

Mechanics and force patterning in B-cell antigen extraction

Anita Kumari(1), Pablo Saez(1), Mathieu Maurin(1), Danielle Lankar(1), Katharina Hennig(2), Vanessa Boura(3), Mabel San Roman(1), Mikael Karlsson(3), Martial Balland(2), Ana-Maria Lennon Dumenil(1), Paolo Pierobon(1)

(1) Institut Curie, PSL Research University, INSERM U932, 26 rue d'Ulm, 75248 Paris cedex 05, France.

(2) Laboratoire Interdisciplinaire de Physique, Université Joseph Fourier (Grenoble 1), 38402 Saint Martin d'Hères Cedex 9, France;

(3) Department of Microbiology, Tumor and Cell Biology, Karolinska Institutet, Nobels väg 16, KI Solna Campus Karolinska Institutet, Box 280, SE-171 77 Stockholm, Sweden.

Efficient immune responses require the internalization, by B cells, of antigens presented on the surface of neighboring cells in lymph nodes. Two models have been proposed for the extraction of surface-tethered antigens by B cells: (1) spreading and contraction; (2) mechanical pulling on BCR-antigen complexes. These two cellular processes involve the actin-based molecular motor protein myosin II. We describe here a unifying model for antigen extraction by B lymphocytes, involving both global contractile forces at the periphery of the B-cell immune synapse and local pulling forces at its center. The peripheral contractile forces are dependent on a centripetal flow of myosin II, whereas the central pulling forces are generated by F-actin protrusions that form in a myosin II-dependent manner. We found that the peripheral contractile forces are pulsatile, providing a possible explanation for their role in favoring actin protrusion formation. Myosin II emerges therefore as global organizer of the cell-cell contacts and may be unexpectedly implied in other systems where receptors internalization is required.