

Force-controlled electrophysiology

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Abstract

Glass micropipettes are the typical instrument for intracellular injection, patch clamping or extracellular deposition of liquids into viable cells. The micro pipette is thereby slowly approached to the cell by using micro manipulators and visual control through an optical microscope. During this process, however, the cell is often mechanically injured which leads to cell death and failure of the experiment. To overcome these challenges and limitations of this conventional method we developed the FluidFM technology, an evolution of standard AFM microscopy combining nanofluidics via cantilevers with integrated microfluidic channel [1]. The channel ends at a well-defined aperture at the apex of the AFM tip while the other extremity is connected to a reservoir. The instrument can therefore be regarded as a multifunctional micropipette with force feedback working in liquid environment.

We are investigating three applications for “force-controlled” single-cell biology [2]: i) cytosolic and intranuclear injection, ii) cell adhesion, and iii) electrophysiology.

This paper is focused focus on two aspects: The force controlled patch clamp [3] and the force controlled scanning ion conductance microscope.

References

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