

Nanochemistry-Based Immunotherapy for HIV-1

F. Lori, S.A. Calarota and J. Lisziewicz

*Research Institute for Genetic and Human Therapy (RIGHT), Pavia, Italy and Bethesda, MD, USA
Genetic Immunity, Washington DC, USA and Budapest, Hungary*

Abstract: Highly active antiretroviral treatment (HAART), i.e. the combination of three or more drugs against human immunodeficiency virus type 1 (HIV-1), has greatly improved the clinical outcome of HIV-1-infected individuals. However, HAART is unable to reconstitute HIV-specific immunity and eradicate the virus. Several observations in primate models and in humans support the notion that cell-mediated immunity can control viral replication and slow disease progression. Thus, besides drugs, an immunotherapy that induces long-lasting HIV-specific T-cell responses could play a role in the treatment of HIV/AIDS. To induce such immune responses, DermaVir Patch has been developed. DermaVir consists of an HIV-1 antigen-encoding plasmid DNA that is chemically formulated in a nanoparticle. DermaVir is administered under a patch after a skin preparation that supports the delivery of the nanoparticle to Langerhans cells (LC). Epidermal LC trap and transport the nanomedicine to draining lymph nodes. While in transit, LC mature into dendritic cells (DC), which can efficiently present the DNA-encoded antigens to naïve T-cells for the induction of cellular immunity. Pre-clinical studies and Phase I clinical testing of DermaVir in HIV-1-infected individuals have demonstrated the safety and tolerability of DermaVir Patch. To further modulate cellular immunity, molecular adjuvants might be added into the nanoparticle. DermaVir Patch represents a new nanomedicine platform for immunotherapy of HIV/AIDS. In this review, the antiviral activity of DermaVir-induced cellular immunity is discussed. Furthermore, the action of some cytokines currently being tested as adjuvants are highlighted and the adjuvant effect of cytokine plasmid DNA included in the DermaVir nanoparticle is reviewed.