

Abstract Submitted
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Glassy Dynamics in the Adaptive Immune Response Prevents Autoimmune Disease JUN SUN, MICHAEL DEEM, Rice University — The immune system normally protects the human host against death by infection. However, when an immune response is mistakenly directed at self antigens, autoimmune disease can occur. We describe a model of protein evolution to simulate the dynamics of the adaptive immune response to antigens. Computer simulations of the dynamics of antibody evolution show that different evolutionary mechanisms, namely gene segment swapping and point mutation, lead to different evolved antibody binding affinities. Although a combination of gene segment swapping and point mutation can yield a greater affinity to a specific antigen than point mutation alone, the antibodies so evolved are highly cross-reactive and would cause autoimmune disease, and this is not the chosen dynamics of the immune system. We suggest that in the immune system a balance has evolved between binding affinity and specificity in the mechanism for searching the amino acid sequence space of antibodies. Our model predicts that chronic infection may lead to autoimmune disease as well due to cross-reactivity and suggests a broad distribution for the time of onset of autoimmune disease due to chronic exposure. The slow search of antibody sequence space by point mutation leads to the broad of distribution times.

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