Hydrogel-Based Vaccine Delivery Platform (VacSIM)

INVENTION: University of Georgia investigators have engineered a self-assembling gel matrix that is biocompatible and biodegradable to deliver vaccines such that the vaccine antigens are released over time. The delivery platform reduces the immediate pro-inflammatory response in the host and enhances immunogenicity.

To date the platform has been tested using the following: Hep B sAg, HIV Envelope, 2 different Burkholderia recombinant antigens, 3 different schistosome antigens (Protein backbone of CCA, TSP-1 and TPI), 3 different malaria antigens (CelTOS, CSP and AMA-1), whole inactivated influenza vaccine, and influenza nucleoprotein. In all cases where comparisons were made, VacSIM delivery drives enhanced vaccine-specific responses compared to delivery in alum or complete Freund's adjuvant. For the malaria candidate vaccines, we derive the same level of vaccine response in 2 doses, that are normally seen after 3 doses using Montanide.

APPLICATIONS:
- Delivery of recombinant subunit vaccines and adjuvants
- Delivery of whole inactivated virus and/or subunit vaccines for influenza
- Delivery of mucosal vaccines
- Delivery of viral and parasitic vaccines

ADVANTAGES:
- No toxic breakdown products or off target immune reactions
- Does not require polymerization ex vivo
- Does not require conjugation of antigenic motif to the self-assembling peptide
- No cold chain required
- Alter rate of release of antigen for robust adaptive immunity and memory responses
- Protects vaccine components from degradation
- Can release proteins, small molecules, and cells
- Can be employed to produce Th1, Th2 or mixed type immune response depending on desired outcome for each vaccine target
- Delivery includes subcutaneous, intramuscular, intradermal, mucosal, intraperitoneal, and aerosol


BACKGROUND: Vaccines remain the single greatest public health tool to combat infectious diseases. Vaccine formulation and delivery are key to the ability of vaccines to induce the desired immune responses. One goal of vaccine delivery is to present vaccine antigens in a manner that enhances antigen-presenting-cell (APC) activation, leading to antigen/organism uptake and processing of vaccine antigen(s). Delivery methods or adjuvants that safely enhance vaccine immunogenicity/efficacy are desirable for vaccines that are marginally effective and for vaccines administered to low responders or immunocompromised populations. Additional goals are to reduce the number of doses required to induce effective, vaccine responses and to reduce the amount of vaccine/dose, especially when a single dose of vaccine is administered, as with annual influenza vaccines. There is a need for improved delivery modes and adjuvants that are safe and increase adaptive immunity and memory responses.

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