

CO-FUNDING FOR INTERNATIONAL FOOT-AND-MOUTH DISEASE RESEARCH

Co-funding from BBSRC and the Department for International Development (DFID) is supporting an international collaborative project between researchers from the Institute of Animal Health (IAH), the University of Glasgow, the Agricultural Research Council (ARC)-Onderstepoort Veterinary Institute in South Africa, the Jenner Institute in Oxford and an Indian vaccine manufacturer, Indian Immunologicals Ltd. The collaboration is harnessing the unique capabilities of the different groups to help control foot-and-mouth disease (FMD) in east Africa and to develop cheaper methods for developing countries to develop FMD vaccines.

One of the clearest impacts of BBSRC's activities is through its actions as a leading UK funder of bioscience research and training, often when working in partnership with researchers, users and other funders. In particular, BBSRC is working with DFID to bring together bioscientists and users from around the world to address global challenges with the potential for significant long-term impact. For instance, research led by Professor Satya Parida, Head of the Vaccine Differentiation Group at IAH, aims to improve vaccines against FMD in east Africa¹; an area where the disease has a major impact on the livelihoods of rural subsistence farmers.

The researchers will identify novel adjuvants to boost the effectiveness of FMD vaccines. They

will also identify the most suitable virus strains for use in an FMD vaccine in east Africa and create a model to allow developing countries to test vaccines in laboratories rather than relying on animal tests in expensive high-containment facilities; the project builds on IAH's substantial expertise in FMD research, which includes being the FMD World Reference Laboratory for the UN's Food and Agriculture Organisation.

The projects is part of the Combating Infectious Diseases of Livestock for International Development (CIDLID) initiative; a £13M programme co-funded by BBSRC and DFID, with a contribution from the Scottish Government². DFID's involvement encouraged Parida to renew a long-term collaboration between IAH and Indian Immunologicals Ltd (IIL)³ and to work with a laboratory in South Africa to conduct long-term animal vaccination experiments.

The nature of the research means that the international collaborations are vital to its success.

"Indian Immunologicals will be very helpful, if we do develop a new vaccine, with how we will formulate it on a much larger scale," says Parida. The manufacturer provides a direct route to translate the research into a vaccine for use by African farmers. However, they need the input from IAH as the company cannot do all of the tests required to identify

Impact Summary

BBSRC and DFID co-funding has enabled a collaboration bringing together the unique expertise of UK researchers at IAH and the University of Glasgow with counterparts in South Africa and the largest vaccine manufacturer in South Asia to improve vaccines against foot-and-mouth disease.

In return, the researchers are helping the company improve their research and vaccine development capabilities.

In particular, the vaccine manufacturer, Indian Immunologicals Ltd, provides vaccine formulation expertise and a direct route to distribute the improved vaccine.

the most useful adjuvants.

“We have listed ten adjuvants,” Parida explains “We’ll test them in cattle in IIL and we will find four good adjuvants which we’ll bring to our laboratory at Pirbright. Here, we’ll do our experiments to select at least one because, when we do the experiments at Indian Immunologicals; we cannot do all of the assays we need because they are not established.”

In return, Parida and team are helping the company adopt the techniques they need to improve their in-house capabilities. “[Parida’s] work pertaining to cell-mediated immunity, selection of new generation adjuvants and designing the animal experiments are beneficial to IIL,” explains Dr V. A. Srinivasan, Research Director at IIL in India. “Furthermore, a couple of IIL scientists have already been trained in Professor Parida’s lab and further visits of scientists to his laboratory scheduled this year.”

Once IAH researchers have identified at least one promising adjuvant from those they are testing, it will be sent to their South African collaborator, Dr Francois Maree at the ARC Onderstepoort Veterinary Institute, for final long-term vaccine testing. “That best one, we’ll take to South Africa and do the animal experiments there, on a long-term basis,” says Parida.

From the data generated, Dr Richard Reeve and Professor Dan Haydon at Glasgow will develop

a model that can be used to test vaccines in the laboratory, so reducing the number of animals used in vaccine development for FMD. This will make it cheaper and easier for developing nations to carry out their own vaccine testing. The work also contributes to BBSRC’s continued commitment to the replacement, refinement and reduction of the use



Collecting samples in the field in Tanzania. Credit: Prof. Satya Parida/IAH

of animals in research.

FMD – a global problem

FMD is a devastating disease of livestock in the developed and developing world⁴. Domestic and wild cloven-hoofed animals such as cattle, buffalo, sheep, goats and pigs are susceptible to the disease. Affected animals lose weight, and milk production falls⁵. Although most will recover from the illness, the disease can still have a serious impact on the livelihoods of rural subsistence farmers and smallholders in Eastern Africa and Southeast Asia. For instance, a study in Cambodia has shown that smallholder farmers lost between 54 per cent and 92 per cent of their income following a foot-and-mouth outbreak⁶.

FMD is hard to control as it is highly contagious. It is spread in animal secretions such as milk, and on their breath. It can also be carried on clothing and can contaminate buildings and vehicles.

Farmers can vaccinate their animals against FMD, although current vaccines only protect animals for a short period of time. According to Srinivasan, “The Government of India is embarking on an ambitious plan for control of FMD which aims to vaccinate 300 million cattle and buffaloes twice annually covering all states and union territories during the year 2012-13. In contrast, no proper vaccination

strategies are scheduled for the control of FMD in Sub-Saharan Africa.”

Future Impact

To address this, Parida and colleagues are trying to identify the most suitable virus strains to use in vaccines, and improve the methods used to do so. They will also identify novel adjuvants that can be added to FMD vaccines used in sub-Saharan Africa to make them more effective, and give longer protection, against the various different strains of FMD circulating in this region.

They are also planning to use the data collected from vaccine trials to build a model which will allow future projects to conduct more tests in the laboratory, reducing the number of animals needed for the research and meaning that poorer nations don't need to maintain costly high containment facilities for testing the vaccine in animals.

Parida and colleagues are also collaborating with a second CIDLID project led by Professor Sarah Cleaveland from the University of Glasgow. Cleaveland is investigating the epidemiology of FMD in east Africa. The two projects have already held a joint workshop in Tanzania attended by local officials, veterinary officers and researchers.

Ultimately, the researchers hope to develop a new

vaccine for use in India and sub-Saharan Africa. Srinivasan explains; “The control of FMD using potent vaccines will be beneficial to various endemic countries, particularly India and Sub-Saharan countries, for effectively controlling the disease, thereby averting the economic loss in various species of animal. In addition, a vaccine conferring a long duration of immunity will help in reducing not only the cost of the vaccine by reducing the number of vaccinations but also other associated vaccination costs. This will also help in effectively controlling the deadly disease in these regions.”

Notes and references

1. See: <http://www.iah.ac.uk/CIDLID/A643.aspx>
2. See: <http://www.bbsrc.ac.uk/funding/opportunities/2008/combating-infectious-diseases-livestock.aspx>
3. See: <http://www.indimmune.com/>
4. For more information, see: http://www.oie.int/fileadmin/Home/eng/Media_Center/docs/pdf/Disease_cards/FMD-EN.pdf
5. Mersie A, Tafesse B, Getahun F, & Teklu W (1992). Losses from foot-and-mouth disease in a mixed farming area of eastern Ethiopia. *Tropical Animal Health and Production*. 24 (3), p 144. See: <http://www.springerlink.com/content/a7g7nx8118176133/>
6. J. R. Young, J.R., Suon, S., Andrews, C.J., Henry, L.A., & Windsor P.A. (2012). Assessment of Financial Impact of Foot and Mouth Disease on Smallholder Cattle Farmers in Southern Cambodia. *Transboundary and Emerging Diseases*. Published online 18th April 2012