Intracellular activity and mechanics in dividing epithelial cells

Sebastian Hurst and Timo Betz

Institute of Cell Biology, Münster, Germany

While there is a good understanding of chromosome segregation during cell division, surprisingly little is known about how the different organelles are distributed during this fundamental process. It is generally assumed that organelles are not systematically transported to the daughter cells but that their distribution relies on passive diffusion and hence stochastic transport throughout the cell. Although diffusion will provide fast mixing of small molecules, it is not clear if this can explain the even distribution of larger organelles with low copy number, especially in highly polarized cells.

An attractive mechanism for equal distribution of organelles during cell division is the increase of random mobility. This could be achieved by active, undirected fluctuations, e.g. generated through motor protein activity. To test this hypothesis that active fluctuations help distributing organelles we perform passive and active microrheology measurements using optical tweezers, with exogenous particles inside dividing MDCK cells. The results are used to calculate the intracellular viscoelasticity and mechanical activity to pinpoint the influence of active cytosolic mixing during cell division. We identify that during metaphase the activity decreases while it is enhanced during anaphase.