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THE ROLE OF MATRIX STIFFNESS ON 3D CELL MIGRATION

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Understanding the cellular migration plays a key role to advance in the diagnosis and treatment of different diseases. Joint experimental and computational studies have pointed out as a promising tool to advance in this issue. Until now, most studies have been developed in 2D [1], however, with the advance of technology and the possibility to test 3D conditions a new type of cellular migration has been discovered, lobopodial-based migration [2].

This type of migration only appears in 3D extracellular matrices, although only under certain conditions which are not clear yet. In lobopodial-based migration, the cell creates a single protrusion through which the nucleus begins to pass and acts as a piston, dividing the cell in two parts and thus increasing the pressure in the front part [3].

Mechanical properties of the extracellular matrix (ECM) are thought to play a key role in this type of cell migration. In fact, depending on whether the ECM is linear elastic or non-linear elastic, the lobopodio will appear and the nucleus will begin to move [2].

In order to elucidate if the mechanical properties of the extracellular matrix are crucial in the choice of the cell migration type, we propose a finite element model in which we simulate a previous in vitro experiment [2] for ECM with different mechanical properties and behaviours (stiffness, constitutive model) for a single cell migrating in a lobopodial-based mode. We simulate the cell as three-part model consisting of a nucleus, a cytoplasm and a membrane.

Previous works [2-4] have concluded with the relevance of the ECM behaviour as a differential factor chosen lobopodia-based migration or not. Thereby, the main results we analyse are mechanical environment in the cytoplasm and nucleus for the different matrices.

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