Nanotomography of brain networks

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The first step to understanding how the brain functions is to analyze its 3D network. The brain network consists of neurons having micrometer to nanometer sized structures. Therefore, 3D analysis of brain tissue at the relevant resolution is essential for elucidating brain's functional mechanisms. Here, we report 3D structures of human and fly brain networks revealed with synchrotron radiation nanotomography, or nano-CT. Neurons were stained with high-Z elements to visualize their structures with X-rays. Nano-CT experiments were then performed at the 32-ID beamline of the Advanced Photon Source, Argonne Nat'l Lab and at the BL37XU and BL47XU beamlines of SPring-8. Reconstructed 3D images illustrated precise structures of human neurons, including dendritic spines responsible for synaptic connections. The network of the fly brain hemisphere was traced to build a skeletonized model. An article reviewing our study appeared in MIT Technology Review. Movies can be found in our YouTube channel.

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https://www.technologyreview.com/s/602398/first-3-d-map-of-a-fruit-flys-brain-network/
https://www.youtube.com/user/mizutaniLab