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Multifunctional nanoparticles for simultaneous two-photon imaging and phototherapy

Optical imaging-guided cancer therapy with multifunctional nanoparticles are critical for early detection and treatment of cancers. Two-photon excitation (2PE) based optical imaging and phototherapy have unique advantages such as 3-D selectivity and deep tissue penetration, compared to their one-photon counterparts. Photodynamic therapy (PDT) is noninvasive cancer therapy technique by using combination of light and photosensitizers. Conventional photosensitizers have limited two-photon absorption efficiency and lack of simultaneous imaging capability. Nano-photosensitizers are attractive due to their potential multifunctional capability, which allows integration of efficient Nano-photosensitizers with specific targeting and 2PE fluorescence imaging capabilities to allow imaging-guided PDT with high selectivity. In the last decade, our group have been actively working on development of nanocomposite materials with enhanced two-photon optical properties for biomedical applications. Two different strategies were utilized to develop nanomaterials with enhanced two-photon properties. One method is based on energy transfer from conjugated polymers that have large two-photon absorption cross sections. We have used conjugated polymers as two-photon light harvesting materials to develop various schemes

for two-photon sensing, imaging and photodynamic therapy, with efficiency improved by up to 1000 times. The second approach is based on plasmon resonance enhancement. Noble metal nanoparticles are known to display interesting properties of Plasmon resonance, which could be utilized to enhance linear and nonlinear optical properties of nearby chromophores (extrinsic) and metal nanoparticles themselves (intrinsic). We have developed various plasmon engineered nanocomposites with significantly enhanced two-photon optical properties, which can act as highly efficient agents for two-photon excitation based optical imaging guided therapy.

Speaker Biography

Qing Hua Xu has completed his PhD in 2001 from University of California at Berkeley, USA. He is currently an associate professor in department of chemistry, National University of Singapore. He has published over 190 publications that have been cited over 7000 times, and his publication H-index is 49.

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