Reverse vaccinology: a different way to create vaccines

Traditional vaccines are based on culture of pathogens and successive treatment of the microorganism, in order to make it less pathogenic but more immunogenic. However, this approach was severely limited by high mutational frequency of the microorganism antigens and their similarity to self-proteins.

“Reverse vaccinology” has a complete revolution compared to traditional vaccines and is one of the most promising and innovative method in vaccine development. In this approach the vaccine is designed and developed starting from the sequencing of pathogen genome rather than from the analysis of the laboratory grown strain.

Through genomic screening, sequences of pathogen DNA encoding for proteins supposed to be exposed on the surface are identified and selected. Using these proteins in a vaccine could arouse a greater immune response and guarantee an effective and long-lasting memory.

Reverse vaccinology has been successfully applied for developing effective vaccines against several diseases, including tuberculosis, leptospirosis, leishmaniosis and in particular in the development of 4CMenB (meningococcal B vaccine), the first one deriving from Reverse vaccinology and licensed in Europe in 2012.

The antigenic diversity of meningococcal surface proteins and their similarity to self-proteins had not permitted the production of an effective vaccines using standard procedures; Reverse vaccinology managed to identify and isolate sequences codifying for the most immunogenic antigens expressed by Neisseria meningitidis, leading to the development of a highly specific and effective vaccine.

In this paper, we report the key points of “Reverse vaccinology” and its application in health and prevention fields, focusing our attention on the development, diffusion and evolution of the meningococcal B vaccine.