Can the T-cell anergy be explained via slow dynamics of glassy systems ?

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For the activation of T cell, interaction between the T cell Receptor (TCR - residing on the surface of the T cell) and the peptide bound Major Histocompatible Complex (pMHC) (residing on the surface of the Antigen Presenting Cell (APC)) as well as interactions between various co-stimulatory and adhesion molecules between the contact area of the T cell and the APC are essential. In this study, we show how a particular Directed Polymer Model (or a self avoiding random walk on a tree lattice) could be used to model the interaction between the T cell and the APC in its simplest form where a binary 1 is assigned to an interaction which acts favorably for the activation (of T cell) and a binary 0 when it acts unfavorably for the same. Employing large deviation techniques, the phase diagram for various states for the T cell-APC system is obtained where it has been shown how the system could become activated as the width of the distribution of the dissociation rate of agonist peptides is varied. In particular, it is conjectured here the so called T cell anergy could be the analogy of the frozen (or the slow dynamic) state found in spin glass models in statistical mechanics.