

3D PATHOLOGY OF HUMAN TUMORS BY ULTRAMICROSCOPY

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Histological pathology of human tumors relies on the inspection of thin mechanical sections prepared at sparse separations within the tumor. This diagnostics is done for staging of the tumor and to control the resectate for cancer free margins. However mechanical sections do not allow 3D imaging of the removed cancerous tissue and as sectioning is sparse there is never hundred percent security that no tumor cells adjacent to the surgical margins are missed.

We therefore applied light sheet microscopy for the 3D imaging of cleared human tumors. A prerequisite for imaging of such cm sized objects with cellular resolution is the generation of a light sheet with a thickness in the 1 μm range and a very large Rayleigh length. As this is not possible with any existing optics we constructed a new light sheet generator providing an extremely flat and thin light sheet and applied it to human tumor samples. In addition we developed a new kind of clearing that makes within one day cm large tumor samples completely transparent for clear visualization of cells [1]. For validation with standard histology we could rehydrate our samples after optical recording to allow for standard mechanical sectioning and histological staining. By comparison of optical and mechanical sections we showed that we are able to clearly identify malignancies in the optically recorded tissue volumes. We assume that in future ultramicroscopy of cleared tumors will play an important role in pathological diagnostics.

[1] H.U. Dodt, S. Saghafi, K. Becker, N. Jährling, C. Hahn, M. Pende, M. Wanis, A. Niendorf
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