

Optics and Biotechnology

[In vivo time-gated diffuse correlation spectroscopy at quasi-null source-detector separation](#)

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[Opt. Lett.](#) 43(11), 2450-2453 (2018) [View HTML](#) | [PDF](#)

[Therothermal optical coherence tomography of indocyanine green in rat kidney](#)

Maryse Lapierre-Landry, Thomas B. Connor, Joseph Carroll, Yuenkai K. Tao, and Melissa C. Skala

[Opt. Lett.](#) 43(11), 2470-2473 (2018) [View HTML](#) | [PDF](#)

[Real-time full-field optical angiography utilizing principal component analysis](#)

Mingqi Wang, Caizhong Guan, Wenjian Mao, Honglan Kong, Haisha Fan, Dingan Hang, and Yaqun

[Opt. Lett.](#) 43(11), 2569-2572 (2018) [View HTML](#) | [PDF](#) [\(Suppl. Mat. \[1\]\)](#)

Medical Optics in OSA Editors pick

A study reporting new method with for more sensitive, compact and depth resolved, non-invasive blood flow measurement is chosen as part of the OSA Editor's pick of the week.

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The Optical Society has recently highlighted the study titled "In vivo time-gated diffuse correlation spectroscopy at quasi-null source-detector separation" as the Editor's pick of the week for the Medical Optics and Biotechnology section. The Editor's Picks serve to highlight articles with excellent scientific quality and are representative of the work taking place in a specific field like, in this case medical optics.

Published in the last issue of Optics Letters, the study demonstrates time domain diffuse correlation spectroscopy on a human, in vivo, at a quasi-null source-detector separation. In other words, a new method with for more sensitive, compact and depth resolved, non-invasive blood flow measurement.

Time domain diffuse correlation spectroscopy (TD-DCS) is an optical, non-invasive technique that makes use of pulsed, but coherent, laser light to characterize the blood flow and optical properties of living tissue up to a depth of a few centimeters, in a safe, continuous and non-invasive way. The time-domain approach is beneficial since it increases the sensitivity of DCS to deep blood flow and allows the rejection of superficial tissue contributions. This depth discrimination is achieved by selectively considering the back-scattered light from the tissue within a time-of-flight (TOF) window, or gate, that spans from a few picoseconds up to a few nanoseconds.

In this study, the team of researchers has shown that they can achieve quasi-null separation TD-DCS using fast-gated SPADs (fgSPADs) that can be switched on and off in hundreds of picoseconds at every laser pulse period. They use fgSPADs to recover the blood flow index (BFI) from the auto-correlation of light intensity detected at a very short, ideally null (less than 3 mm), source-detector separation. The increase in light collection efficiency was sufficient to discriminate the superficial from deep variations in perfusion following the reversible occlusion of the arteries flowing to the arm with 2 seconds resolution. By using gated detectors, expensive time-tagging electronics are also not needed, which means that simpler electronic auto-correlators can be used to obtain TD-DCS data in real time, with a dramatic simplification of the detection side. This is an important step towards the realization of compact but dense matrices of TD-DCS sensors to be applied directly on the skin.

The reduction of the distance between the source and detector paves the way to integrated and miniaturized probe assemblies that look like few square millimeter patches to apply directly on the skin. It increases the sensitivity of the measurement by allowing an increase in the collection of light and a higher contrast for the detection of localized hemodynamic changes like, for example, the ones generated in the cerebral cortex during realistic cognitive tasks and others.

The study has been carried out by Marco Pagliazzi led by ICREA Prof. at ICFO Turgut Durduran, in collaboration with Sanathana Konugolu Venkata Sekar, Laura Di Sieno, Lorenzo Colombo, Davide Contini, Alessandro Torricelli, Antonio Pifferi, and Alberto Dalla Mora from Politecnico di Milano.

