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Large scale imaging of neuronal networks of the brain

Wednesday, 17 May 2023 10:00 (30 minutes)

Imaging the structure of neuronal networks is of fundamental importance for the understanding of information processing in the healthy and diseased brain. But neuronal networks in the brain span several millimeters in each dimension and the smallest neurites and synaptic connections are on the order of a few tens of nanometers in size. To date, only volume electron microscopy (vEM) provides sufficient resolution and sufficient field of view for the dense reconstruction of synaptic-resolution neuronal circuits. Using vEM, mm3-sized samples can be acquired at synaptic resolution within a couple of months. However, these vEM techniques are all based on cutting tens of thousands of ultrathin (30 –50 nm) sample sections, which is a delicate process and inherently prone to failure. Sectioning artifacts and the limited resolution in Z are the major source of errors of state-of-the-art automated neuron segmentation algorithms. Therefore, synchrotron X-ray nanotomography is a promising, nondestructive alternative for ultrastructural imaging of large tissue samples such as whole brains.

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