Periodical evolution of reactive oxygen species (ROS) from single human bladder cancer cells investigated by scanning electrochemical microscopy (SECM)

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Reactive oxygen species (ROS) have gained great interests as they are closely related to the cellular homeostasis. Therefore new insights into cancer cells were anticipated from the analysis of ROS profile at single cell level. We discovered a periodical ROS evolution of human bladder cancer (T24) cells. One ROS generation cycle consists of one active stage when the cell is releasing ROS, and one resting stage when the cell is not releasing ROS. The temporal development of the ROS profile was investigated by time-lapse scanning electrochemical microscopy (SECM). Quantitative study on the ROS in the vicinity of a T24 cell was accomplished by simulating experimental probe approach curves (PACs). In the active stage, a homogeneous distribution of ROS around an untreated T24 cell was observed. The ROS evolution of the cisplatin treated T24 cells was compared to that of the untreated T24 cells. When the death procedure is triggered inside T24 cells by cisplatin, the periodicity of the ROS generation cycle is significantly accelerated. Enhanced ROS production was observed with cisplatin treated T24 cells in the active stage. SECM provides an excellent label-free method to monitor the physiological activity of the single cancer cells.