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A live attenuated nasal vaccine against pertussis

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Pertussis or whooping cough is making a dramatic comeback in several countries, especially since the switch from the first-generation whole-cell to the more recent acellular vaccines. The reasons for this resurgence are still under debate, but may essentially be due to unexpectedly fast waning of acellular vaccine-induced immunity and insufficient effectiveness of these vaccines to protect against infection by *Bordetella pertussis*, the principal causative agent of whooping cough, even though they protect effectively against *pertussis* disease. To ultimately control pertussis, new vaccines are necessary that protect both against the disease and B. *pertussis* infection. We have developed a live attenuated *pertussis* vaccine that can be administered by the nasal route. This vaccine, named BPZE1, has been shown to be safe in pre-clinical animal models, including severely immunocompromised mice, and to induce strong antibody and T cell responses. A single nasal dose of BPZE1 was able to protect mice against challenge with virulent B. pertussis, and protection was significantly longer lived than that induced by multiple administrations of acellular vaccines. In non-human primates, BPZE1 was also found to be safe and to protect against disease and infection caused by a highly virulent B. *pertussis* clinical isolate. BPZE1 has now successfully completed a phase I clinical trial in humans and was found to be safe in adults, to be able to colonize transiently the human respiratory tract and to induce immune responses in the colonized individuals. The vaccine is now undergoing further clinical development. Interestingly, in the course of the preclinical investigations, unexpected immunomodulatory properties or BPZE1 were uncovered. Without being immunosuppressive, BPZE1 appears to be anti-inflammatory and to protect mice against influenza virus-induced death, against experimental asthma and against experimental hypersensitivity of the skin, most probably linked to innate immune responses induced by the vaccine. Together with the protective effects against B. *pertussis* infection, these anti-inflammatory properties make BPZE1 an interesting tool for the benefit of public health, far beyond the control of pertussis.

Biography

Camille Locht currently holds a position as Research Director at the French National Institute of Health and Medical Research (Inserm) and, since 2010, is the Founding Director of the Center for Infection and Immunity of Lille on the campus of the Institut Pasteur de Lille in France. He has obtained his PhD at the Catholic University of Leuven in Belgium in 1984. After 3-years Postdoctoral stay at the National Institute of Allergy and Infectious Disease in the USA, where he started to work on *pertussis* and cloned the *pertussis* toxin genes, he joined SmithKline – Beecham (now GSK) to help developing acellular *pertussis* vaccines. Since 1989 he is the Head of a research laboratory at the Institut Pasteur de Lille, where he has been the Scientific Director from 2002 to 2013. His research interest is in molecular pathogenesis of respiratory infections, essentially *pertussis* and tuberculosis, with the long-term aim to develop new tools to combat these diseases. He has authored more than 300 international publications, book chapters and patents and has obtained several research awards.

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