Modelling the motility of Cytotoxic T Lymphocytes inside infected lymph nodes

Zeinab Sadjadi[1] ,Stephan Halle[2] and Michael Meyer-Hermann[1]

[1]Helmholtz Center for Infection Research, Braunschweig, Germany and [2]Institute for Immunology, Hannover Medical School, Hannover, Germany

Cytotoxic T Lymphocytes detect and kill infected cells in lymph nodes. The underlying mechanisms of this process are however still unclear. The results of 2-photon microscopy experiments in vivo have shown different migration patterns and processivities of CTLs during search and killing processes[1]. We aim to understand the possible roles of chemotaxis, T cells cooperativity during killing, and fibroblastic reticular network on the dynamics and search strategy of CTLs inside a lymph node. We develop a two-state persistent random walk model for the motion of CTLs during search and killing phases. Four different realizations of experiments are of particular interest: no virus infection (control), virus infection without cognate antigen MCMV-2D, virus infection without direct presentation MCMV-3D, virus infection with direct antigen presentation of target cells MCMV-3D-ΔvRAP. By tuning the parameters of the analytical model to each of the realizations we reproduce the observed dynamics of CTLs, which enables us to study the role of key parameters on search efficiency and killing.

[1] Stephan Halle et al., Immunity 44, 233(2016).