MAR09-2008-020384

Abstract for an Invited Paper
for the MAR09 Meeting of
the American Physical Society

Fast, continuous recirculation of germinal center B cell populations enhances robustness of immune response towards varying pathogens

MICHAL OR-GUIL, Systems Immunology Research Group, Institute for Theoretical Biology, Humboldt University, Berlin, Germany

Germinal centers (GCs) are dynamic microstructures that form in lymphatic tissues during immune responses. There, B cells undergo rapid proliferation and mutation of their B cell receptors (BCRs). Selection of B cells bearing BCRs that bind to the pathogen causing the immune response ultimately leads to BCRs that, when secreted as antibodies, form a new, effective, and pathogen specific antibody repertoire. However, the details of this evolutionary process are poorly understood, since currently available experimental techniques do not allow for direct observation of the prevailing mechanisms [Or-Guil et al., Imm.Rev. 2007]. Based on optimality considerations, we put forward the assumption that GCs are not isolated entities where evolutionary processes occur independently, but interconnected structures which allow for continuous exchange of B cells. We show that this architecture leads to a system whose response is much more robust towards different antigen variants than a set of independently working GCs could ever be. We test this hypothesis by generating our own experimental data (time course of 3-D volume distribution of GCs, analysis of high-throughput BCR sequences), and show that available data is consistent with the outlined hypothesis.