

CPRC Update – A novel necrotic enteritis vaccine strategy: type IV pilus of *Clostridium perfringens*

Increased pressure on the poultry industry to produce antibiotic free chickens remains a challenge as rearing of antibiotic free birds results in an increased risk of pathogen contamination. The Canadian Poultry industry is currently faced with an increased risk in the development of necrotic enteritis, which is known to be caused by *Clostridium perfringens* bacterium. Professor Martine Boulianne, the Poultry Research Chair, from the Faculty of Veterinary Medicine at the University of Montreal conducted a large scale commercial study in which the incidence of development of necrotic enteritis was monitored in broiler flocks raised free of antibiotics. This study demonstrated that 25% of antibiotic free flocks experience necrotic enteritis outbreaks, whereas 50% of the flocks experienced various levels of subclinical enteritis and 25% of the flocks were classified as clinically healthy. This is not only a bird health and welfare concern, but additionally an economic concern for the industry as it reduces antibiotic use. This on-farm broiler trial showed that cost increased 10 cents per kilogram of chicken produced for antibiotic free birds compared to conventionally raised chickens. A unique *Clostridium perfringens* culture collection, covering a full spectrum of chicken intestinal health, spanning healthy to necrotic enteritis infected birds will be used in the research project lead by Professor Boulianne, with the objective of developing a novel necrotic enteritis vaccine strategy.

The Approach

The pathogenicity and genetic characteristics of *Clostridium perfringens* able to cause necrotic enteritis is unknown. Recent evidence suggests that attachment of the bacteria could play an important role in the development of necrotic enteritis. Virulence factors conferring them a competitive advantage in the presence of other predisposing factors has recently been discovered. Additionally, capacity to attach to some intestinal mucosal cells' molecules following coccidial damages has been demonstrated for some *Clostridium perfringens* isolates.

Dr. Boulianne and her research team have developed a unique experimental method to compare the virulence of both commensal and pathogenic *Clostridium perfringens* strains using a surgical model. Additionally, recent observations from her laboratory suggest that intestinal mucosa attachment by the bacteria could play a role in the pathogenesis of necrotic enteritis. A specific hair-like appendage found on the surface of bacteria plays a predominant role in the attachment by bacteria found within the *Clostridium perfringens* genetic code. Thus, the research approach will be to compare the organization of genes encoding for this pilus in both commensal and virulent strains to evaluate the role of bacterial attachment mediated through this specific hair-like appendage. Two post-doctoral students, Drs MarieLou Gaucher and Audrey Charlebois are working on the project in collaboration with Drs. Marie Archambault and John Prescott.

Experiments, Findings and Outcomes

The researchers have identified and localized regions encoding for type IV pilus using bioinformatics and molecular biology techniques. Researchers are currently conducting tests of the genetic variability within the regions from commensal and virulent strains to establish a 'profile pilus' specific to each strain. The role of these different regions encoding the pilus in the attachment of the bacterium to intestinal cells will be evaluated to understand the role of the pilus in strains causing necrotic enteritis. The researchers plan

to further the experiments to better understand the pathogenic mechanisms underlying necrotic enteritis. Such understanding will improve the development of better control methods. The planned outcome of this research group is to develop a novel vaccine strategy against necrotic enteritis.

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CPRC, its Board of Directors and member organizations are committed to supporting and enhancing Canada's poultry sector through research and related activities. For more details on these or any other CPRC activities, please contact The Canadian Poultry Research Council, 350 Sparks Street, Suite 1007, Ottawa, Ontario, K1R 7S8, phone: (613) 566-5916, fax: (613) 241-5999, email: info@cp-rc.ca, or visit us at www.cp-rc.ca.

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