

FUNCTIONALIZED BIOMEMS SENSORS FOR STUDYING FORCE RESPONSE OF SINGLE LIVING CELLS

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ABSTRACT

We present a new MEMS based force sensor to study the mechanical response of a single living cell (on a substrate) when deformed at a local site. The sensor consists of a series of fixed-fixed micro beams with a probe to contact the cell. The contact region of the probe can be designed to apply both tensile and shear force on the cell. The probe is functionalized by coating it with a thin layer of fibronectin which prompts the cell to form adhesion sites with the cell by integrin activation. Thus the deformation is applied directly on the cytoskeletal structure through focal adhesion complexes, and the cytoskeletal force response can be measured. The force resolution of the sensor is on the order of $10\text{nN}/\mu\text{m}$. The method allows to study the force – displacement response of the cell in-situ with an inverted optical microscope. Thus, the cytoskeletal structure of the cell can also be visualized in-situ by fluorescence techniques such as GFP to study the mechanism of cell deformation under mechanical forcing. The method will be demonstrated by testing several endothelial cells. Preliminary interpretation of the cell response will be provided based on mechanics models.