Micropatterned material surface controls cell orientation

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Cells could be orientated in a controlled way on a micro-patterned surface based upon a delicate material technique, and the orientation could be semi-quantitatively described by some statistical parameters, as suggested by the group of DING from Fudan University, Shanghai, CHINA. The study is reported in Issue 18, Volume 54 (September 2009) of the *Chinese Science Bulletin* as one of the papers in a special issue about Biomedical Materials in this journal.

Cell-material interaction is a very important fundamental topic in natural science, yet is too complex to be revealed without unique research methods. Micropatterning technique, especially photolithography, a widely used technique in microelectronic industry, has recently been employed by material scientists and biologists to generate a surface with cell-adhesion contrast to control cell localization. The present study confirms that cells could be well orientated along a micropattern with cell-adhesive stripes in an adhesion-resistant background.

"While cell orientation on a micropattern is not the first observation, our work distinguishes itself by employing a PEG hydrogel instead of a PEG self assembly monolayer as background, and thus the cell adhesion contrast would be maintained for a long time, which guarantees more convenient and convincing observations," noted the corresponding author Jian-dong DING, director of the Key Laboratory of Molecular Engineering of Polymers of the Chinese Ministry of Education and professor of the Department of Macromolecular Science, Fudan University. "This paper further put forward five statistical parameters

which describe cell orientation from different aspects."

In this paper, the authors prepared, by the photolithographic transfer technique, stable gold (Au) micropatterns on PEG hydrogel surfaces with defined cell-resistant (PEG hydrogel) and cell-adhesive (gold microstripes) properties. 3T3 fibroblasts were cultured on Au-microstripe surfaces to observe cell adhesion and orientation. Five statistical parameters were defined and used to describe cell orientation on micropatterns. With the increase of inter-stripe distance, the orientational order parameter, the ratio of long and short axes of a cell, and the occupation fraction of cells on stripes increased gradually, whereas the spreading area of a single cell decreased. The abrupt changes of these four parameters did not happen at the same inter-distance. The adhesion ratio of a cell on Au stripes over cell spreading area did not change monotonically as a function of inter-stripe distance. The combination of the five statistical parameters represented well the cell orientation behaviors semi-quantitatively.

More information: Jianguo Sun, Jian Tang, Jiandong Ding. Cell orientation on a stripe-micropatterned surface. *Chn. Sci. Bull*. 2009; 54(18): 3154-3159. www.wjgnet.com/1007-9327/13/4873.asp

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