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Production of virus-like particles for vaccines

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Vaccine development undergoes extensive and complex work before its commercial availability. Many methods are involved in vaccine development and virus-like particle (VLP) technology is one of the very powerful methods for developing vaccines. VLPs are nanostructures that resemble the structures of viruses. They are composed of one or more structural proteins that can be arranged in several layers and can also contain a lipid outer envelope. They are attractive carrier proteins of foreign antigens, which present antigens in a dense and repetitive manner. This feature enables the cross-linking of B cell receptors (BCRs) that leads to robust B cell activation and signalling. Their repetitive structures trigger a high humoral and cellular immune response. A key factor that determines VLPs’ safety is the lack of viral genomic material, which enhances safety during both manufacture and administration. Contemporary VLP production might take advantage of several systems, including bacterial, yeast, insect and mammalian cells. The choice of production platform depends on several factors, including cost and the need for post-translational modifications, which can be essential in generating an optimal immune response. Some VLP-based vaccines designed to prevent several infectious diseases are already approved and are on the market (e.g. vaccines against hepatitis B virus and human papillomavirus), with many others at the clinical trial or research stage (e.g. vaccines against chikungunya (CHIKV), zika virus, etc. Interest in this technology has recently increased owing to its advantages over classical vaccines. Thus, VLP technology is serving as a powerful template in the development of many next-generation vaccines.

Keywords: Recombinant vaccines, Virus-like particles, Immunogen, Antigen presentation, Carrier proteins, Immunogenicity

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