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Scanning ion conductance microscopy in biology

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Scanning ion conductance microscopy (SICM) was introduced in 1989 as a new technique for scanning probe microscopy (SPM)¹. This technique uses a glass micropipette as a sensitive probe, which contains electrode and is filled with an electrolyte solution. The pipette-sample distance is controlled by detecting the ion current that flows between the electrode in the micropipette and a bath electrode. Since SICM can obtain topographic images of soft samples in liquid conditions, the later investigators have been interested in its application of imaging of the surface topography of cultivated living cells²⁻³. In this paper, we applied hopping mode SICM, by using the XE-Bio system (Park Systems Corp., Korea), for imaging different types of biological samples⁴. We first showed SICM images of collagen fibrils and chromosomes in liquid (Figure 1). We then showed SICM images of live and fixed cultured cells. Sequential time-lapsed SICM images of live cells were also shown for revealing the movement of cellular processes on the time scale of minutes. We further applied SICM for imaging the surface of tissue blocks such as trachea and kidney. Although atomic force microscopy (AFM) provides better resolution than hopping mode SICM in some samples, only the latter can obtain contact-free images of soft samples with complicated shapes. Thus, we consider that hopping mode SICM is a useful technique with unique capabilities for imaging the three-dimensional topography of a wide range of biological samples under physiologically relevant aqueous conditions.

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References

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