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Tomography of Biological Materials using Focused Ion Beam Sectioning and Backscattered Electron Imaging

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Tomography in a focused ion beam (FIB) scanning electron microscope (SEM) is a powerful method for the characterization of three-dimensional micro- and nanostructures. It has been widely applied in studying three-dimensional nano- and microstructures of materials such as metals and semi-conductors (e.g., Inkson et al., 2001; McGrouther and Munroe, 2007). In biology the method is extremely useful to study cell / implant interactions (Giannuzzi et al., 2007; Greve et al., 2007; Nalla et al., 2005). The density difference between the biological matter and the implant is so extreme that standard microtomy is very difficult if not impossible. An other application is to dig into biological objects and reveal the structures of interest (Drobne et al., 2007; Drobne et al., 2005a; Drobne et al., 2005b). The real power of FIB-SEM tomography, however, is to find the place of interest at low magnification in the SEM and then analyse the spot at higher magnification with the Slice and View™ (FEI Company) method, which means cutting a slice off with the ion beam and imaging the fresh surface with the electron beam, usually with the backscatter electron mode (De Winter et al., 2009; Heymann et al., 2006; Knott et al., 2008). More advanced investigations aim at using the focused ion beam scanning microscope as an ultramicrotome to create thick cryo-sections (Marko et al., 2006; Marko et al., 2007). In this presentation we will share our experience in analysing endothelial cells and atherosclerotic plaques of Epon embedded samples with FIB-SEM tomography.

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