ANIMAL PHYSIOLOGY 2026

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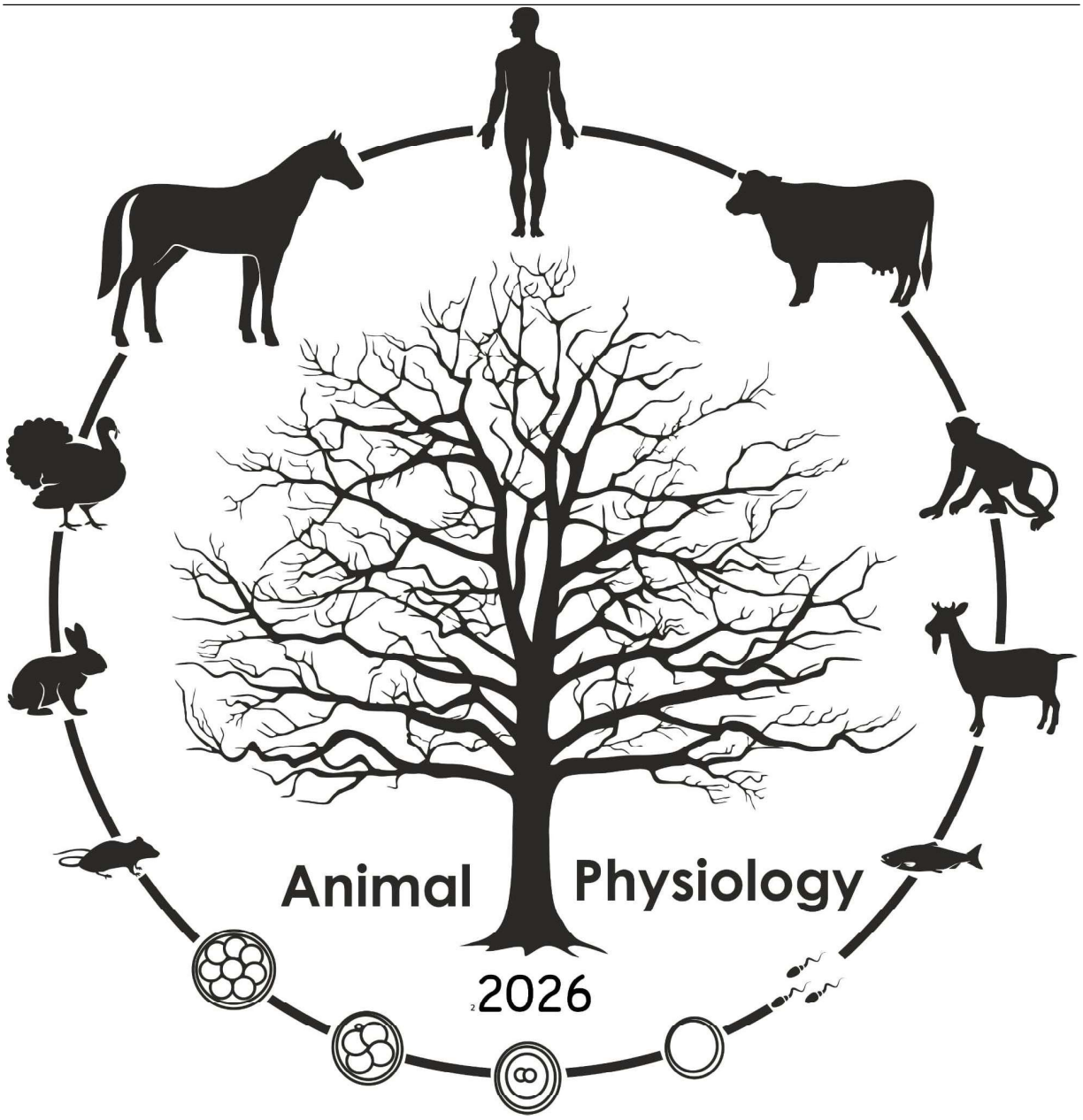
Book of Abstracts



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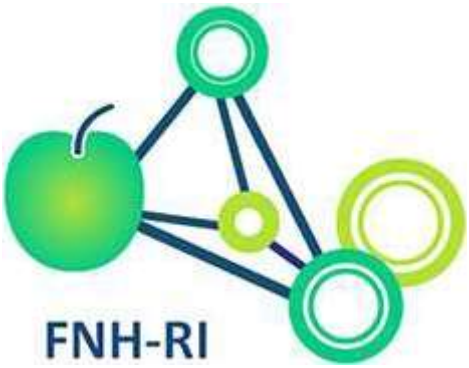

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Oxidative stress behind the pathogenesis of mastitis in dairy cows

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The peripartum period in dairy cows is characterised by profound metabolic challenges that substantially elevate oxidative stress, thereby increasing susceptibility to intramammary infections and mastitis. Under physiological conditions, the balance between reactive oxygen species (ROS) production and neutralisation is maintained through enzymatic antioxidants, superoxide dismutase (SOD), glutathione peroxidase (GPx), and catalase (CAT), alongside non-enzymatic components including albumin sulfhydryl groups, alpha-tocopherol, and carotenoids. Disruption of this redox equilibrium triggers cellular dysfunction and compromises mammary gland immunity. Furthermore, the interplay between reductive and oxidative processes is not only central to metabolic functions but also plays a role in redox signalling. This redox balance is vital, since oxidative stress can lead to cellular dysfunction if not tightly regulated. The disparity between the production rate of ROS and their neutralisation results in oxidative stress. The pathophysiological link between oxidative stress and mastitis is primarily mediated through the inflammatory response. Bacterial invasion activates immune cells that release ROS as a defense mechanism; however, excessive ROS production paradoxically amplifies tissue damage within the mammary gland, establishing a self-reinforcing cycle of inflammation and oxidative injury. This harmful cycle can impair immune function, making the cow more vulnerable to further infections. Increases in oxidative products have been observed in cows with mastitis, reinforcing the notion that these oxidative markers correlate with disease severity. Bacterial endotoxins further potentiate this process by upregulating pro-inflammatory cytokine expression in mammary tissues, while different mastitis pathogens appear to elicit distinct antioxidant enzyme responses. Our findings demonstrated that contagious mastitis pathogens exerted a statistically significant effect on SOD and GPx activity in the blood serum of transition dairy cows, while intramammary infections significantly influenced SOD and GPx activity in milk serum ($p<0.05$). Notably, contagious pathogens were associated with elevated GPx activity, whereas environmental pathogens induced more pronounced increases in SOD activity in milk. These results highlight the critical role of oxidative balance in udder health and mastitis pathogenesis. Targeted nutritional interventions and management strategies that strengthen antioxidant defences represent a promising approach to reducing oxidative damage, improving mastitis outcomes, and supporting overall dairy cow welfare and productivity.

Keywords: antioxidants, cattle, ROS, udder inflammation