Micro-fabricated elastomeric pillar arrays for studies of cellular sensing of extracellular matrix rigidity

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The mechanical features of the microenvironment surrounding cells affect many important aspects of cellular behavior, including cell growth, differentiation, migration, and death [1,2]. To respond to microenvironmental mechanical signals, cells have to actively test the environment, but the mechanisms of such mechanosensing are not clear. Recently, the development of specialized micro- and nano-fabricated surfaces that can be bio-functionalized has opened the possibility of studying mechanosensing events with high accuracy, including sensing of extracellular matrix rigidity [3,4]. I will describe our recent results using micro-fabricated elastomeric pillar arrays that allow tracking cellular forces during rigidity sensing. We found that cells form local actomyosin-based contractile units at their edges, which periodically pinch the environment through cell-matrix adhesions. Once a certain force level is reached in the contractile units, adhesion reinforcement is activated by recruitment of additional adhesion-related proteins. Depletion of the actomyosin regulatory protein tropomyosin leads to significantly increased forces and aberrant rigidity sensing. These results may explain fundamental processes that occur in cancer cells, which also do not properly sense microenvironmental rigidity.

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