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Fluorescent Probes for Molecular Imaging of ROS/RNS Species in Living Systems

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Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS) are highly reactive species which play crucial roles in many fundamental physiological processes including cellular signalling pathways. Over-production of these reactive species by various stimuli leads to cellular oxidative stress which is linked to various disease conditions. Therefore, the development of novel detection methods for ROS and RNS is of great interest and indispensable for monitoring the dynamic changes of ROS and RNS in cells and for elucidating their mechanisms of trafficking and connections to diseases. We have been recently developing various fluorescent sensors which can selectively detect metal ions, ROS or RNS species in live cells or animals. Our turn-on profluorescent sensors are capable of imaging oxidative stress promoted by metal and H_2O_2 (i.e. the Fenton Reaction conditions) in living cells (Chem Commun 2010); our highly selective and sensitive iron sensors can image the endogenous exchangeable iron pools and their dynamic changes with subcellular resolution in living neuronal cells (ChemBioChem 2012 and unpublished data), and so do our superoxide sensors (ChemBioChem 2012 and unpublished data). Moreover, we have recently developed nitric oxide (NO) sensors for molecular imaging of stimulated NO production in live cells with subcellular resolution as well as novel near infra red (NIR) sensors for NO imaging in live animals.