Laser speckle decorrelation time measurement inside the mouse brain *in vivo*

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In biomedical engineering, light is widely used in imaging and therapeutic application because light has the ability to focus and deliver energy with high spatial resolution noninvasively. However, the strong optical property of biological tissue confines our ability to focus the light up to a few hundreds of microns. This challenge can be overcome by the recent work in the field of wavefront shaping technique. Focusing of light to the targeted location in the scattering media with the help of wavefront shaping needs an input light field pattern such that the light can interfere constructively at the desired locations. But it requires a static medium as the change in the arrangement of scatterers between the wavefront recording and playback steps reduces the fidelity of the focus that is formed. Moreover, the thickness of the scattering medium also affects the focusing capability of the system. In this study, we investigate the relationship between laser speckle decorrelation time and the depth of point-like source inside the living mouse brain at the depths of down to 3.2 mm, by analyzing the scattering dynamic in the mouse brain *in-vivo* via multispeckle diffuse wave spectroscopy (MSDWS), and by using a customized point-like source of optical fiber inside the brain.

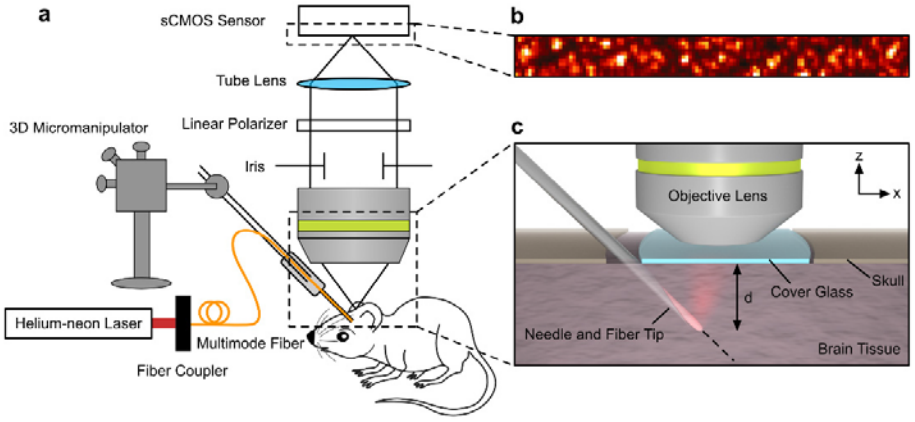

Figure 1. Experimental setup of in vivo laser speckle imaging (a) The experimental setup consisted of a Helium-neon laser coupled to a custom-made fiber probe (b) speckle pattern on the surface of the brain (c) zoomed view of mouse brain, fiber tip and objective lens.

Reference:

1. M. M. Qureshi, J. Brake, H.-J. Jeon, H. Ruan, Y. Liu, A. M. Safi, T. J. Eom, C. Yang, and E. Chung, "In vivo study of optical speckle decorrelation time across depths in the mouse brain," Biomed. Opt. Express **8**, 4855 (2017).