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Abstract for an Invited Paper
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**Physical Theory of Vaccine Design for Influenza and Dengue Fever**

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The immune system normally protects the human host against death by infection. I will introduce a physical theory of the evolutionary dynamics that occurs in the antibody-mediated and T cell-mediated immune responses. The theory will be used to provide a mechanism for original antigenic sin, wherein an initial exposure to antigen can degrade the response of the immune system upon subsequent exposure to related, but different, antigens. A new order parameter to characterize antigenic distance will be introduced from the theory. This order parameter predicts effectiveness of the influenza vaccine more reliably than do results from animal model studies currently used by world health authorities. I will discuss how this order parameter might be a valuable new tool for making vaccine-related public health policy decisions. Next, I will briefly discuss dengue fever. Infection with, or vaccination against, one of the four serotypes of dengue fever typically increases susceptibility to dengue hemorrhagic fever from one of the other three serotypes. I will present a physical theory of this immunodominance and use this theory to quantify the predicted mitigation of immunodominance in a novel formulation of the dengue vaccine.