

# Are mixtures of different *Treponema* bacteria making digital dermatitis worse?

Caroline Beninger, Sohail Naushad, Karin Orsel, Jeroen De Buck<sup>1</sup>

Department of Production Animal Health, Faculty of Veterinary Medicine, University of Calgary, Calgary, AB, Canada

<sup>1</sup>Corresponding author. Jeroen De Buck, Department of Production Animal Health, Faculty of Veterinary Medicine, University of Calgary, 3330 Hospital Drive NW, Calgary, AB, T2N 4N1. Tel.: +1 (403) 220-5393; E-mail: jdebuck@ucalgary.ca

Digital dermatitis (DD) is the leading cause of lameness in Alberta dairy cattle and present in 15% of cows and 94% of herds. DD is characterized by painful, ulcerative or proliferative lesions that compromise animal welfare and leads to significant economic losses. Multiple species of *Treponema*, a pathogenic anaerobic bacterium, are consistently found in DD lesions and rarely isolated from healthy hooves. We believe there is a relationship between *Treponema* species present and the severity of the lesion and that different *Treponema* species need each other for better growth and/or worsening of the lesion grade.

We have collected 150 biopsies on 10 Alberta farms, from dairy cattle hooves infected with DD (120) and uninfected (30) hooves. Using the M-stage scoring system, we have found correlations between which *Treponema* species are present and lesion grades. Using an in-house qPCR, which detects species of *Treponema* present, we have identified that *T. pedis*, *T. phagedenis*, and *T. medium* are more likely to be found in pairs than alone, indicating there are likely relationships between these species. However, *T. denticola* does not depend on another species presence and *T. phagedenis* is present in nearly all lesion stages. Further, *T. denticola* was found by itself in nearly all hooves 5 days post-treatment with oxytetracycline, potentially pointing to oxytetracycline treatment resistance. Finally, *T. denticola* is rarely present healthy or early DD lesions and typically found in later stages of disease progression, suggesting there may be a relationship between the species present, or combinations thereof, and the lesion grade.

Implications. Our project has identified which species of the *Treponema* bacterial family are most important for changes in lesion grade and identified species that appear to be resistant to antibiotic treatment, pointing to an explanation for DDs persistent nature. By further understanding the relationships between species of bacteria and their effect on disease progression, we will be able to identify targets for vaccine development and more effective DD prevention strategies.