The IVI is researching a vaccine for African swine fever

The highly complex African swine fever virus is spreading and poses a challenging puzzle for researchers. The IVI is part of an international cooperation project working on the registration dossier for a vaccine.

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African swine fever (ASF) is spreading within Europe. Although Switzerland remains free of outbreaks to date (see box), Swiss researchers are involved in developing a vaccine: at the Institute of Virology and Immunology (IVI) in Mittelhäusern, the teams led by Artur Summerfield and Nicolas Ruggli are working on a vaccine for the European market together with seven other institutes from Germany, the Netherlands, Belgium, Spain, France and the USA, as well as with industry partner Zoetis. The vaccine is to be formulated in bait for oral ingestion by wild boar. As part of the Horizon Europe project ASFaVIP ("African Swine Fever attenuated live Vaccines In Pigs") headed by Germany's Friedrich-Loeffler-Institut (FLI), the project partners also want to identify the protective immune response to the ASF virus and thus to develop improved vaccines.

"ASF is deadly and difficult to control," says Artur Summerfield, Head of Immunology at the IVI and Professor at the University of Bern. Local outbreaks in wild boar can be controlled by capturing and shooting the animals, but the vaccine is essential for disease control where the virus has a wide geographical distribution, as in large parts of Eastern Europe.

To date, only one country in the world, Vietnam, has approved a vaccine for ASF. The aim of the ASFaVIP research project is to prepare a registration dossier which will allow a vaccine to be used in Europe. This requires a lot of data on safety and efficacy, such as determining the duration of immunity, the effect of age, the safety in pregnant animals. Another task is to clarify whether infected animals can be distinguished from vaccinated animals. In order to collect all this data and answer these questions, the IVI is using animal experiments involving domestic pigs.

“We are also trying to understand how the pig’s immune system works following infection with the ASF virus,” says Artur Summerfield. Despite long years of research, many aspects of the disease remain unclear. ASF is a large DNA virus with a highly complex genome that codes for around 170 proteins. “It is significantly larger than most of the viruses we face.” In the past, vaccine development adopted a trial-and-error approach. “Correlation analyses have now brought us much closer to the immunological protection mechanisms.” To this end, vast amounts of immunological, clinical and virological data were collected and analysed in depth with the aid of bioinformatics. “This enabled us to differentiate the protective from the pathogenic immune response and we are now using this information to modify the vaccine.”

A major question remains, because the antibody level in pigs is not correlating to the degree of protection. “We don’t understand how antibodies work in ASF,” admits Artur Summerfield. “The virus attacks the immune system, triggering an immunopathological response, and in the end it is not the virus that kills the animal, but the immune response.” To understand all of this, there is a need for additional basic research. “We want to know precisely what is happening and where the immune defence is moving in the wrong direction.” What is clear at this point is that there is no single viral protein that gives animals immunological protection.

Domestic pigs can be shielded against transmission using good farm biosecurity, such as fences and hygiene measures, although vaccination by injection may be useful in certain circumstances. As this is possible only to a limited extent for wild boar, vaccination in bait form would be highly desirable. However, there is no guarantee that all animals in a wild population will ingest a bait and receive the vaccine. “This is why the project is also investigating the percentage of a population that would need to be vaccinated in order to halt the spread of the virus.”

The vaccine for which the ASFaVIP partners are drafting a registration dossier contains live attenuated viruses. There is therefore a risk that the virus might mutate after vaccination and become more virulent. “So far, however, it is the only form of vaccine that offers protection against ASF,” says Artur Summerfield. As there are no plans for large-scale vaccination, it might be appropriate to deploy the vaccine region by region. “The vaccine is not perfect, but it is good enough that the benefits can outweigh the potential harm.” However, more research and more data are needed before the vaccine can be approved.