Large-Volume en-bloc Staining for Electron Microscopy and Targeted Imaging using X-Ray Microscopy

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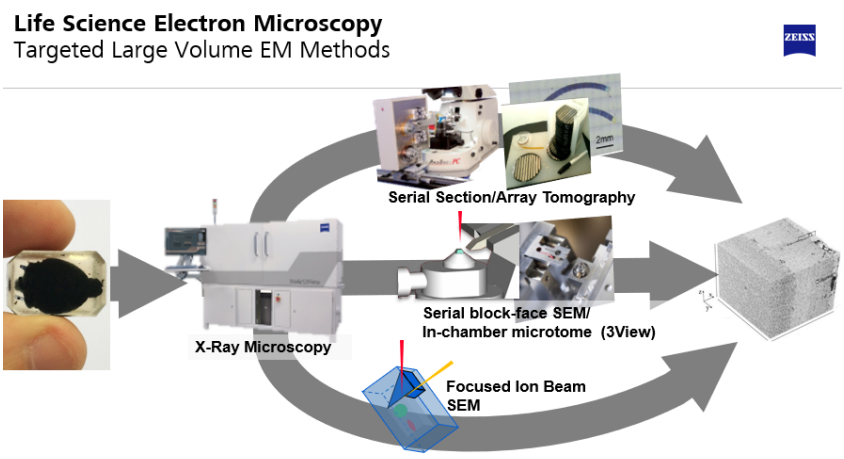
Electron microscopy imaging has been used as a valuable research tool in the Life Sciences for many years. From research of single cell organisms, viruses or eukaryotic cells to identification of synaptic contacts between neurons, the ability to image biological samples in nanometer resolution has proven to be extremely valuable for many areas of biological research. The majority of these examples has been studied using the well-established Transmission Electron Microscopy (TEM) technique which requires thin sample preparations and limits the third dimension in scale and resolution.

Recent developments in Scanning Electron Microscopy (SEM) offers high-resolution and large-volume imaging of biological tissue. This, however, requires dense staining of tissue blocks with heavy metals. Conventional staining methods are lacking the capability to yield dense and homogeneous levels of staining throughout large volumes of biological tissues.



This talk will introduce recent developments in large-volume en-bloc SEM staining that overcomes the staining gradients, which so far substantially limited the sample volume which can be imaged in three-dimensional (3D) SEM techniques. Furthermore, I will give an outlook on how the challenges of relocating structures of interest can be addresses using X-Ray Microscopy and will show the latest results in the field of neuroscience, plant, vascular and renal research using this technique.

[1] C. S. Xu, K. J. Hayworth, Z. Lu, P. Grob, A. M. Hassan, J. G. Garcıa-Cerdan, K. K. Niyogi, E. Nogales, R. J. Weinberg, H. F. Hess, "Enhanced FIB-SEM systems for large-volume 3D imaging", eLife, (2017).