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In Vivo Fluorescence Resonance Energy Transfer Imaging for Targeted Anti-Cancer Drug Delivery Kinetics[1]
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— We describe an approach for the evaluation of targeted anti-cancer drug delivery *in vivo*. The method emulates the drug release and activation process through acceptor release from a targeted donor-acceptor pair that exhibits fluorescence resonance energy transfer (FRET). In this case, folate targeting of the cancer cells is used - 40 % of all human cancers, including ovarian, lung, breast, kidney, brain and colon cancer, over-express folate receptors. We demonstrate the reconstruction of the spatially-dependent FRET parameters in a mouse model and in tissue phantoms. The FRET parameterization is incorporated into a source for a diffusion equation model for photon transport in tissue, in a variant of optical diffusion tomography (ODT) called FRET-ODT. In addition to the spatially-dependent tissue parameters in the diffusion model (absorption and diffusion coefficients), the FRET parameters (donor-acceptor distance and yield) are imaged as a function of position. Modulated light measurements are made with various laser excitation positions and a gated camera. More generally, our method provides a new vehicle for studying disease at the molecular level by imaging FRET parameters in deep tissue, and allows the nanometer FRET ruler to be utilized in deep tissue.

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