Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Directionality Time - New Analytical Treatment of Directionally Biased, Crawling Motility JAY TANG, ALEXANDER LOOSLEY, Brown University — Insights on crucial biological functions often emerge from measuring how animal cells crawl on surfaces, particularly in response to gradients of external cues that cause directionally biased motion. Most existing metrics commonly used to characterize directional migration, such as straightness index (or chemotactic index), persistence time, and turning angle distribution, tend to be sensitive to relatively large errors at short sampling times. In contrast, we recently introduced a new metric, called directionality time, to define the onset time by which a seemingly random motion becomes directionally biased (OBrien et al., J Leukocyte Biol, 2014, 95:9931004; Loosley et al., PLOS ONE, 2015, 10.1371). Directionality time is obtained by fitting the mean squared displacement as a function of time interval, in log-log coordinates, to a fit function based on biased and persistent random walk processes. We show that the fit function is approximately model invariant and is applicable to a variety of directionally biased motions. Simulations are performed to show the robustness of the directionality time model and its decoupling from measurement errors. Finally, we demonstrate as an example how to usefully apply the directionality time fit to trajectories of chemotactic neutrophils.

Jay Tang
Brown University

Date submitted: 03 Nov 2015 Electronic form version 1.4