BDR SEMINAR in Osaka

"CDB SEMINAR" and "QBiC SEMINAR" have been renamed "BDR SEMINAR".

Hans-Ulrich Dodt

Chair of Bioelectronics, Technical University Vienna

Thursday, July 5, 2018 14:20-15:20

3F Seminar Room, Quantitative Biology Bldg. A, Osaka

Light sheet microscopy of whole mouse brains with improved clearing and optics

Summary

Visualization of complete neuronal networks in the brain is an important goal of neuroscience. To this end clearing and recording of mouse brains with light sheet microscopy has become increasingly popular in recent years. Various water based clearings have been developed which have certain advantages like good fluorescence preservation but also certain disadvantages like incomplete clearing or complicated and unreliable procedures. We developed the first brain clearing 8 years ago which was then based on organic solvents. By clearing neuronal tissue with benzyl alcohol and benzyl benzoate (BABB) after dehydration, we could visualize GFP-labelled neuronal networks in the whole brain (Dodt et al., 2007). Improving our clearing technology by using tetrahydrofuran (THF) for dehydration and dibenzylether (DBE) for clearing (3DISCO) we were able to image GFP-labelled axons even in heavily myelinated neocortex and spinal cord (Becker et al., 2012, Ertürk et al. 2012). However both BABB and DBE based clearings quench GFP fluorescence to a certain extent, making it necessary to keep clearing times as short as possible and eventually compromising complete clearing. We found now a way to stabilize GFP fluorescence in DBE for weeks with negligible bleaching during recording by sDISCO (stabilized 3DISCO clearing). With sDISCO we were able to visualize very delicate neuronal structures like the finest neuronal branches of the axonal network in the neocortex as well as dendritic spines. As the sDISCO clearing procedure is very reliable and the cleared brains are very solid and stable we expect sDISCO to become a standard procedure for brain clearing. In addition we developed optical devices for correcting existing air objectives used for imaging of brains in clearing solutions. To improve the axial resolution of our recordings we further developed optics for the generation of longer and thinner light sheets. With the combination of improved clearing and improved optics we were able to record neuronal networks in mouse brains with unprecedented details.

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