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Investigation of tumor cell targeting of a dendrimer nanoparticle using a double-clad optical fiber probe

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Abstract

Fluorescence quantification in tissues using conventional techniques can be difficult due to the absorption and scattering of light in tissues. Our previous studies have shown that a single-mode optical fiber (SMF)–based, two-photon optical fiber fluorescence (TPOFF) probe could be effective as a minimally invasive, real-time technique for quantifying fluorescence in solid tumors. We report improved results with this technique using a solid, double-clad optical fiber (DCF). The DCF can maintain a high excitation rate by propagating ultrashort laser pulses down an inner single-mode core, while demonstrating improved collection efficiency by using a high–numerical aperture multimode outer core confined with a second clad. We have compared the TPOFF detection efficiency of the DCF versus the SMF with standard solutions of the generation 5 poly(amidoamine) dendrimer (G5) nanoparticles G5-6TAMRA (G5-6T) and G5-6TAMRA-folic acid (G5-6T-FA). The DCF probe showed three- to five-fold increases in the detection efficiency of these conjugates, in comparison to the SMF. We also demonstrate the applicability of the DCF to quantify the targeted uptake of G5-6T-FA in mouse tumors expressing the FA receptor. These results indicate that the TPOFF technique using the DCF probe is an appropriate tool to quantify low nanomolar concentrations of targeted fluorescent probes from deep tissue.

Key words: Bio-optics;Cancer;Cellular biophysics;Fibre optic sensors;
Fluorescence;Laser applications in medicine;
Light absorption; Light scattering;Nanobiotechnology;
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