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Glutathione peroxidases as redox sensors in plants

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Glutathione peroxidases (GPXs) are antioxidant enzymes that catalyze the reduction of hydrogen peroxide (H_2O_2) or organic peroxides to water or alcohols, using either glutathione (GSH) or thioredoxins (TRXs) as reducing agents. Although animal and non-animal GPXs share a common ancestor, they present different enzymatic mechanisms, structures and reducing agent preferences. Because plant and yeast GPXs use TRXs as reductants, they were termed GPX-like (GPXL). Yeast GPXL3p (*syn.* Orp1p) can oxidize the transcription factor Yap1 by reacting with H_2O_2. Ultimately, this increases the expression of genes encoding proteins involved in antioxidative defense. This suggests that GPXLs may have other functions besides peroxide reduction. *Arabidopsis thaliana* GPXL8 is localized in the cytosol and nucleus, but little is known about its involvement in ROS sensing and signaling. Therefore, our main goals are to identify proteins interacting with GPXL8 and determine whether and how GPXL8 oxidizes such proteins. To evaluate the ability of GPXL8 to react with H_2O_2 and oxidize target proteins, we used a reduction-oxidation-sensitive GFP (roGFP2) as an artificial GPXL8 target protein. *In vitro* assays display that GPXL8 can oxidize roGFP2, showing that it possesses a thiol oxidase activity. Substitution of the resolving cysteine (C89S) or the central cysteine (C70S) close to the active site revealed that both are involved in regulating and limiting the oxidation of roGFP2, but only the peroxidatic cysteine (C41) is essential for the GPXL8 thiol oxidase activity. GPXL8 putative interactors were identified by the TurboID-based proximity labeling and Yeast Two Hybrid methods. Our preliminary findings indicate that GPXL8 can interact with proteins involved in several biological processes, but further studies are necessary to confirm these interactions and their biological relevance. Through this project, we expect to expand our understanding of how plants relay information from H_2O_2 to target proteins in response to various environmental stimuli.
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Histone deacetylases (HDAs) remove acetylation from histones and are