Biomedical Applications of Nanotechnology

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Deep-tissue optical imaging is of particular interest, as the equipment costs are lower than for competing technologies such as magnetic resonance imaging. For this purpose, the development of novel contrast agents with near-infrared (NIR) fluorescence is especially important. We report on the use of NIR and upconversion semiconductor nanoparticles in deep-tissue *in vivo* optical imaging. Semiconductor nanocrystals of CdMnTe/Hg were grown in aqueous solution and then coated with bovine serum albumin (BSA). The nanocrystals were approximately 5 nm in diameter and have a broad fluorescence peak in the NIR (770nm). Nanocrystals were injected either subcutaneously or intravenously into athymic mice and then excited with a spatially broad 633 nm source; the resulting fluorescence was captured with a sensitive CCD camera. We have demonstrated that the nanocrystals are a useful angiographic contrast agent for vessels surrounding and penetrating a murine squamous cell carcinoma in a C3H mouse. Preliminary assessment of the depth of penetration for excitation and emission was done by imaging a beating mouse heart, both through an intact thorax and after a thoracotomy. The temporal resolution associated with imaging the nanocrystals in circulation has been addressed, and the blood clearance for this contrast agent has also been measured. There was no significant photobleaching or degradation of the nanocrystals after an hour of continuous excitation. The stability of the nanocrystals together with the time resolution of the optical detection makes them particularly attractive candidates for pharmacokinetic imaging studies. The author would like to thank the supports by NIH and Army Medical for grants.

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