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Oxidative stress-dependent structural and functional switching of a 2-cys peroxiredoxin

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Although large amounts of biochemical information on a redox protein, peroxiredoxin (Prx), have been reported, a genuine physiologic function for the protein has not been established. We show here that a plant Prx, C2C-Prx, existing as discretely-sized multiple forms of high molecular weight (HMW) protein complexes acts both as a peroxidase and as a molecular chaperone. The peroxidase function predominates in lower MW proteins, whereas the chaperone function is more significant in higher MW protein complexes. Using the yeast system, we analyzed the physiological significance of the Prx protein exhibiting the dual functions. Exposure of yeast cells to heat shock or oxidative stress, such as H_2O_2or hyperaerobic conditions (95% O_2/5% CO_2) leads to a remarkable shift in its protein structures from the low MW species to HMW protein complexes and triggers an in vivofunctional switch from a peroxidase to a molecular chaperone in a reversible manner. Due to its chaperone function, the C2C-Prx confers greatly enhanced resistance of yeast and plant cells to thermal and oxidative stresses in vivo.