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Modeling of T-Cell polarization

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The repositioning of the microtubule organizing center is a part of many fundamental biological processes. It occurs in T-cell lymphocyte immediately after antigen presenting cell is recognized by T-cell. The Dynein's effort to walk to the minus end of the microtubule while being anchored at one place results in microtubule's sliding, and, hence in the repositioning of the microtubule organizing center and in the rotation of the whole microtubule structure. This process was experimentally observed, but its inner dynamics and key features remained poorly understood. We developed a physical model of microtubules and their organizing centre. By taking account of the cell's inner geometry, various forces acting in the cell and contact between microtubules and other organelles, we achieved to perform realistic simulation of the repositioning. The output of the model is in compliance with experimental observables. The results can cast a new light on the intracellular dynamics that is a key part of many biological processes. The influence of the rotation of microtubule structure on the intracellular patterns of concentration of calcium ions is explained.

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