

Distinct cell migration related properties are associated with cell migration speed versus membrane dynamics

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Keywords: *Cell migration, Membrane dynamics, Adhesion complex, Paxillin, F-actin.*

Abstract

The membrane dynamics of cells in 2D may correlate better than cell migration speed with 3D invasive potential of cancer cells (Meyer et al. *JCB* 2012). However, it remains unclear what cellular properties that may specifically be linked to cell migration speed versus cell membrane dynamics during cell migration. We therefore aimed to resolve this matter.

We used confocal laser scanning microscopy to study live, migrating H1299 non-small cell lung carcinoma cells stably transfected by EGFP-Paxillin and RubyRed-Lifeact. We analyzed single migrating cells using custom-developed image analysis software and multivariate statistics, extracting quantitative data characterizing a large set of cell migration related properties. These were concurrently sampled at the macromolecular scale, where cell-matrix adhesion complex and F-actin properties were measured, and at the cellular scale, where membrane dynamics, cell morphology and migratory features were extracted.

Among a total of 150 analyzed variables, we found 15 variables specifically correlated to cell migration speed, 7 specifically to membrane dynamics and 33 variables that were significantly correlated to both migration speed and membrane dynamics. For example, decreased paxillin concentration in adhesions correlated to increases in both cell speed and membrane dynamics while a decrease in the concentration of F-actin in adhesions specifically correlated to increased membrane dynamics. In contrast, we found that a homogeneous distribution of adhesion complex age and size was specifically linked to increased cell speed.

In conclusion, we have been able to separate cellular and subcellular properties connected to cell migration speed versus membrane dynamics.