Stochastic Model for Centrosome Relocation in T-Cells during Polarization

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During activation and killing T-cells establish a contact area, the immunological synapse (IS), with a target cell, towards which then their centrosome, the microtubule organizing center (MTOC), is relocated [1]. The main forces in that process appear to be both a growth based pushing force of the microtubules and a pulling force generated by motor proteins, such as Dynein, at the cell cortex. Those forces are calculated via a deterministic model for the distributions of the microtubules [2]. The centrosome's motion results from solving the time-evolution for the distributions of the microtubules taking into account the off-centering behaviour of Dynein largely located at the synapse in T-cells. The investigation of the centrosome's positioning is extended to a stochastic model based on the microtubules' growth [3] and the capturing by Dynein. The study illustrates that, in comparison to ordinary cells, the centrosome's adjustment towards the center of the cell, is mainly altered by the asymmetric distribution of motors and nucleation sites.

[1] Alberts, Johnson, Lewis et al., Molecular Biology of the Cell, 2002.

[2] Pavin, Laan et al., New Journal of Physics 14.10, (2012)

[3] Zhu et al., Molecular Biology of the Cell 21.24, (2010)