Membrane fluidity: biophysical parameter measuring the cell plasticity during tumorigenesis process

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Cell plasticity is a key determinant of physiological and pathophysiological processes such embryonic development, wound healing, normal cell reprogramming and cancer. Neoplastic transformation is therefore a combined disease of genetic alterations and aberrant epigenetic reprogramming. Moreover, disturbance of normal state of differentiation open the way to the acquisition of new phenotypic traits especially important for tumour development and cell aggressiveness (therapeutic resistance, invasive capacity, or an adaptation of a new physiological environment).

Measuring cell plasticity is a complex problem due to the dynamic nature of cell reprogramming, especially in aberrant condition such as cancer, representing therefore a strong obstacle to the use of this parameter in clinic as a diagnostic tool. For these reasons, we decide to determine whether a measurable biophysical parameter could follow the same dynamic and constitute an ideal marker of cancer cell plasticity. Among the numerous modifications of cancer cells, the unsaturation levels and the lipid composition of their membranes are among the most affected at different level and in different manner regarding the type and the aggressiveness of cancer. We thus decide to measure the modifications of membrane fluidity and to test if they could represent a new way to follow cell reprogramming. We developed a non-toxic ratiometric dye able to follow dynamically and quantitatively the fluidity of all cell membranes. We then define by using existing models of cell reprogramming the correlation occurring between the membrane fluidity and peaks of plasticity taking place during cell transition between different phenotypic states.