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Volume Electron Microscopy to Provide Insight into the 3-Dimensional World of Cells and Tissues

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Volume Electron Microscopy (vEM) is a collection of electron microscopy techniques that provides access to the 3-dimensional world of cells and tissues, generally with a volume thickness over 1 μm. Whereas TEM-based techniques such as serial section EM and Electron Tomography (ET) provide the highest resolution, SEM-based techniques such as Serial Block Face Scanning EM (SBF-SEM), Focused Ion Beam SEM (FIB-SEM) and Array Tomography are superior in acquiring larger volumes. As such it depends very much on the underlying question what vEM is most appropriate.

In my presentation I will discuss 3 different research projects that highlight the application of 3 different vEM approaches to answer the biological question. In project 1 we study the segregation pathways within endosomes using Correlative Light Electron Microscopy (CLEM) including serial section ET to provide insight into intracellular membrane connections [1]. The second project aims at identifying a single neuron within the brain, a case of the needle in the haystack. Following identification of the neuron using 2-photon fluorescence microscopy, the high power of the laser is used to brand marks for identification and correlate with EM. Finally, SBF-SEM is applied to to reconstruct the neuron and identify its connections [2]. In the last project, Titanium micros pikes were made as a possible solution to Anti-Microbial Resistance of bacteria. In order to show that bacteria are damaged and "pierced" by the spikes, FIB-SEM had to be applied to gain access to the interface between the spike and the bacterium [3].

Gaining access to such a variety of technologies is not trivial and the vEM community has gathered (https://www.volumeem.org) to discuss and promote funding and access to vEM technology. I will briefly discuss that aspect in my presentation but will present the initiative in the Sunday symposium X31 in more detail.

References:

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