

Lay Summary

Investigation into the Role of the Infectious Bronchitis Virus (IBV) Envelope Protein in Viral Replication and Pathogenicity.

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Infectious bronchitis virus (IBV) is a highly contagious virus which causes infectious bronchitis in chickens. Infectious bronchitis has high direct disease costs as it reduces egg production and quality in layers and weight gain in broilers. Currently used vaccines are generated via serial passage of a virulent isolate through embryonated hen's eggs; the molecular method of attenuation is unknown and there is a risk of reversion to virulence. Additionally, these vaccines cannot be inoculated into eggs and have limited cross-protection between strains of IBV. This project, funded by the British Egg Marketing Board Trust, aimed to assess the potential for generating vaccines by targeting an essential virus component, the envelope (E) protein of IBV. This approach has been successful for another coronavirus, severe acute respiratory syndrome coronavirus (SARS-CoV).

IBV E protein can form a channel which ions pass through. To characterise the role of the ion channel in infection, two mutations have been made which prevent ion channel formation. These mutations have been made in the E protein of two strains of IBV, one of which causes clinical disease (M41-K) and a weakened virus which cannot cause disease (Beau-R). The mutations were tolerated in Beau-R but not in M41-K, indicating a strain dependent effect. One mutation in M41-K did not result in viable virus. The second mutation in M41-K E protein caused additional mutations in other virus proteins, which may compensate for the lack of ion channel activity.

To characterise the roles of the IBV E protein during infection in cells, the growth and ability to retain the E protein mutations has been assessed for the generated viruses. The effect of these mutations on virus growth was different when investigated in different cell types. This highlights the importance of selecting a relevant cell type for research into the IBV E protein. Additionally, an experiment was carried out to determine whether the viruses which are unable to form ion channels were potential vaccines against infectious bronchitis. M41-K with a mutation in E was infected into chickens and clinical signs were monitored after infection. Although the virus caused delayed clinical disease in the bird, it is not suitable as a vaccine candidate. The potential role of additional mutations in the M41-K genome on ability to cause disease needs to be investigated further.

This thesis furthers knowledge on the function of the IBV E protein during infection and demonstrates that both the cell-type and IBV strain are important considerations for the future study of IBV vaccine candidates.