**Novel carbon-based fluorescent nanomaterials for biosensing and bioimaging application**

*Pooria Lesani A, Gurvinder Singh A, Zufu Lu A, Hala Zreiqat A*

A Biomedical Engineering, University of Sydney, Sydney, Australia

Carbon dots (CDs) based nanoparticles have been extensively explored for biological applications in sensing and bioimaging. However, the major translational barriers to CDs for imaging and sensing applications include synthetic strategies to obtain monodisperse CDs with tunable structural, optical properties in order to achieve high-resolution deep tissue imaging, intracellular detection and sensing of metal ions with high detection sensitivity. Herein, we report a novel strategy to synthesize and develop a multifunctional carbon dot-based probe of different sizes using a new combination of carbon and nitrogen sources. This work also demonstrates the development of a two-photon dual-emissive fluorescent multifunctional probe by conjugating a fluorescent molecules on the surface of nitrogen-doped CDs which demonstrates an excellent two-photon near-infrared excitation ability, high photostability, and good biocompatibility. Our multifunctional probe shows excellent deep tissue high-resolution imaging capabilities with the penetration depth up to 3000 µm and 280 µm in hydrogel scaffold and pigskin tissue, respectively. The designed probe exhibits ultra-sensitivity and specificity towards Fe3+ ion with a remarkable detection limit of 2.21 nM using two-photon excitation. In addition, we also demonstrate the use of multifunctional CDs probe for ultrasensitive exogenous sensing of Fe3+ ions and imaging in live fibroblasts with rapid response times for intracellular ferric ion detection.