Urban Lundberg, J Vaccines Vaccin 2015, 6:3
http://dx.doi.org/10.4172/2157-7560.S1.027

OMICS International
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6th Euro Global Summit and Expo on
Vaccines & Vaccination
August 17-19, 2015 Birmingham, UK

Characterization and optimization of a novel vaccine for protection against *Lyme borreliosis*

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Lyme borreliosis (LB) is the most common vector-borne disease in the northern hemisphere and there is no vaccine available for disease prevention. However, it has been shown that the disease can be averted by immunization with an OspA based vaccine (LYMErix™). The majority of LB cases in Europe are caused by four different *Borrelia* species expressing six different OspA serotypes, whereas in the US only one of these serotypes is present. The various pathogenic *Borrelia* species express different OspA serotypes on their surface: *B. burgdorferi* (serotype 1), *B. afzelii* (serotype 2), *B. garinii* (serotypes, 3, 5 and 6) and *B. bavariensis* (serotype 4). Outer surface protein A (OspA) is one of the dominant antigens expressed by the spirochetes when present in the tick vector. Immunization with the C-terminal part of OspA is sufficient for protection against infection transmitted by Ixodes ticks. In order to target the *Borrelia* species expressing the six different OspA serotypes, we have designed a multivalent OspA-based vaccine. The vaccine includes three proteins, each containing the C-terminal half of two OspA serotypes linked to form a heterodimer. In order to stabilize the C-terminal fragment and thus preserve important structural epitopes, disulfide bonds were introduced and the immunogenicity increased by addition of a lipidation signal. The OspA heterodimers were highly purified with low amounts of endotoxin, host cell proteins and host cell DNA. All three proteins were at least 85% triacylated which ensured high immunogenicity. Active immunization with the adjuvanted Lyme borreliosis vaccine protected mice from a challenge with spirochetes expressing either OspA serotype 1, 2 or 5, 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. This rational designed OspA-based vaccine is therefore suitable for global prophylaxis of Lyme borreliosis.

Biography

Urban Lundberg received his PhD in 1991 from the Karolinska Institute, Sweden. Subsequent to his work at the Karolinska Institute, he completed Post-doc at Yale University in the lab of Sidney Altman. In 1995 he moved to the Department of Microbiology and Genetics, University Vienna, as an Assistant Professor. After five years at Baxter AG he joined Intercell AG, now Valneva Austria GmbH. At present he is heading the preclinical vaccine development department.

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