

Nitrite reduction by molybdoenzymes: a new class of nitric oxide-forming nitrite reductases

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Abstract Nitric oxide (NO) is a signalling molecule involved in several physiological processes, in both prokaryotes and eukaryotes, and nitrite is being recognised as an NO source particularly relevant to cell signalling and survival under challenging conditions. The “non-respiratory” nitrite reduction to NO is carried out by “non-dedicated” nitrite reductases, making use of metalloproteins present in cells to carry out other functions, such as several molybdoenzymes (a new class of nitric oxide-forming nitrite reductases). This minireview will highlight the physiological relevance of molybdenum-dependent nitrite-derived NO formation in mammalian, plant and bacterial signalling (and other) pathways. The mammalian xanthine oxidase/xanthine dehydrogenase, aldehyde oxidase, mitochondrial amidoxime-reducing component, plant nitrate reductase and bacterial aldehyde oxidoreductase and nitrate reductases will be considered. The nitrite reductase activity of each molybdoenzyme will be described and the review will be oriented to discuss the feasibility of the reactions from a (bio)chemical point of view. In addition, the molecular mechanism proposed for the molybdenum-dependent nitrite reduction will be discussed in detail.

Keywords Molybdenum · Nitrite reduction · Nitric oxide · Cell signalling · Moonlighting

Abbreviations

AO	Aldehyde oxidase
AOR	Aldehyde oxidoreductases
CuNiR	Copper-containing nitrite reductase (one of the enzymes responsible for the respiratory nitrite reduction to NO)
DMSOR	Dimethylsulphoxide reductase
DPI	Diphenyleiodonium chloride
EPR	Electron paramagnetic resonance spectroscopy
Fe/S	Iron–sulphur centre
mARC	Mammalian mitochondrial amidoxime-reducing component
MOSC	From molybdenum cofactor sulphurase C-terminal domain (proteins involved in pyranopterin cofactor biosynthesis)
NaR	Nitrate reductase (all types of nitrate reductase enzymes)
NiR	Nitrite reductases (“dedicated” and “non-dedicated” enzymes)
NO	Nitric oxide radical
NOS	NO synthases
ROS	Reactive oxygen species
SO	Sulphite oxidase
SOD	Superoxide dismutase
XD	Xanthine dehydrogenase
XO	Xanthine oxidase