



VETERINARY
VACCINOLOGY
NETWORK



Meeting Report

The BBSRC UK Veterinary Vaccinology Network co-hosted the European Veterinary Vaccinology Workshop in conjunction with SAPHIR and PARAGONE on 9-10 May 2016 at the University of Gent, Belgium, two multinational veterinary vaccinology consortium projects funded by The European Union under the Horizon 2020 Programme in 2014. SAPHIR (Strengthening Animal Production and Health through the Immune Response; <http://www.h2020-saphir.eu/>) and PARAGONE (<http://www.paragoneh2020.eu/>) are multinational vaccinology consortium projects funded by The European Union under the Horizon 2020 Programme aimed at technological development and demonstration of impact of livestock vaccines. Common to both projects and to the BBSRC UK Veterinary Vaccinology strategy is the generation of knowledge of immune responses that underpin the strategic design and development of vaccines that have end-user relevance.

This was reflected in the programme of the meeting, with presentations by representatives from veterinary Pharma, veterinary consultants and academic researchers from universities and research institutes. Catherine Charreyre (Merial, France) gave an insight into the factors that industry consider important for project selection and her hopes for closer relationships between academics and industry in the future. Jonathan Rushton and Alexis Delabougliise (RVC, UK) described the socio-economic aspects of vaccination and highlighted the current gaps in knowledge of the true cost of livestock diseases and how this relates to decisions for management strategies. Mike Francis (BioVacc Consulting Ltd, UK) discussed technological advances that have improved vaccine delivery, particularly vaccine vectors that prompted a robust debate, and gave his vision for future opportunities. Danny Goovaerts (DGVAC Consulting, Belgium) described the history of adjuvant development (particularly Alum) and activation of innate immunity to optimise vaccine efficacy. This was followed by a round table debate hosted by Bruno Goddeeris (KU Leuven, Belgium) which aimed to capture the key elements of veterinary vaccine development and challenging the assumptions that can be a barrier to progress. This was particularly aimed at the early-career researchers who were encouraged to contribute their perspectives to the debate. Artur Summerfield (EDI-IVI, Switzerland) gave his perspective on the complex area of identifying immunological correlates of protection for both human and animal vaccines and why technological design (choice of assay/readout) needs to be carefully considered for the generation of useful data. The meeting concluded with a talk from Jacqui Matthews (Moredun Institute, UK) discussing the particular challenges associated with vaccine development against multicellular parasites and how vaccination needs to be considered within the whole package of parasitic disease management strategies.

Special thanks go to Bruno for prompting discussion and debate throughout the meeting in his unique style. Bruno has made major contributions to veterinary immunology throughout his career and is always willing to challenge immunological paradigms and we wish him well for his impending retirement.

The meeting was attended by 58 delegates, which included the BBSRC Veterinary Vaccinology Network Leader (Bryan Charleston), Manager (Madeleine Clark) and two members of The Steering Committee (Mike Francis and Gary Entrican). Additionally, the support was provided for 10 other Network members to attend the meeting, here are their comments and views on the Workshop:

Suzanne Martin, RVC:

Many thanks for the opportunity to attend this year's Veterinary Vaccinology Workshop in Ghent. It was a fantastic event, hosted in a brilliant location. The selection of talks on offer covered an incredibly broad range of vaccinology related topics. My PhD is predominantly lab focussed and so I found the discussions on the socioeconomic aspects of veterinary vaccines very helpful. The workshop brought together colleagues, working in a variety of vaccinology related disciplines and contexts. This really helped to encourage some very lively debates and encouraged us to understand how our own work might fit into the "bigger picture". It was also great to listen to discussion about how academics and colleagues in industry can work together to overcome some of the challenges in the field. The social events were well planned and very friendly, due to the small size of the conference. Overall it was a great experience and I hope to attend again next year.

Nick Ciccone, Pirbright:

Coming from a more basic immunology research perspective, but with a keen interest in exploring how my work can help vaccine development, the workshop highlighted for me how multi-faceted the vaccinology field is with several distinct areas of studies required to come together in order to develop a robust vaccine for market use. In this way, the veterinary vaccinology network has provided a stage where people with varied skill sets can interact at this workshop, I think this is essential to drive development of vaccines. The talks were varied and informative and the discussion throughout the workshop was thought provoking and informative in an open and informal manner.

Saskia Deeney, RVC:

The Vet Vaccinology Workshop was a great event, it offered a very useful review of progress in the veterinary field. The event was attended by scientists in a range of careers and positions, and this made it a very interesting networking event. The informal atmosphere of the meeting put an early career scientist, like myself, at ease around the established scientists. I really loved the idea of 'the challenger' played by Bruno, it was great to see such basic questions being asked which sparked lively discussions. I thoroughly enjoyed the workshop and have recommended it to colleagues in my field.

Clara Zifko, Roslin Institute:

As an early career researcher, this meeting provided an ideal surrounding for networking and extending one's understanding of vaccine development from the industry's perspective. Informative talks stimulated diverse discussions that were kept going well into the coffee breaks and during the lunch breaks. I immensely enjoyed getting to know so many experts from different backgrounds, and hearing their opposing views. The setting was fantastic, too, in the historical centre of the beautiful city of Gent. Thank you to the organisers for this unique experience.

Cosmin Chintoan-Uta, Roslin Institute :

I thoroughly enjoyed the workshop in Ghent and the open discussion that took place during and around each talk. The workshop provided me with valuable insights into the process of vaccine development and the sequence of steps involved in this process. This is very valuable information as the group that I am part of is about to start work on a large BBSRC project that aims to develop glycoconjugate vaccines against veterinary pathogens. Of direct relevance to our future work, the workshop highlighted a number of important aspects to consider:

1. The need to ensure delivery of antigens in a form that effectively activates a balanced immune response, especially in the case of recombinant protein and glycoconjugate antigens that are not vectored;
2. The importance of the vaccine adjuvant
3. Guidance on how to test for immune correlates of protection in a way that is likely to yield meaningful data
4. The sequence in vaccine development that may be preferable from the industry's point of view (e.g. choose and test adjuvant before optimising the dose)
5. The fact that vaccination may not be a strategy for control on itself but it may need to be combined with other measures and that, with adequate training and knowledge dissemination, the end users may be amenable to such an approach.

Finally, as an overarching theme, the importance of basing vaccine development on strong knowledge of the immune response in particular veterinary species and to the particular pathogen of interest was evident. It further emphasised the need for more research in my major areas of work (vaccines against *Campylobacter* in poultry) into the nature of the immune response following natural infection and that elicited by previously described partially protective vaccines so that future vaccine development can be undertaken in a more rational fashion.

Sean Monaghan, Institute of Aquaculture, University of Stirling:

Coming from a fish vaccinology background, the meeting provided me with a great comparative insight into challenges facing vaccine developments for higher vertebrates. Determining correlates of protection for fish vaccines has been a particular hurdle for researchers and pharmaceutical industries catering for aquaculture diseases and realising the progress made in development of *in vitro* immunological assays for higher vertebrates has provided me with ideas for implementing these for fish. While the genetic distances between fish and birds and mammals can sometimes limit the feasibility of these tools for fish, this meeting has highlighted assays that may be applicable.

Determining the cost-effectiveness of vaccination in aquaculture is essential for evaluating funding potential and I have obtained a much greater understanding of vaccine economics through this meeting. Whilst there are many advances in technologies for vaccine design, delivery and adjuvant inclusion for mammals and birds, the meeting has made me realise not only the limitations for different mammalian and avian models, but also the difficulties with regards to applying some of these technologies to the aquatic environment. For example, stimulation of mucosal immunity or driving strong humoral IgG antibody responses in higher terrestrial vertebrates will differ for aquatic animals where mucosal surfaces include the skin and gills, and where there is an absence of antibody isotype switching from IgM to IgG. However, the understanding and knowledge I have gained regarding such approaches in higher vertebrates, that emphasises the diversity of tools that have been, and are being, applied for various viral, bacterial and parasitic diseases, will certainly help direct my current research on mucosal immunisation strategies for Atlantic salmon against bacterial disease.

This forum provided an ideal setting for knowledge exchange, sharing experiences and ideas, and potential collaborations, with veterinary vaccinologists and immunologists from both research and industrial backgrounds, for applying the most appropriate tools for the disease being researched. Of

particular note for me were the considerations that need to be made where complications exist either with vaccination management strategies, e.g. for notifiable animal diseases caused by microbial pathogens or integrated pest management of complicated multicellular parasites. These factors relate to my other areas of interest in DIVA vaccination for aquatic viruses and sea lice vaccine development, and thus the information I have gathered from the workshop will also be of direct value to other fields of research at my institute.

Nick Lyons, Pirbright:

I found the workshop to be a friendly forum for discussion on various aspects of veterinary vaccines and it was refreshing to hear frank comments from both the speakers and audience. The diversity of disciplines present was excellent for gaining an insight into what is being done by researchers I would not normally follow. Furthermore, the workshop highlighted areas of deficiency in this field that could be addressed by more effective interdisciplinary collaboration