Multi-scale modeling of influenza vaccination for optimal T cell immunity

Problems with the current influenza vaccine:
• low and variable vaccine efficacy  • requires frequent reformulation  • does not protect against pandemic strains

Background and Approach: Most current universal influenza vaccine research targets conserved antibody epitopes. However, T cells epitopes are also conserved and are potential targets for vaccination. The effectiveness of T cell-based vaccine is complicated by two main factors. First, pre-existing immunity preventing the attenuated vaccine virus from replicating and inducing an immune response. Second, T cell immunity prevents pathology (and to a lesser extent infection), so vaccine effectiveness needs to take into account boosting of immunity by asymptomatic infection with the circulating virus.

What is new inside?
(i) Development and empirical validation of a quantitative framework to determine how CD8 T cell immunity affects dynamics of infection and transmission.
(ii) Multi-scale model that incorporates reciprocal feedback between immunity at the individual level and boosting at the epidemiological level.

End Users: The multi-scale models will guide the development of new T cell-based vaccine and strategies for its implementation.