PL-06. - Carbon dioxide redox metabolites in eustress and oxidative distress

Ohara Augusto [1]
[1]Departamento de Bioquímica, Instituto de Química, Universidade de São Paulo (SP, Brazil)

Life adaptation to molecular oxygen allowed evolution of complex life forms but came with a cost because oxygen is prone to one-electron transfers, producing metabolites (radicals and oxidants) that are toxic to life. In consequence, oxygen pushed an evolutionary explosion of alternative and novel metabolic networks yielding a variety of gene products, such as antioxidant enzymes that increased fitness of the organisms. Although oxygen and its metabolites imprinted the evolution of complex life forms, the cell damaging mechanisms of these metabolites received most of the attention over the years. Only recently, the participation of radicals and oxidants in both, physiological and pathological processes became widely accepted and the aged oxidative stress concept is changing to oxidative distress as opposed to the eustress concept (homeostasis). Here, I summarize investigations arguing for the influence of carbon dioxide (CO_2) redox metabolites on cells and organisms. Aerobes produce considerable amounts of this gas through respiration (humans, about 1 kg of carbon dioxide/day). The gas, in equilibrium with bicarbonate, is crucial for physiological pH control but at high level it toxic to mammals (hypercapnia) and microorganisms. Relevantly, carbon dioxide reacts with biologically ubiquitous oxygen metabolites such as peroxynitrite and hydrogen peroxide to render redox active metabolites such as the carbonate radical and peroxymonocarbonate, respectively. Several evidences indicate the participation of the carbonate radical in situations of oxidative distress (associated with nitric oxide overproduction, hypercapnia and related clinical situations). Peroxymonocarbonate attracted much less attention. Nevertheless, its formation may explain the accelerating effects of the bicarbonate buffer on the oxidation of thiol proteins, including important players in redox signaling, such as protein tyrosine phosphatase (PTP1B) and 2-Cys peroxiredoxins (Prx1 and Prx2). In times of increasing levels of atmospheric carbon dioxide, more studies are required to the understanding its impact on cellular and organisms homeostasis. **Keywords:** carbon dioxide, oxidative stress, eustress. **Supported by:** FAPESP (2013/07937-8); CNPq (300465/2009-2)