**OPTICAL BIOPSY: EMERGING TECHNOLOGIES TOWARDS EARLY CANCER DIAGNOSIS AND NON-INVASIVE BRAIN IMAGING**

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**Abstract.** In the work non-invasive optical-based imaging approach that allows visualize major cerebral vessels at the high temporal and spatial resolution is presented.

**Keywords:** optical biopsy, emerging technologies, non-invasive imaging, early cancer, brain

We utilize the latest light techniques and optical engineering solutions to advance brain research, offering the potential of state-of-the-art diagnostics and imaging techniques never before possible. An example of such a technique – Transcranial Functional Optical Imaging (TOVI) for imaging of cerebral vasculature *in vivo*. *In vivo* imaging of cerebral vasculature is highly vital for clinicians and medical researchers alike. For a number of years non-invasive optical-based imaging of brain vascular network by using standard fluorescence-based spectroscopic approach considered as impossible. We developed a robust non-invasive optical-based imaging approach that allows visualize major cerebral vessels at the high temporal and spatial resolution. The developed technique is simple to use, utilizes dynamic light scattering and standard fluorescent dyes, inexpensive imaging and computation procedures. The ability to clearly visualize middle cerebral artery and other major vessels of brain vascular network, as well as the measurements of dynamics of blood flow are presented. The developed imaging approach has a great potential in neuroimaging and can significantly expand the capabilities of preclinical functional studies of brain and notably contribute for analysis of cerebral blood circulation in disorder models. In addition, a few other techniques, such as Circular Polarized Light (CPL) technique that is able to assess quantitatively amyloid plaques and identify irregular cells (neurons), e.g. in focal cortical dysplasias (FCD) samples, and Near-Infra-Red (NIR) brain imaging of functional response will be presented.