IN BRIEF

A Functional Nitric Oxide Synthase in Ostreococcus tauri

Nitric oxide (NO) functions as a signaling molecule in many biological processes in plants and animals. In animal cells, NO is synthesized primarily by nitric oxide synthases (NOSs), which catalyze the NADP-dependent oxidation of Arg to NO and citrulline, and several NOS isoforms have been identified. Plant NO synthesis is a matter of ongoing investigation and debate. Despite evidence of an Arg-dependent pathway for NO synthesis in plants, no plant NOS homologs have been identified to date, and there is also evidence for a nitrate-dependent mechanism, catalyzed by cytosolic nitrate reductase (reviewed in Gas et al., 2009).

At long last, Foresi et al. (pages 3816–3830) report on the existence of a NOS enzyme in the plant kingdom, from Ostreococcus tauri, a tiny single-celled green alga. O. tauri shares a common ancestor with higher plants and is considered to be part of an early diverging class within the green plant lineage. Thus, it is potentially a useful model system to study gene evolution and cellular processes in photosynthetic eukaryotes.

The authors started with a sequence in the O. tauri genome predicted to encode a NOS enzyme (Derelle et al., 2006). The O. tauri protein sequence shares 45% similarity to human NOS, and phylogenetic analysis assigned it to a cluster with putative NOS sequences from Synechococcus sp and Physarum polycephalum. Structural models showed high similarity between O. tauri and animal NOS catalytic domains (see figure). Purified recombinant O. tauri NOS was found to have NOS activity in vitro, and Escherichia coli expressing the recombinant O. tauri showed increased levels of NO and increased cell viability. The authors report on the catalytic activity of the recombinant enzyme and find that it has similar characteristics to other NOS enzymes in terms of the $K_m$ for L-Arg and the rate of NADPH oxidation.

Finally, they measured NO production in cell suspension cultures of O. tauri under a variety of conditions to assess the biological importance of the enzyme in this organism. O. tauri cells were found to have a high level of NOS-dependent NO production during exponential growth, which could be further augmented by the exogenous addition of L-Arg. The authors hypothesize that NOS-dependent NO production could contribute significantly to the regulation of the marine N cycle and algal bloom dynamics, since high NO production has been linked to reduced growth and photosynthesis and increased cell death in marine diatoms (Vardi et al., 2008).

This work provides compelling evidence for a plant NOS enzyme in O. tauri, which in addition could play an important role in marine ecology.

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REFERENCES


A Functional Nitric Oxide Synthase in *Ostreococcus tauri*

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