MAR14-2013-020673

Abstract for an Invited Paper
for the MAR14 Meeting of
the American Physical Society

Tumor cell migration is a superstatistical process[1]

BEN FABRY, Department of Physics, University of Erlangen-Nuremberg

Over short time scales, cell migration can be well described as a homogeneous correlated random walk with a fixed average step length and a certain degree of directional persistence. On time scales of up to 24 h, however, the migration process is highly inhomogeneous. Superstatistical fluctuations of step length and directional persistence lead to "anomalous" features, such as an exponential step width distribution (SWD) and a superdiffusive mean squared displacement (MSD). These features are quantitatively reproduced by a correlated random walk with temporally varying persistence. By comparing cell migration on planar substrates and in a 3D collagen matrix, we demonstrate that the globally averaged MSD and SWD are not sensitive to the microscopic migration mechanism of the cells and can therefore yield identical results in these different environments. By contrast, the temporal fluctuations of step length and directional persistence, and their mutual correlations, provide a characteristic fingerprint of the migration process in different environments.

[1]In collaboration with Julian Steinwachs and Claus Metzner, Department of Physics, University of Erlangen-Nuremberg.