

Quantifying Cell adhesion and Cell stiffness using Single Cell Force Spectroscopy

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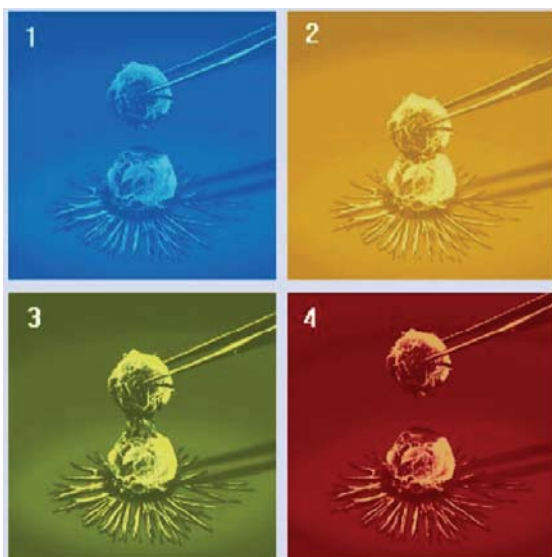
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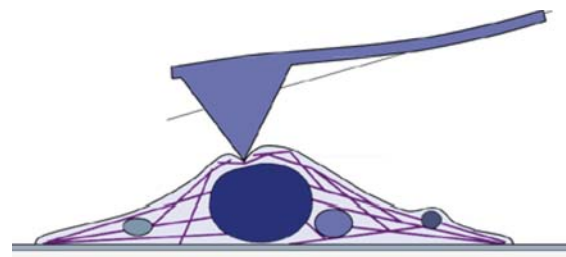
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The interaction of cells with their external environment plays a key role in multiple cellular processes, from tissue development and cohesion, to cell motility, cancer development and metastasis, and immunology. Using single cell force spectroscopy (SCFC), cell adhesion can be quantified (1), and the contribution of different components e.g. from the extra cellular matrix, can be assessed (2). Additionally, based on atomic force microscopy the nano-indentation technique has emerged as a useful tool to determine elastic properties like the Young's modulus for biological samples. Nanomechanical analysis of cells increasingly gains in importance in different fields in cell biology like cancer research (3), and developmental biology (4).

contact time, contact force, and pulling length) and for elasticity measurements (tip geometry, indentation depth, contact point) will be discussed as well as the boundary conditions of the Hertz model. We have developed a technique to run such measurements on living cells, in a temperature controlled environment in combination with light and fluorescence microscopy. With two different pulling ranges of 15µm/100µm we are able to investigate the binding forces between a single cell and a monolayer (5), between two cells (4), or between a cell and a target surface down to the single-molecule level. Using a special designed holder we are able to transfer a cantilever-attached-cell from one culture dish to another one and back again.



We present a strategy to carry out cell adhesion and elasticity experiments using SCFS. The related working parameters for force measurements (e.g.



REFERENCES:

- 1) Benoit et al., *Nature Cell Biology* 2, 313 - 317 (2000)
- 2) Puech et al., *Journal of Cell Science* 118 4199-4206 (2005)
- 3) Gross et al., *Nature Nanotechnology*, 2, 780-783 (2007)
- 4) Krieg et al., *Nature Cell Biology* 10/4, 429-436, (2008)
- 5) Puech et al., *Ultramicroscopy* 106, 637-644 (2006)