6-12-2022

Developing a 'One Health' Nipah virus vaccine to protect animal and public health

Simon P. Graham
The Pirbright Institute, United Kingdom

DEVELOPING A 'ONE HEALTH' NIPAH VIRUS VACCINE TO PROTECT ANIMAL AND PUBLIC HEALTH

Simon P. Graham, The Pirbright Institute, UK
simon.graham@pirbright.ac.uk

An expanding human population and the concomitant increase in demand for animal protein has led to the use of previously unused habitable land and disruption of ecosystems. Increased human-livestock-wildlife interactions has led to an increase in virus spillover events from wildlife reservoirs, which in turn has elevated the risk of epidemics of new and emerging zoonotic diseases. 'One Health' recognises that human, animal, and environmental health are tightly interconnected; an initiative that is righfully gaining more attention in the post-COVID-19 world. Vaccination is a powerful strategy to prevent and control viral outbreaks, as exemplified by the COVID-19 pandemic. Moreover, the vaccination of amplifying intermediate animal hosts provides an effective way to further protect human health. To support efforts to develop vaccines to combat emerging viral zoonoses, we are developing a Nipah virus (NiV) vaccine for use in pigs, which would reduce the risk that NiV poses to the Asian pig industry, livestock keepers and public health. Pig-to-human transmission was responsible for the first and most severe NiV outbreak. This outbreak caused severe and lasting economic costs to the Malaysian pig industry. Despite the threat NiV poses to some of the most pig dense regions of the world, no vaccines are currently available. We have therefore evaluated the immunogenicity of recombinant NiV glycoprotein (G or F) based vaccine candidates delivered as protein subunits or by viral or mRNA vectors in pigs. Three vaccine candidates have been evaluated for efficacy and shown to confer a high degree of protection following a prime-boost regimen. These are now being evaluated under field conditions in Bangladesh. In addition to providing a platform for the further development of a NiV vaccine for pigs, we hope these studies will also benefit ongoing human vaccine development efforts.

Biography:
I am a veterinary immunologist with an interest in understanding mechanisms of protective immunity and its application to vaccine development. My early career focussed on parasitic diseases, I developed a natural cattle model for testing vaccines against onchocerciasis (river blindness), which provided the first proof-of-principle for vaccine-induced protection. I identified and evaluated vaccine candidate antigens from the apicomplexan parasite *Theileria parva*, which were designed to induce protective bovine CD8 T cell responses. More recently, my research has focussed on porcine viruses, such as classical swine fever (CSFV) and porcine reproductive and respiratory syndrome (PRRSV) viruses. I informed discussions on the use of emergency vaccination to control future CSF outbreaks by demonstrating that live attenuated CSFV prevented transmission of divergent CSFV strains after only 3 days. I showed that this rapid protection was associated with broadly reactive CD8 T cell responses, opening new avenues to develop DIVA vaccines for outbreak settings. For PRRSV, I contributed to the study of the enhanced pathogenicity of Eastern European strains, highlighting the threat these viruses pose; and contributed to vaccine development efforts through the identification of conserved T cell antigens. My current research is largely focussed on PRRSV and we are pursuing complimentary approaches to improved vaccine development. I am also leading research aimed at developing a Nipah virus vaccine for pigs and supporting COVID-19 vaccine development by using the pig as a preclinical model for assessing immunogenicity.