

CORRELATIVE QUANTITATIVE NANOMECHANICAL MAPPING AND CONFOCAL IMAGING OF LIVING CELLS BY SCANNING ION-CONDUCTANCE MICROSCOPY

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Quantitative nanomechanical mapping (QNM) of single cell via Scanning Ion-conductance Microscopy (SICM) is a novel method of studying cell mechanical properties. SICM allows to topography mapping with lateral and vertical nanoscale resolution, based on working principles. Moreover, it is possible to perform stiffness mapping simultaneously, due to applying force to living cell surface, whose nature is intrinsic colloidal pressure between nanopipette tip and cell membrane (Clarke et al., 2013, 2016). Nanoscale diameter of nanopipette tip allows to obtain cell QNM with nanoscale resolution and to avoid cell damage due to small values of applying force and non-contact scanning.

As it was reported previously (Kolmogorov et al., 2021), SICM successfully used for detection of Young's modulus alteration of PC-3 and HT-1080 cells before and after treatment with drugs like paclitaxel or cytochalasin-D, which are change actin filaments or microtubules state. But in this particular work, we have demonstrated possibility of correlative QNM and confocal imaging, allowing to study living cell morphology, Young's modulus dynamic and live confocal visualization of cytoskeleton elements for single cell analysis. Correlative imaging showed significant changes of cell topography as well as changes to the Young's modulus and structure of actin filaments in confocal images. In the case of cell topography we observed a decrease in the height of the periphery of the cell but not at the central part after actin filaments disruption, which is explained by a higher concentration of actin located within the periphery of the cell. Then, a decrease in Young's modulus is clearly observable during Cyto-D treatment, as expected. Moreover, disruption of actin filaments is clearly observable at confocal image in comparison with control cell where structured filaments are seen. Also, aggregation of actin is observable, as expected.

Thus, SICM technique can be successfully used for studying mechanical properties of living cells are important for various biological functions such as division, growth, differentiation, motility and tissue homeostasis.

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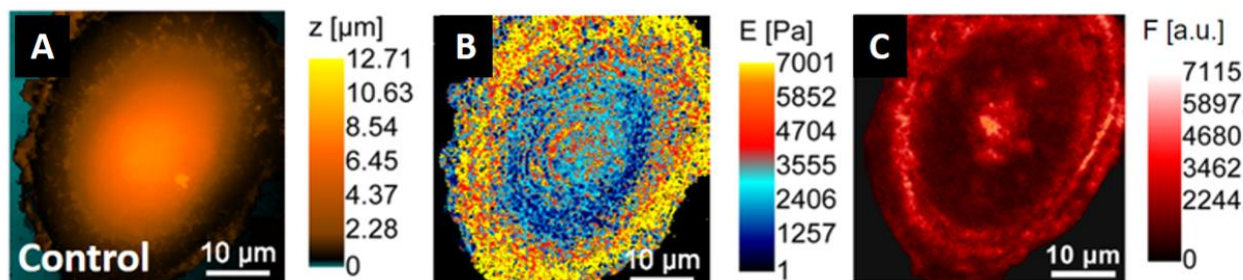


Figure 1. Fig 1 a, b and c - topography map, QNM and confocal image of actin filaments of living HT-1080 cell before Cyto-D treatment (30 μM), respectively

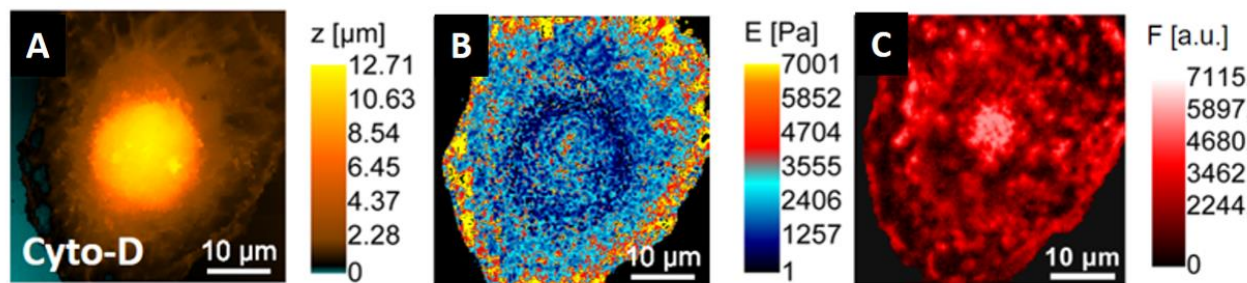


Figure 2. Fig 2 a, b and c - topography map, QNM and confocal image of actin filaments of living HT-1080 cell after Cyto-D treatment (30 μM)

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