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Selective photodynamic therapy based on aggregation-induced emission enhancement two- photon absorbing nanoparticles

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Photosensitizer aggregation usually decreases the quantum yields from photophysical processes. Especially, most conventional photosensitizers that are incorporated into polymeric nanocarrier systems easily form aggregates and results in an incomplete release and significant reduction of the photodynamic activity by self-photoquenching. Here, the first generation of binary molecule conjugates were achieved by conjugating chromophore (3, 6-bis-(1-methyl-4-vinylpyridinium)-carbazole diiodide, BMVC) to photosensitizers. BMVC plays the role of cancer cells recognizer; linear and nonlinear absorption of light, AIEE (aggregation-induced emission enhancement) generator, and FRET (Fluorescence Resonance Energy Transfer) donor. The self assembling properties of the binary conjugates result in AIEE and then achieve the formations of FONs (fluorescent organic nanoparticles), which present efficient FRET and singlet oxygen generations. Biologically, FONs-photosensitizers from these compounds were much more phototoxicities to cancer cell than to normal cell without significant dark toxicity. The better PDT efficacy could be attributed to their more intracellular accumulation and sub-cellular localization in singlet oxygen-sensitive organelles, such as mitochondria. Consequently, the distinct properties of these conjugates provide a second generation of binary photosensitizer to PDT treatment. The better AIEE-PDT efficacy by metalloporphyrin could be attributed to their more FRET efficiency and singlet oxygen yield. On the other hands, the windows of transparency for porphyrin or metalloporphyrin derivatives in the range of 450-500 nm allow us to selectively excite BMVC, which can reduce the side effects of PDT. That is, similar results were observed with 820nm two-photon light source. Moreover, the excellent contrast in cellular imaging with o-2B-P can be applied to monitor the pathway of PDT and serve as a cell death marker.

Biography

Cheng-Chung Chang has completed his Ph.D from department of chemistry, Tamkang University of Taiwan and postdoctoral studies from IAMS, Academia Sinica of Taiwan. His research interests including developments and research of targeting fluorophores, photosensitizers and NIR biomarkers

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