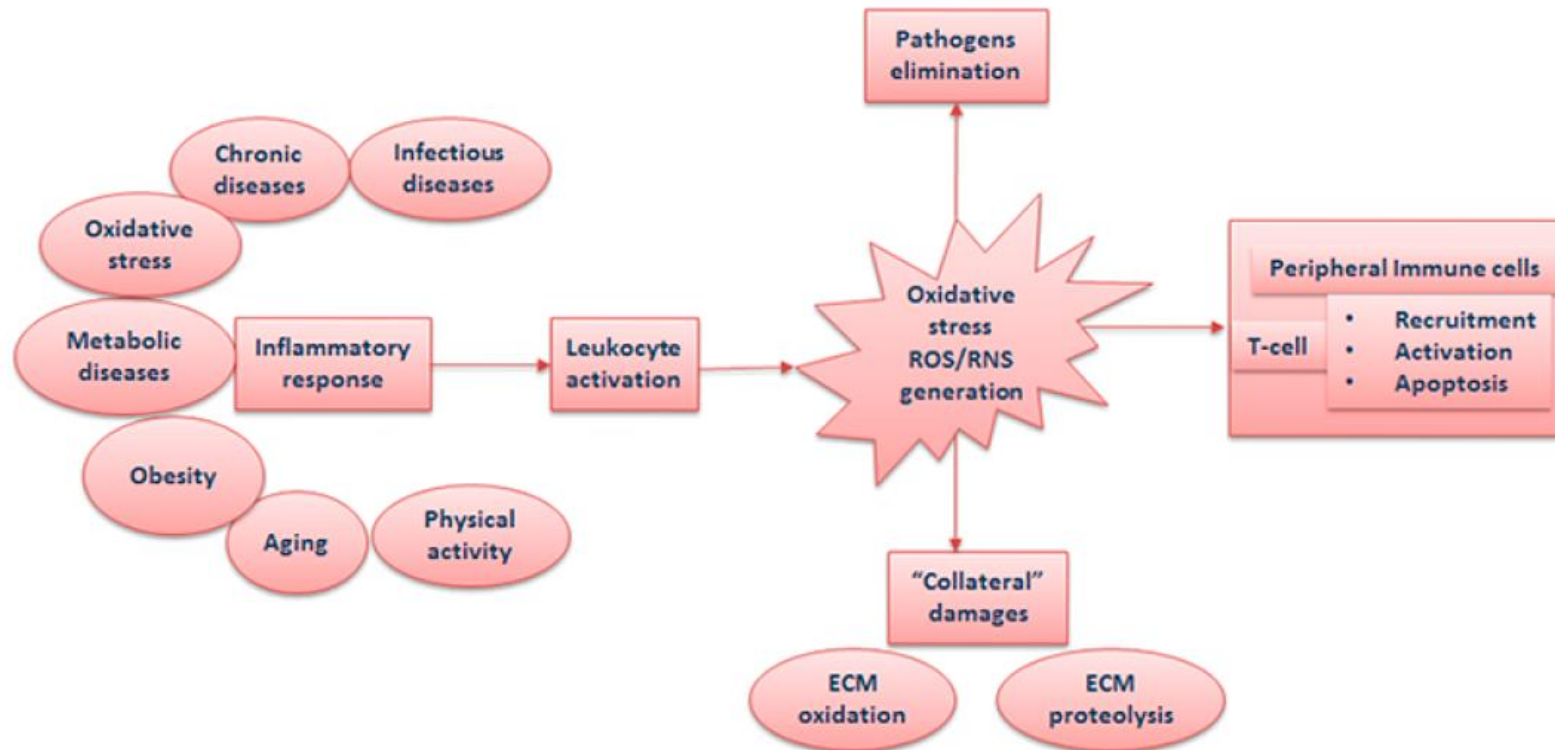
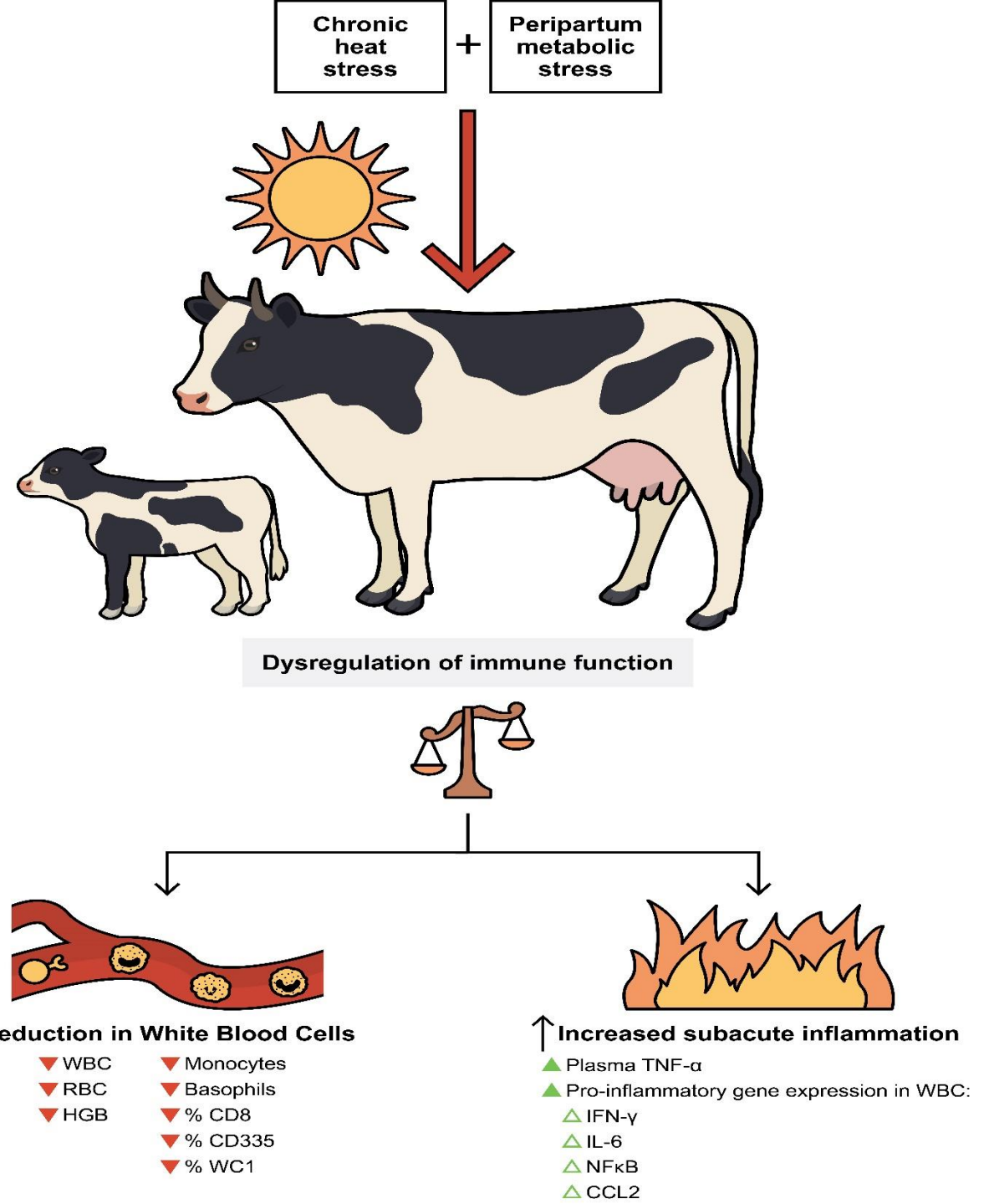


Figure 1. Schematic representation of the relationship among inflammation, oxidative stress, and leukocytes. ROS = reactive oxygen species; ECM = extracellular matrix; RNS: reactive nitrogen species.

Heat stress dysregulates immune function during in peripartum cows



Heat stress is one of the main topics for biomarker research in dairy cows

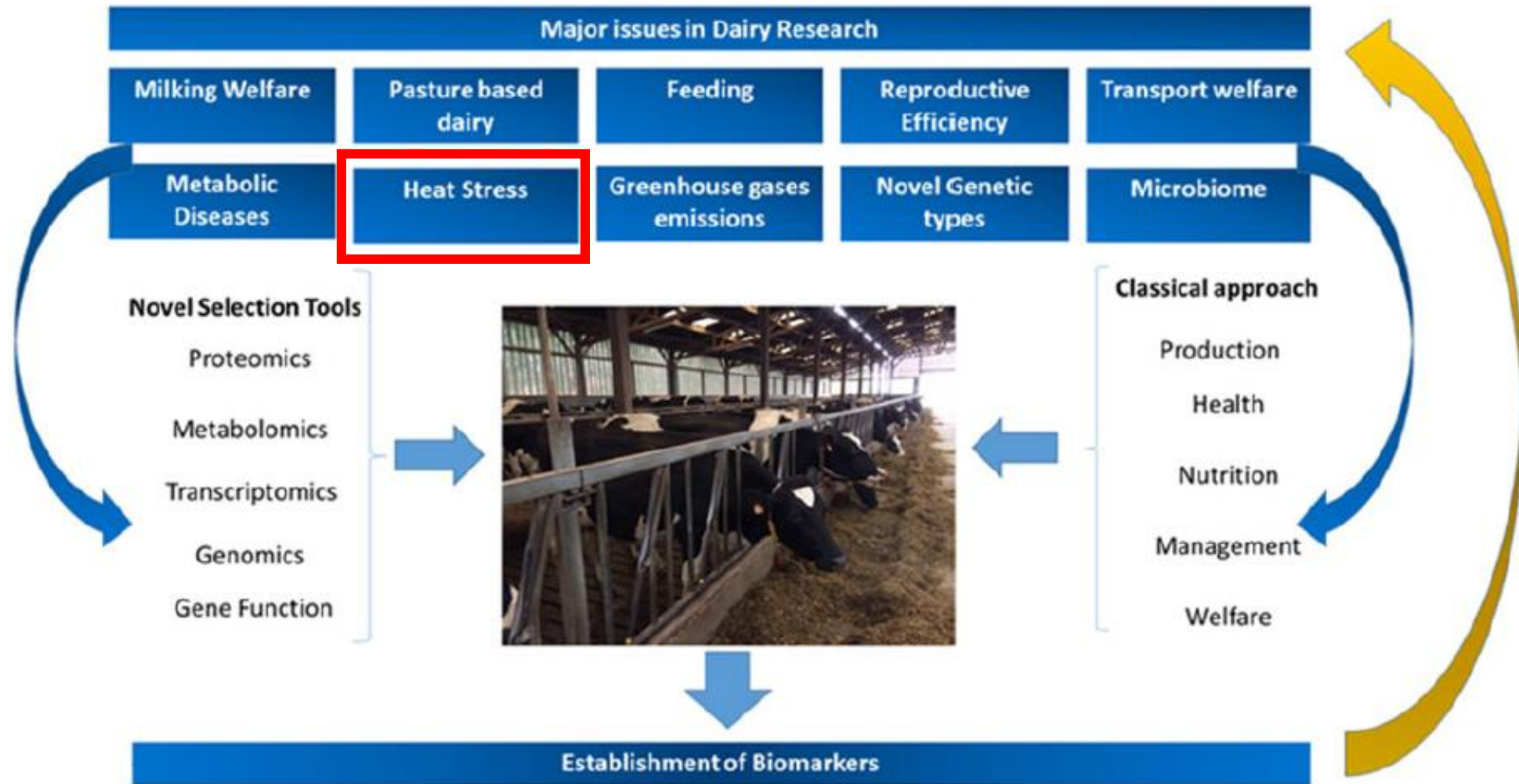


Fig. 1. Major challenges and areas of research in modern dairy production systems and how to address them, highlighting the importance of classical and novel selection tools as well as the establishment of biomarkers.

Omics can be used to identify new biomarkers for heat stress

D.M. Ribeiro, et al.

Journal of Proteomics 227 (2020) 103905

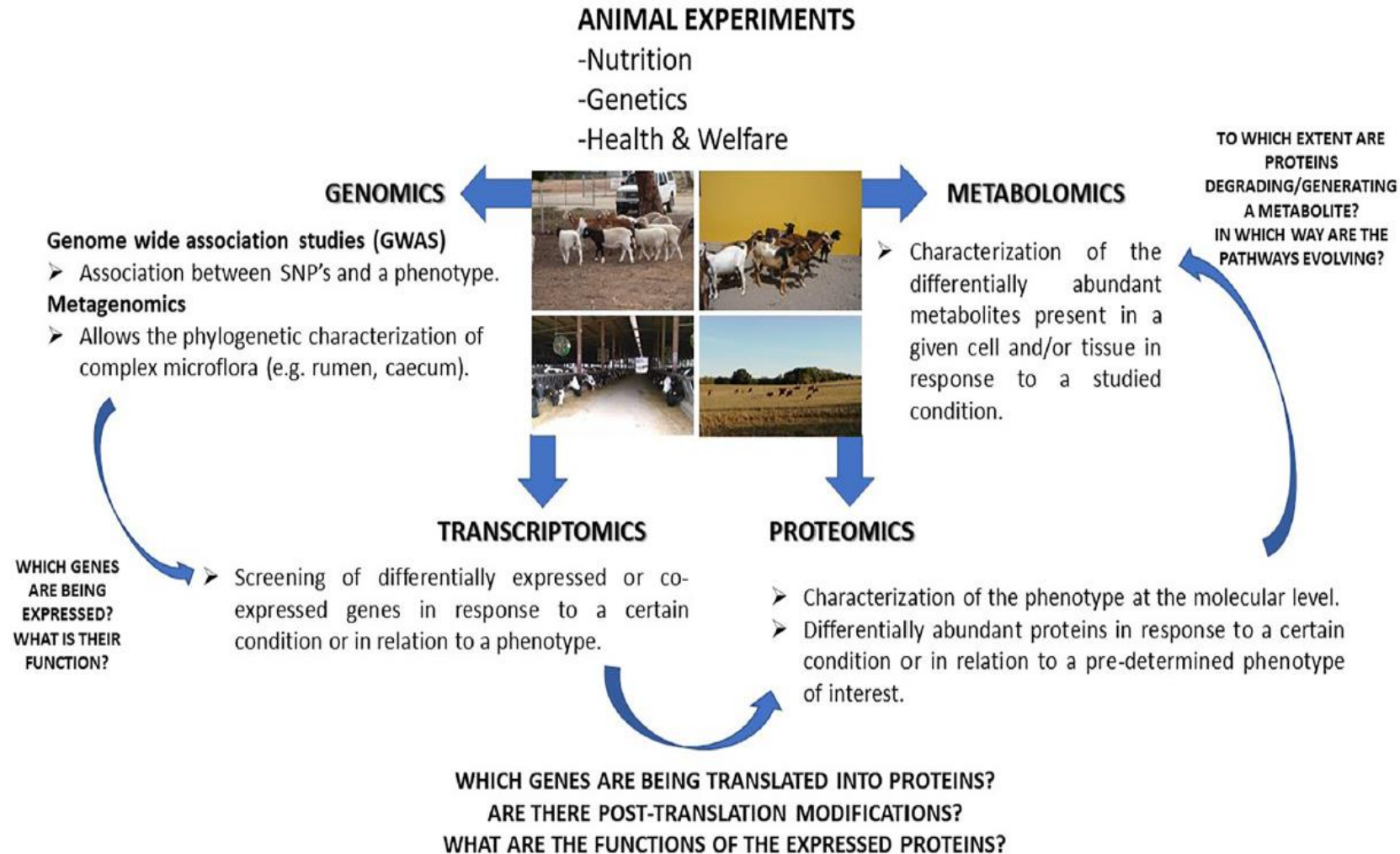


Fig. 1. Systems biology network applied to animal science experiments.

Potential biomarkers of heat stress in dairy cows

D.M. Ribeiro, et al.

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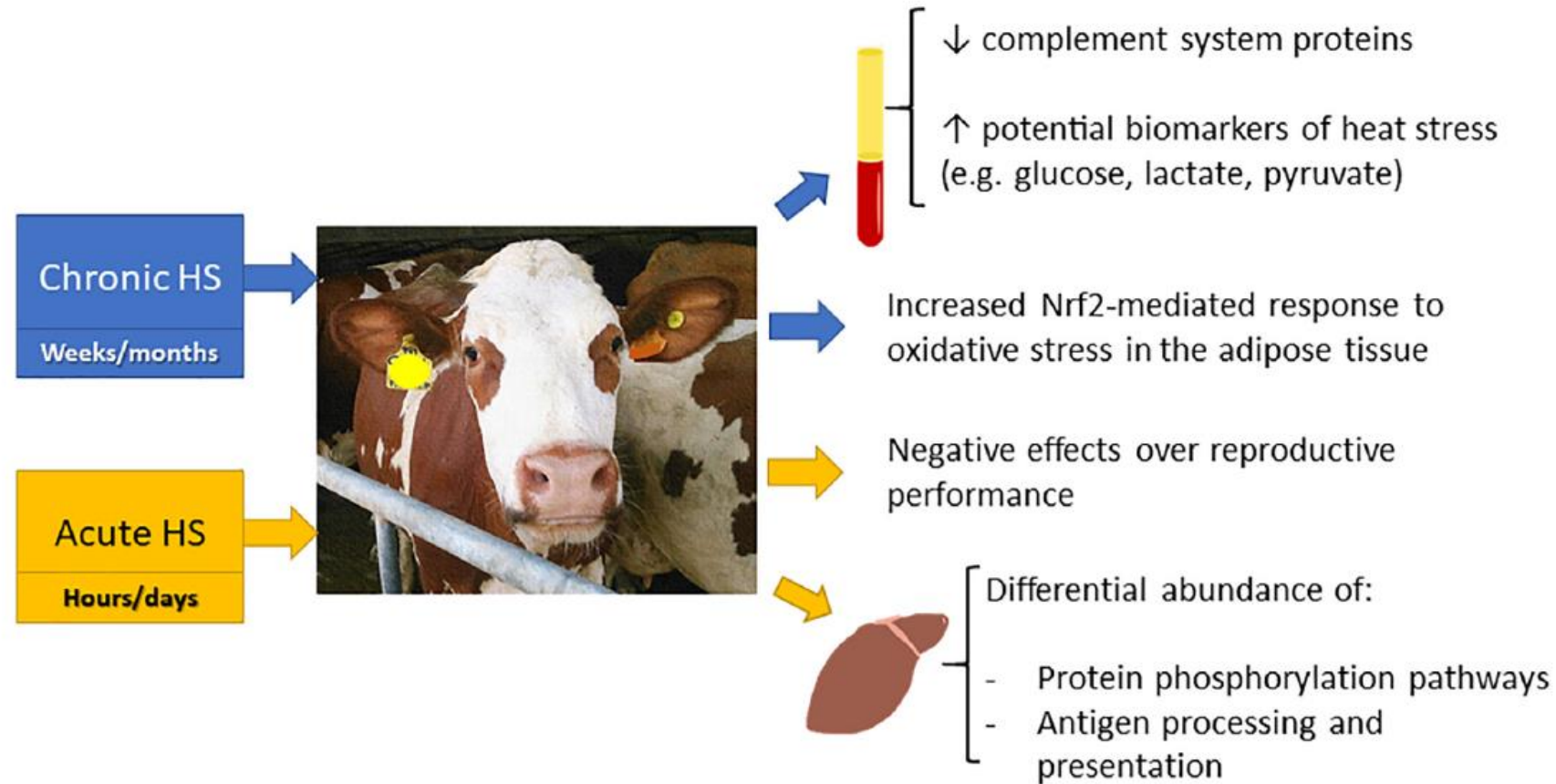


Fig. 3. Effect of different types of heat stress (HS): chronic (blue) or acute (yellow), over dairy cows' metabolism.

WG2 - Animal patho-physiology and biomarkers

