

Peroxynitrite and nitroxidative stress: detection probes and micro-sensors. A case of a nanostructured catalytic film

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Abstract: Peroxynitrite, the primary product of the reaction of superoxide ion and nitric oxide, emerged as an important species with profound biological roles. Relatively speaking, it is a new member of the nitroxidative array of reactive metabolites, and details of its actions, impact on biological systems in health and disease states are still accumulating. It has already been linked to a host of pathological conditions. At the same time, its cytoprotective roles including redox regulation of critical signaling pathways are also reported. Assessment of peroxynitrite's deleterious versus potential protective/signaling roles strongly depends on the possibility to accurately measure and monitor its concentration. This will help build a clearer understanding of its physiological roles. However, peroxynitrite's extremely short half-life under physiological conditions and its very complex reactivity with many cellular targets create a major analytical chemistry challenge, particularly at the single cell level. The dynamic concentration of peroxynitrite versus other reactive species generated in situ under various conditions modulates its role in many vital cell functions. In this chapter, we give a brief overview of peroxynitrite biochemistry, physiology, and related therapeutic efforts to control its impact under pathological conditions. We then discuss the challenges and accomplishments in terms of major analytical methods developed for peroxynitrite's sensing up-to-date, as well as opportunities for the future.