Nitric oxide (NO) is an important signaling molecule in organisms. It plays a role in wide spectrum of physiological and pathophysiological processes, including vasodilatation, neurotransmission and host defense. The gaseous molecule of NO is produced by oxidative reaction catalyzed by proteins from the family of nitric oxide synthases (NOSs). Three NOS isoforms were identified in mammals, endothelial (eNOS), neuronal (nNOS) and inducible or immunologic (iNOS).

Some bacteria harbor genes coding for proteins homologous to the mammalian NOS oxygenase domain and showing NO-producing activity in vitro. NO generated by pathologic organisms such as B. anthracis and S. aureus is supposed to play a critical role in the pathophysiological processes during the infection. Comparative study of bacterial NOS-like proteins and mammalian NOSs confirmed their principal similarity, but also revealed differences in the interactions of distinct bacterial proteins and mammalian NOS isoforms with different analogs of substrate L-arginine and various ligands. On the basis of the kinetics measurement of NO-rebinding a second NO-binding site in the active center of NOS was predicted. Further, the regulation of NO dynamic and release from the protein by the active site Hbonding network connecting the heme, the substrate and BH4 cofactor was described.

(...)

NO in mitochondria plays an important role in reactive oxygen species (ROS) formation and in the regulation of energetic metabolism. The existence of mitochondrial NOS isoform is subject to an extensive research, but the full proof is still missing. Newly described plant protein AtNOS1, with orthologs in bacteria and eukaryotic organisms, was identified as a putative novel NOS. The results of this work denied direct involvement of mammalian AtNOS1 orthologs in the NO production. The protein was localized in mitochondria and its function was shown to take place in the mitochondrial ribosome assembly, mitochondrial protein synthesis, and such basal mitochondrial functions as ATP synthesis and apoptosis.