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Monomers to nanoplatforms for tumor-imaging and phototherapy

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Most of the photosensitizers (PS) investigated and/or being used to date in photodynamic therapy (PDT) are highly fluorescent. This property has been used to guide surgical interventions and PDT. Unfortunately, most of the photosensitizers exhibit small Stokes shift(s) between the long-wavelength absorption and emission and are therefore not desirable candidates for fluorescence imaging of cancer. Conversely, certain highly efficient cyanine dye–based fluorophores (non-porphyrin based compounds) generally do not localize within tumors efficiently, but require an additional moiety or process to provide selectivity, such as attachment of a peptide[2] or other moieties that bind to a targeted receptor(s) known for high expression in tumors. Promising clinical-PDT results suggest that certain porphyrin-based photosensitizers preferentially accumulate within a wide range of malignancies compared to their normal tissue surroundings. This characteristic has been used in designing bi- and multifunctional agents in which the PS also helps in delivering the desired imaging agent(s) to tumors. For quite some time, one of the objectives of our laboratory has been to develop agents that can be used concurrently detect tumors (via PET, MRI and/or fluorescence) and treat them (with PDT). One of our approaches involves the synthesis, characterization and pre-clinical validation (including in vivo toxicity) of novel conjugates of tumor-avid PS linked to unique near infrared (NIR) fluorescent dyes or the long half-life PET agent labeled with ^{124}I. In another approach, imaging and therapeutic monomers are post-loaded onto biocompatible PAA nanoparticles. Preliminary work shows that some of the multifunctional agents developed in our laboratory provide promising in vivo tumor selectivity while maintaining PDT efficacy. This "See and Treat" approach enhances the scope of image guided therapy. The synthesis and comparative tumor-imaging and therapeutic potential of the monomers and the corresponding multifunctional nanoplatforms will be discussed.

Biography

Professor Pandey is currently associated with the PDT Center, Roswell Park Cancer Institute as Distinguished professor and Director of Pharmaceutical Chemistry. He has been investigating the utility of porphyrin-based compounds in PDT for the last 25 years and their use in imaging (MRI, PET, Fluorescence, Photoacoustic, and Raman) for the last ten years. One of the objectives of his research has been to develop bi- and multifunctional agents for tumor-imaging and therapy. He is also investigating the use of several biodegradable nanoplatforms for efficient delivery of these agents to tumors. He has published >250 research papers, 35 patents, several review articles and book chapters. He is the reviewers of national and internationally funded grant applications, >25 scientific journals. He has received several awards: Inventor of the year awards, International award in heterocyclic chemistry, Excellence on PDT award by International Society of Porphyrins and Phthalocyanines and Regional Award by American Chemical Society and the RPCI President's Certification of Recognition award. He has delivered several invited and plenary lectures all over the world. Several compounds developed in his laboratory are at various stages of clinical and advanced preclinical trials. He is also a Founder and CSO of Photolitec, LLC.

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