In association with

DEVELOPMENT OF A BOCOV VACCINE

This month we highlight a recent research initiative in relation to a bovine coronavirus (BoCoV) vaccine study

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Bovine coronavirus (BoCoV) is a pneumoenteric pathogen that causes winter dysentery, calf diarrhoea and is one of several pathogens associated with the bovine respiratory disease complex. Inactivated virus and a recently developed modified live virus vaccine are administered to protect against disease, but the vaccine strains and natural isolates are highly divergent so protection afforded by the vaccine may be suboptimal. Phylogenetic analysis of natural isolates also demonstrated divergence based on location suggesting different regions may require location-specific vaccines. This study focused on natural isolates of BoCoV from Ireland to genetically characterise the virus and design an Ireland-specific vaccine.

Selective pressure analysis and prediction of immune epitopes were also performed to identify proteins recognised by the immune response. Genes with a high prevalence of diversifying selection are more likely to be recognised by the immune response because there would be a selective advantage for amino acid changes that enable immune escape. Of the five structural proteins analysed, spike and haemagglutinin esterase (HE) were under increased diversifying selection, and these two proteins also contained more predicted immune epitopes. As such, mRNA vaccines expressing BoCoV spike and HE were developed.

Irish isolates were collected during 2022 and 2023 and their spike and HE genes sequenced. These sequences were used to design mRNA vaccines, which expressed proteins representative of BoCoV currently circulating in Ireland. Conventional mRNA vaccines were generated and tested to determine their functionality. Attempts were also made to generate self-amplifying mRNA vaccines by inserting spike and HE genes downstream of the Semliki Forest virus replicase. This work demonstrated how surveillance of currently circulating animal viruses and targeted sequencing of immunogenic proteins can be used to quickly develop or update a vaccine.