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Dynamics of Coevolution and Branching in the Immune System¹ KIMBERLY SCHLESINGER, SEAN STROMBERG, JEAN CARLSON, Univ of California - Santa Barbara — We investigate the dynamics of coevolution between two coupled populations, in the context of the interaction between mutating pathogen and the adaptive immune response. Our model represents the binding affinities between antigen epitopes and lymphocyte receptors which mediate the interactions of the two populations, and which may change with pathogen mutation. We see diverse possible outcomes of infection, including early pathogen clearance, early pathogen escape from immune control, and an intermediate state of chronic infection, in which pathogen strains coexist with lymphocytes at relatively stable levels. The coevolutionary dynamics within this chronic infection state display emergent structure, including evolutionary branching that is fundamentally driven by the coevolutionary interaction and that results in the clustering of the pathogen population into distinct and independently evolving clusters. The increased fragility of the immune system as it distributes its resources to control a growing number of clusters can lead to the sudden out-of-control growth of the pathogen after months or years of chronic infection.

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