Anomalous dynamics of cell migration

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Cell movement, for example, during embryogenesis or tumor metastasis, is a complex dynamical process resulting from an intricate interplay of multiple components of the cellular migration machinery. At first sight, the paths of migrating cells resemble those of thermally driven Brownian particles. However, cell migration is an active biological process putting a characterization in terms of normal Brownian motion into question. By analyzing the trajectories of two different types of kidney cells, we show experimentally that anomalous dynamics [1] characterizes cell migration. A superdiffusive increase of the mean squared displacement, non-Gaussian spatial probability distributions, and power-law decays of the velocity autocorrelations are the basis for this interpretation. Almost all results can be explained with a fractional Klein-Kramers equation allowing the quantitative classification of cell migration by a few parameters [2].

[1] R. Klages, G.Radons, I.M.Sokolov (Eds.), Anomalous transport (Wiley-VCH, Weinheim, 2008).

[2] P.Dieterich, R.Klages, R.Preuss, A.Schwab, PNAS **105**, 459 (2008).