THG Imaging of Zebrafish Immunocytes In Vivo

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Abstract

Immune system plays a critical role in defense against invading microorganisms. Intravital imaging shows a great potential in monitoring the dynamic process of the immune response. Especially, in vivo optical imaging can track the dynamics of the immune response with high spatiotemporal resolution.

Third harmonic generation (THG) can noninvasively reveal cellular morphology, subcellular organelles, and melanin distributions in deep tissues for the application of developmental biology and clinical diagnosis [1]. In deep tissues, this technique has less background interference than reflectance confocal microscopy and better transverse resolution (~500 nm) than infrared-laser based μ-optical coherence tomography (OCT) and spectrally encoded confocal microscopy [2].

We have developed imaging technologies that can detect zebrafish immunocytes in real time using multiphoton confocal microscopy base on a femtosecond laser. By using multi-photon confocal microscopy and Hkz04tTg (CZ61) zebrafish which is generated by random integration of a GFP-containing construct, predominantly expresses GFP in myeloid cells and T lymphocytes. We can observe monocytes (green fluorescence) and blood cells (blue fluorescence) in the tail region with 1300 nm wavelength laser excitation in THG image (Figure 1). The immunity condition of a zebrafish can thus be routinely checked. Related experiences and results can be translated to medical use in the future.

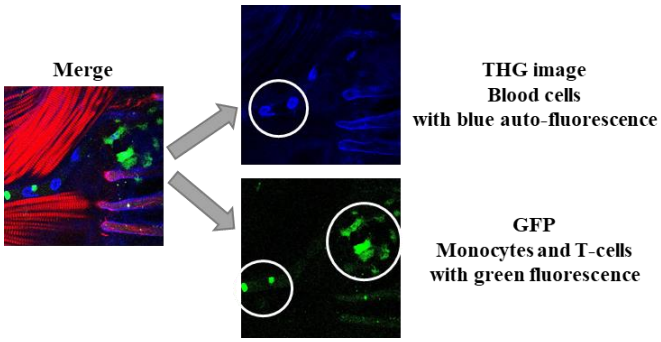

Figure 1: THG image of zebrafish tail region.

Reference

[1] M.-R. Tsai, S.-Y. Chen, D.-B. Shieh, P.-J. Lou, and C.-K. Sun, Biomed. Opt. Express 2, 2317-2328 (2011).
[2] L. Golan, D. Yeheskely-Hayon, L. Minai, E. J. Dann, and D. Yelin, Biomed. Opt. Express 3, 1455-1464 (2012).

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