CPRC Update: Why is AIV so difficult to control?

Although only viruses of the *Influenzavirus* A genus are known to infect birds, the complexity of this genus is increased by the possible combinations of the subtypes present, based on the antigenicity of surface glycoproteins hemagglutinin (HA) and neuraminidase (NA). Each virus consists of one of the 18 identified HA antigens and one of the 11 NA antigens, generating a large number of virus subtypes.

Avian Influenza (AI) is classified based on the severity of the disease caused; highly pathogenic AI (HPAI) and low pathogenicity AI (LPAI). HPAI is restricted to strains with H5 and H7 subtypes exhibiting a multi-basic cleavage site (MBCS) at the precursor of the HA molecule. HPAI is a 'dead-end infection' in certain domestic birds and its effects are variable in domestic waterfowl and feral birds, in which it may or may not cause clinical signs and mortality. Viruses belonging to subtypes without the MBCS are maintained in feral bird populations and serve as an ever-present source of the virus. A large portion of the influenza gene pool is present in waterfowl whereas shorebirds and gulls maintain a number of isolated subtypes of the virus. These viruses cause LPAI when introduced into domestic bird populations.

Several mechanisms result in the virus mutating to HPAI once the LPAI (H5 and H7 subtypes) is introduced into poultry. However the factors that bring about this mutation are not fully understood and can occur at any time. It is therefore imperative that both LPAI and HPAI should be controlled.

The complexity of the variants of the virus, their omnipresence in nature and the ability to mutate to a highly pathogenic strain from a low pathogenic strain all contribute to the challenge that this virus presents to the poultry industry.

Transmission of the virus between birds is poorly understood, although research suggests that bird-to-bird transmission is extremely complex and determined by the virus strain, bird species and environmental factors. Studies also show that the virus is present in considerable quantities in bird feces, to the extent that the virus can be isolated from untreated lake water in waterfowl habitats. Nonetheless, the primary route of introduction of AI virus in domestic poultry occurs through direct or indirect contact with infected birds affirming that implementation of biosecurity measures at the farm level can prevent AI infections.

CPRC has been funding AIV studies since 2006 and has committed almost $520 thousand to 11 research projects with total research budgets of more than $2.5 million. This research has looked at a range of issues associated with AIV. The issues studied included:

- Identifying the molecular determinants that confer a bird's immunity to the virus and the immune system cells that recognize these determinants. The project was also aimed at determining the dynamics of immune system cells in response to AI virus infection and the genetic pathways that control that response.
- Three related-research projects from the first Poultry Science Cluster investigated adaptation of AIV from its natural reservoir in wild fowl to domestic poultry, how avian influenza is

transmitted to domestic poultry and the bird's immune response to AIV. These projects provided information that is important to developing AIV controls and responses.

- AIV vaccines are difficult to create because the virus is prone to change that interferes with a vaccine's activity. Researchers investigated the use of RNA interference (RNAi), a natural mechanism present in many animals including birds, that can decrease the activity of specific cellular genes and has been shown to serve as a natural antiviral response. This research could lead to improvements in a bird's natural immunity.
- An ongoing series of projects have been moving toward development of an effective AIV vaccine and delivery system to provide poultry with broad protection delivered efficiently and effectively. This research is being continued in CPRC's second Poultry Science Cluster and has already provided patentable results.
- Present approaches to testing for exposure to avian influenza for the national surveillance program are based on taking blood samples from birds and sending them to a laboratory for analysis. CPRC is supporting research that will evaluate a standardized test to use egg-derived immunoglobin for screening of antibodies to avian influenza to avoid the stress and cost associated with handling birds and taking blood samples.

CPRC and its member organizations will continue to support research on this important threat to Canadian poultry production in its ongoing research activities.

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.