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Self-mixing microprobe for monitoring microvascular perfusion in rat brain

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Résumé en anglais	Measuring functional activity in brain in connection with neural stimulation faces technological challenges. Our goal is to evaluate, in relative terms, the real-time variations of local cerebral blood flow in rat brain, with a convenient spatial resolution. The use of laser Doppler flowmetry (LDF) probes is a promising approach but commercially available LDF probes are still too large (450 mum) to allow insertion in brain tissue without causing damage in an extension that may negatively impact local measurements. The self-mixing technique coupled to LDF is herein proposed to overcome limitations of the minimal diameter of the probe imposed by non-self-mixing probes (commercial available probes). Our Monte Carlo simulations show that laser photons have a mean penetration depth of 0.15 mm, on the rat brain with the 785 nm laser light microprobe. Moreover, three self-mixing signal processing methods are tested: counting method, autocorrelation method, power spectrum method. The perfusion signal computed shows a good linearity with the scatterers velocity, for the three methods (a determination coefficient close to one is obtained), for the in vitro measurements. Furthermore, we believe that these indicators can be used to monitor local blood flow changes in the rat brain.
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