A Novel Approach to a Bifunctional Photosensitizer for Tumor Imaging and Phototherapy

Yihui Chen, Amy Gryshuk, Samuel Achilefu, Tymish Ohulchansky, William Potter, Tuoxiu Zhong, Janet Morgan, Britton Chance, Paras N. Prasad, Barbara W. Henderson, Allan Oseroff, and Ravindra K. Pandey

Abstract

Optical imaging has attracted a great attention for studying molecular recognitions because minute fluorescent tracers can be detected in homogeneous and heterogeneous media with existing laboratory instruments. In our preliminary study, a clinically relevant photosensitizer (HPPH, a chlorophyll-a analog) was linked with a cyanine dye (with required photophysical characteristics but limited tumor selectivity), and the resulting conjugate was found to be an efficient tumor imaging (fluorescence imaging) and photosensitizing agent. Compared to HPPH, the presence of the cyanine dye moiety in the conjugate produced a significantly higher uptake in tumor than skin. At a therapeutic/imaging dose, the conjugate did not show any significant skin phototoxicity, a major drawback associated with most of the porphyrin-based photosensitizers. These results suggest that tumor-avid porphyrin-based compounds can be used as "vehicles" to deliver the desired fluorescent agent(s) to tumor. The development of tumor imaging or improved photodynamic therapy agent(s) by itself represents an important step, but a dual function agent (fluorescence imaging and photodynamic therapy) provides the potential for tumor detection and targeted photodynamic therapy, combining two modalities into a single cost-effective "see and treat" approach.