Single Nanoparticle based Sensor of Reactive Oxygen Species (ROS) via Cytochrome c mediated Plasmon Resonance Energy Transfer

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Hydrogen peroxide (H_2O_2) is one of the major reactive oxygen species (ROS), which play a critical role in a variety of normal physiological process and diseases mechanism. Due to its implication in disease pathology, in particular, oxidative stress in neurological disorders, developing methods for monitoring the generation of ROS has increasingly drawn attentions. Although a variety of H_2O_2 detection methods including enzymatic and electrochemical techniques have been developed, they have still some problems: poor sensitivity, reproducibility, selectivity, stability and in vivo applicability. Here, we report a novel H_2O_2 detection method based on single plasmonic nanoprobe conjugated with redox active Cytochrome c (Cyt c). We observed the dynamic spectral change in the fingerprint quenching dip of a single plasmonic nanoprobe in accordance with the redox state of the conjugated Cyt c induced by H_2O_2. Based on the spectral change of single plasmonic nanoprobe, we can detect H_2O_2 at physiologically relevant micromolar concentration range. We believe that our approach could pave the way toward dynamic, high spatial resolution monitoring of ROS in living cells in the future.