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CELL TRACTION ON MICRO-PATTERNED SUBSTRATE

***FY Leong[1], V Chan[2] and KH Chiam[3]**

[1] A*STAR Institute Of High Performance Computing
1 Science Park Road, #01-01
The Capricorn, Singapore
Science Park II,
Singapore 117528

leongfy@ihpc.a-star.edu.sg

[2] Nanyang Technological University
Centre of Biotechnology, School of Chemical and Biomedical Engineering, 50 Nanyang Avenue,
Singapore 639798

mvchan@ntu.edu.sg

[3] A*STAR Institute Of High Performance Computing
1 Science Park Road, #01-01
The Capricorn, Singapore
Science Park II,
Singapore 117528

chiamkh@ihpc.a-star.edu.sg

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ABSTRACT

An important prerequisite for cellular locomotion on an adherent substrate is the application of traction stress. In addition to cell morphology, there is mounting evidence that mechanical stresses can affect critical cellular processes, such as cell growth, differentiation and specialization [1,2]. Traction force microscopy is a technique used to derive the cell traction field from measured point displacements of fluorescent beads embedded in the substrate [3]. For the case of even substrate surface, this involves the solution of an inverse problem based on the Boussinesq Green's function for the elastic half-space. For the case of a typical micro-patterned substrate surface, it is shown that the Boussinesq approximation is inaccurate in the region near an elevated ridge. The purpose of this study is to investigate cellular response to spatial differences in substrate compliance due to surface in-homogeneity, as well as the corresponding effect on cell migration. In particular, we are interested in how cells apply traction stresses on an elevated ridge. Results are obtained through the application of traction force microscopy, as well as numerical simulation incorporating cell adhesion.

REFERENCES

[1] Vogel V. and Sheetz, M., 'Local force and geometry sensing regulate cell functions.' *Nat. Rev. Mol. Cell. Biol.* 7:265-275, (2006)

[2] McBeath, R., Pirone, D.M., Nelson, C.M., Bhadriraju, K., Chen, C.S., 'Cell shape, cytoskeletal tension, and RhoA regulate ítem cell lineage commitment', *Dev. Cell.*, 6:483-495, (2004)

[3] Sabass B., Gardel, M.L., Waterman, C.M., Schwarz, U.S., 'High resolution traction force microscopy based on experimental and computational advances', *Biophys. J.*, 107.113670, (2007).