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Immune responses associated with protection against contagious bovine pleuropneumonia and induced by immunization

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«AnimalS, health, Territories, Risks, Ecosystems»

Executive summary

After a brief presentation of the pathogen and the disease it causes, a summary of current knowledge was given on the main types of immune responses, such as innate immunity, humoral immunity and cell-mediated immunity (CMI). A chronology of the most important scientific discoveries, from the late 60s to the present day, was presented.

As far as innate immunity is concerned, data are very scarce, and the focus was put on recent work by CIRAD on the effect of complement and the mycoplasmacidal capacity of macrophages (*https://microbiol.peercommunityin.org/articles/rec?id=5*). On the contrary, considerable work has been done on characterizing antibody responses during primary infection and immunization because they have long been used as diagnostic tools. However, so far, antibodies cannot serve as correlates of protection and their precise role in protection and/or pathology is still unclear. However, our work at CIRAD has shown that specific antibodies enable macrophages to actively phagocytose and kill mycoplasmas *in vitro*. Work on CMI is more recent, having begun in the 2000s with pioneering work by CIRAD scientists. A controversy exists on the potential role of interferon gamma (IFN-γ), CMI's archetypal cytokine, in protection most likely due to differences in challenge and study protocols used. Nonetheless, more recent work done by CIRAD showed that a strong CMI, strictly controlled by IFN-γ-producing memory CD4+ T lymphocytes, is present in animals that cured the disease and in those, albeit to a lesser extent, that are immunized with the conventional live attenuated vaccine. Interestingly, among these memory CD4+ T lymphocytes, we were able to characterize, for the first time in ruminants, a population described in humans and mice for its role in long-term memory and known as central memory T cells.

Finally, research prospects were discussed for each type of immunity, with the emphasis on those that would enable better vaccines to be developed. Antibody transfer experiments using improved nebulization-based challenge methods are needed. Once the protective antibodies have been identified, those antigens that they target should be characterized. Since memory CMI is necessary for strong and long-lasting immune protection, it is important to characterize in depth these responses in animals undergoing a secondary challenge. The priority should be put on identifying correlates of protection, or successful vaccination to enable prioritization of candidate vaccines before proceeding with costly and tedious efficacy trials requiring large numbers of cattle.