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A novel Lyme borreliosis vaccine protecting against all major borrelia infections

Lyme borreliosis (LB) or Lyme disease is the most common vector-borne disease in the northern hemisphere and at present there is no vaccine available to prevent infections. Recent analyses showed that the number of infections in the US and Europe are largely underreported, emphasizing the need for an effective vaccine. An OspA (Outer surface protein A) based vaccine (LYMErix™) was previously shown to be efficacious against disease caused by the most prevalent *B. burgdorferi* in the US. In Europe, the majority of LB cases are caused by four different Borrelia species expressing six different OspA serotypes. Since Outer surface protein A (OspA) is one of the dominant antigens expressed by the spirochetes when present in the tick vector we have developed a vaccine for global use, consisting only of the C-terminal part of OspA which is sufficient for protection. To target the Borrelia species expressing the six different OspA serotypes prevalent in US and Europe, we have designed a multivalent OspA-based vaccine (VLA15), including three proteins, each containing the C-terminal half of two OspA serotypes linked to form a single fusion protein. The OspA fusion proteins were at least 85% triacylated which ensured high immunogenicity and were highly purified for further preclinical testing. Active immunization with the adjuvanted Lyme borreliosis vaccine VLA15 protected mice from a challenge with spirochetes expressing either OspA serotype 1, 2, 4, 5 or 6, using infected ticks or *in vitro* grown bacteria as a challenge. Further immunological analyses (ELISA, surface binding and growth inhibition) indicated that the vaccine can provide protection against the majority of human pathogenic Borrelia species, including OspA serotype 3. This rational designed VLA15 vaccine was therefore prepared for evaluation in a first-in-man study which currently ongoing.

Recent Publications

- Comstedt P, Schüler W, Meinke A and Lundberg L (2017) The novel Lyme borreliosis vaccine VLA15 shows broad protection against Borrelia species expressing six different OspA serotypes. PLOS ONE. 1:12(9):e0184357.
- Roques P, Ljungberg K, Kümmerer BM, Gosse L,

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Dereuddre Bosquet N et. al. (2017) Attenuated and vectored vaccines protect non-human primates against Chikungunya virus. J. Clin. Invest. Insight 2(6):e83527.

- Olafsdottir TA, Lindqvist M, Nookaew I, Andersen PL, Maertzdorf J, Persson J, (2016) Comparative systems analyses reveal molecular signatures of clinically tested vaccine adjuvants. Nature Scientific Reports. 6:39097.
- Knudsen NPH, Olsen A, Buonsanti C, Follmann F, Zhang Y et. al. (2016) Different human vaccine adjuvants promote distinct antigen-independent immunological signatures tailored to different pathogens. Nature Scientific Reports 6:19570.
- Comstedt P, Hanner M, Schüler W, Meinke A, Schlegl R and Lundberg U (2015) Characterization and Optimization of a Novel Vaccine for Protection against Lyme Borreliosis. Vaccine 44:5982-88.

Biography

Andreas Meinke is an expert in Micro- & molecular biology and infectious disease, with more than 18 years of experience in vaccine R&D. He graduated in Biology, performed his PhD work at the University of British Columbia in Vancouver, Canada and lectured at the University Vienna as an Assistant Professor. At Valneva he was instrumental for the development of the AIP technology and for the development of several vaccine candidates towards clinical testing. During his career, he has authored and co-authored more than 70 publications and filed more than 20 patents in the field of antigen discovery and vaccine research.

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