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TRANSMISSION AND EMISSION SOFT X-RAY SPECTROMICROSCOPIES FOR LIFE AND NANOSCIENCES AT ELETTRA

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Exploring the biochemistry and functionality of complex biological systems at sub-cellular length scales continues to be a challenge. It requires interdisciplinary approaches for discriminating qualitatively and quantitatively the constituent elements and correlating them to the sub-cellular morphology. In this respect high resolution X-ray imaging combined with its chemical sensitivity and complemented by other microanalytical techniques is attractive since it provides specific information not achievable by a single method. The contribution will present the most recent achievements demonstrating the capabilities of the TwinMic soft X-ray spectromicroscope [1] (see Fig. 1) at the Elettra synchrotron radiation facility (Trieste, Italy) in tissue, cellular or subcellular analysis based on imaging with low-energy X-ray fluorescence spectroscopy and micro-spot X-ray absorption spectroscopy [2]. Selected results will represent research fields including biotechnology, biomaterials, food science and nanotoxicology, neuroscience and clinical medicine. They will illustrate new insights into the morphology and compositional enrichment, distribution and correlation of the elements resulting from growth of plants under altered environmental or toxic conditions, concentration dependence of penetration of engineered nanoparticles in different cell organels and changes in the nanoparticle chemistry inside the cells, chemical reaction of lung tissue in the presence of inhaled asbestos species, among others. The importance of complementing the X-ray imaging and spectromicroscopy by other microscopies and conventional lab-based techniques as well as future developments will be outlined.

References

[1] http://www.elettra.trieste.it/twinmic

[2] B. Kaulich *et al.*, "Simultaneous Soft X-ray Transmission and Emission Microscopy", *J. Roy. Soc. Interf.* **6** (2009) 641–647.

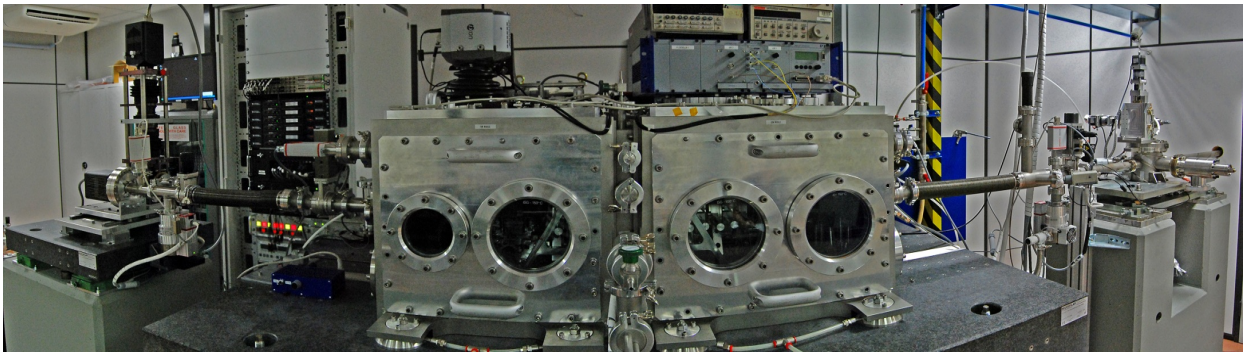

Figure 1. The TwinMic X-ray transmission and emission microscopy station at Elettra, Trieste, Italy.