In vivo through skull NIR-II fluorescence mesoscope

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Compared to the visible wavelength window (400-750 nm) and the first near-infrared wavelength window (NIR-I, 750-900 nm), the fluorescence imaging in the second near-infrared region (NIR-II, 1000-1700 nm) acquire deeper imaging depth owing to significantly suppressed optical scattering and diminished autofluorescence in biological tissues[1,2]. However, few NIR-II fluorescence imaging approaches can simultaneously achieve a large field of view, high resolution and deep penetration depth, while exhibiting optical sectioning capability.

In this work, we present a novel NIR-II fluorescence mesoscopy system based on the f-θ scanning scheme and confocal detection to overcome these limitations. Our system allows performing NIR-II imaging on macroscopic samples as large as 7.5 mm with a lateral resolution of 6.4 μm. The imaging depth could reach up to 2.5 mm below the mouse skull surface. The depth-resolved imaging capability of our system in deep tissue was demonstrated by in vivo NIR-II fluorescence imaging of mouse cerebral vasculature. The zoom in and zoom out features were demonstrated by imaging IR-820 labeled cells. The system is also capable of time-lapse imaging. With all these features, our system provides new opportunities to explore the mechanism of cerebrovascular disease.

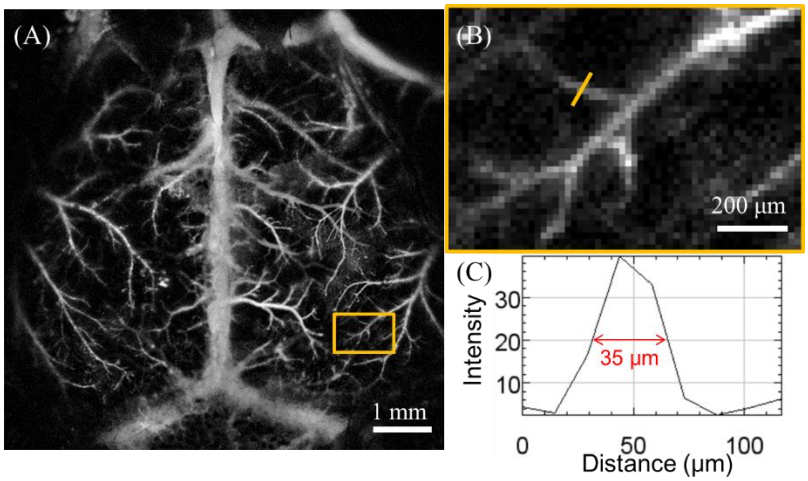

Figure 1: *In vivo* through skull NIR-II fluorescence imaging of mouse cerebral vasculature.

[1] G. Hong, S. Diao, J. Chang, *et al*. "Through-skull fluorescence imaging of the brain in a new near-infrared window," Nature photonics 8, 723-730 (2014).
[2] W. Yu, B. Guo, H. Zhang, J. Zhou, *et al*. "NIR-II fluorescence in vivo confocal microscopy with aggregation-induced emission dots," Science Bulletin 64, 410-416 (2019).