Papers of the Week

Prokaryotic Peroxiredoxins Can Be Sensitive

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Overoxidation of 2-Cys Peroxiredoxin in Prokaryotes. Cyanobacterial 2-Cys Peroxiredoxins Sensitive to Oxidative Stress

Hydrogen peroxide has a dual effect in eukaryotic cells; this byproduct of aerobic respiration is an important signaling molecule, but it is also a potential toxin. The signaling activity of hydrogen peroxide involves a transient increase in its concentration due to the inactivation of 2-Cys peroxiredoxin (2-Cys Prx), a thiol-based peroxidase, by overoxidation. This sensitivity to overoxidation depends on GGLG and YF motifs, which are believed to be exclusive to eukaryotic 2-Cys Prxs. In this Paper of the Week, though, María Pascual and colleagues show that 2-Cys Prxs from several prokaryotes, including two cyanobacteria (Anabaena sp. PCC7120 and Synechocystis sp. PCC6803), contain these motifs characteristic of sensitive enzymes. Further analysis of the cyanobacterial enzymes confirmed that Anabaena 2-Cys Prx is overoxidized at the peroxidatic cysteine residue and furthermore that this enzyme is readily and reversibly overoxidized in vivo in response to high light and hydrogen peroxide, more so than the Synechocystis enzyme. Interestingly, these two cyanobacterial strains have adapted different strategies to cope with hydrogen peroxide; although Synechocystis maintains a low content of less sensitive 2-Cys Prx and high catalase activity, Anabaena contains abundant and sensitive 2-Cys Prx but low catalase activity (much like chloroplasts). The results of this study clearly demonstrate that much remains to be learned regarding the mechanisms by which different prokaryotic organisms have evolved to elicit responses to oxidative stresses.

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