Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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ScienceDirect
The Veterinary Journal 178 (2008) 1–2
The Veterinary Journal
www.elsevier.com/locate/tvjl

Guest Editorial

Infectious diseases know no borders: A plea for more collaboration between researchers in human and veterinary vaccines

Our present society would not be sustainable without vaccination, which is an essential and cost effective strategy to prevent, control and even eradicate infectious diseases in man and animals. A special report in *The Economist* published on 3rd May 2007 entitled *The world goes to town* noted that >50% of mankind and our companion animals now live together in big cities. Moreover, animals for meat production are farmed in ever larger groups, and the movement of humans and animals has increased tremendously. Under these circumstances, infectious diseases (that know no borders anyway) spread easily and vaccination are needed to stop or slow down serious disease outbreaks.

Despite the global importance of vaccines, the knowledge and experience to produce and develop them is limited to an estimated 10,000 specialists worldwide. Most of these experts work for pharmaceutical companies or specialised research institutes and strive to translate a proof of concept from academic research into a vaccine that is not only commercially viable but also safe, efficacious and can be produced consistently under proper quality regimens, such as good manufacturing practice. Following many mergers in recent years there are now only a handful of major commercial players still producing and developing veterinary and human vaccines, largely reflecting the complexity of the vaccine business and the escalating rigour of the quality standards. Some vaccines approved in the past would certainly not be acceptable under the current regulatory framework.

The development of a vaccine typically requires 10 years and will cost hundreds of millions of Euros. For human vaccines, the first 2.4 years and around 20% of the investment are needed for preclinical development (Struck, 1996). When successful, the result is a 'proof of principle', which means that the prototype vaccine has demonstrated that it protects in an animal model. The remainder of the time is then needed to show that the vaccine also protects the target animal (in this case man), that it is safe and can be produced consistently and economically. For veterinary vaccines the procedure is comparable, but it is usually possible to test the prototype vaccine directly in the target animal. All the results are summarised in a dossier that is then submitted to the regulatory authorities, which decide whether the vaccine may be admitted to the market. There are separate regulatory authorities for veterinary and human vaccines. Theoretically, the same vaccine against a zoonotic disease could be used both in animals and man, but two different filings would be necessary.

Only 2/10 attempts to develop a vaccine is successful (Struck, 1996). This, of course, affects the choice of vaccine projects by industry. Since there is an urgent need to recoup the investment, vaccine projects with the best expectations for profit will be at the top of the list. Vaccines against neglected diseases affecting the poorer regions of the world will inevitably therefore be low on the priority list.

The development of new vaccines depends on the collaboration of academic researchers and vaccine specialists from industry. Essential for good teamwork and synchronous working is that both parties understand the complete process of vaccine development. A paper published in this issue of *The Veterinary Journal* by Jacco Heldens and his colleagues does an excellent job in explaining this process (Heldens et al., 2008) and should be required reading for every academic researcher who ventures into vaccine development. The paper also outlines new scientific developments in vaccine R&D. In this field there is so much to gain by more collaboration between academia and industry which could lead to improved methods, for example in the field of genomics to predict protection capability and make vaccine development faster and less expensive.

Shortened timelines for vaccine development would be an enormous asset for the development of vaccines against new or re-emerging viral diseases. Vaccination is virtually the only way to control these diseases, but a development time of 10 years is far too long for a

1090-0233/$ - see front matter
doi:10.1016/j.tvjl.2008.02.023

contemporary threat such as severe acute respiratory syndrome (SARS) or pandemic influenza. Two lesser known examples underline this dilemma: bluetongue, a viral disease of ruminants (especially sheep), and Chikugunya virus in humans are both transmitted by insects. In both cases the region where these insects roam has increased considerably in recent years. In the case of bluetongue, warmer temperatures have enlarged the area where the midges that transmit the virus will survive. With Chikugunya, the virus first mutated and was then transmitted by another mosquito species that is present over a far wider area (Enserink, 2007b). In both cases some vaccine development has been undertaken that will hopefully reduce the 10-year timeline, but additional work will be needed to get these products on the market.

My final plea is for more collaborative research between the medical and veterinary fields. Human and veterinary medicine have drifted apart (Kahn, 2006; Enserink, 2007a), and although there are many good arguments for breaking down the walls between the two disciplines (Michel, 2005), progress is slow. Something must be done, however, as further delay in the field of vaccine development would be inexcusable (Marano et al., 2007). Perhaps commonsense can prevail?

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