Spatial mapping of biophysical properties in human cells and tissues by scanning probe microscopy (SPM)

Annalisa Calò[1,2], Yevgeniy Romin[3], Larissa Huetter[2], Ruben Millan Solsona[2], Gabriel Gomila[2]

[1]Universitat de Barcelona, Department of Biomedical Engineering, C/Martì I Franquès 1-11, 08028 Barcelona
[2]IBEC, Institute for Biomedical Engineering, C/Baldiri Reixac 10-12, 08028 Barcelona
[2]Memorial Sloan Kettering Cancer Center, 1275 York Avenue NY 10065

annalisa.calo@ub.edu

Illnesses can be described in terms of changes in the biophysical properties of cells and tissues, like the elasticity and the electric charge. Mechanic and dielectric properties thus can give useful information for diagnostics and therapeutics. In this work, I present the SPM as a tool to obtain multiparametric mechanic and dielectric maps at the surface of cells and tissues simultaneously. In SPM the dielectric imaging has been relatively less studied compared to the mechanical one, nevertheless its very high sensitivity makes it a valuable addition to the standard force volume mapping [3]. The objective of this research is to distinguish cell phenotypes and areas in tissue sections with heterogeneous biochemical composition at the microscale using simultaneous mechanic and dielectric mapping with SPM. This research aims to bring the SPM from the basic research and the exploration of few sample areas of nanometer-size materials with high pixel density, to the clinical contest [2,3,4], where big datasets are required for statistics, that imply testing many patients and scanning millimeter-size areas of the sample. Such data can be employed in correlative analysis using other biomedical imaging techniques and analytic techniques. Results obtained with tissue sections from patients suffering amyloidosis, as well as on fibroblasts from patients suffering different types of lung cancer, both from the Clinic Hospital in Barcelona will be shown.

References

[1] M. Checa et al. Small Methods 5 (2021) 2100279.
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Figures

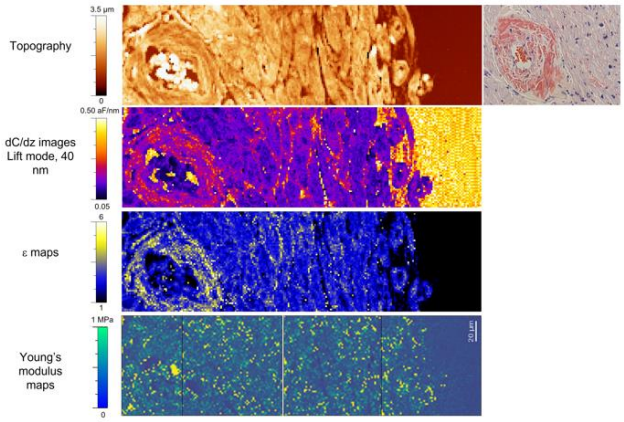

Figure 1. Example of multiparametric mechanical-dielectric mapping in a heart tissue section from a patient of Hospital Clinic (Barcelona) suffering from AL-λ amyloidosis.