



Figure 2. Transcriptional regulation of adaptive response to hydrogen peroxide in the yeast *Saccharomyces cerevisiae*. Designations: Yap1p, transcriptional factor of *Yap1* regulon; Skn7p, transcriptional regulator of *Skn7* regulon; Msn2/4p, transcriptional regulator of *Msn2/4* regulon; STRE, stress-response element. * MnSOD mitochondrial enzyme, which is encoded by *SOD2* gene located in nuclear genome.

Hydrogen peroxide also up-regulates antioxidant enzymes which assist the main enzymes in detoxifying secondary products of free radical modification and maintaining necessary intracellular concentrations of reducing equivalents and low molecular mass antioxidants. For example, GR and G6PDH, maintain intracellular pool of reduced glutathione and NADPH, respectively. It is important to note that the secondary antioxidant enzymes are under the control of sensors of oxidative stress in *E. coli* and many other organisms as well.

The control of H_2O_2 -adaptive response in *S. cerevisiae* involves Yap1p, Skn7p and Msn2p/Msn4p (Msn2/4p) transcriptional factors (Figure 2) [7,23,26,32,33]. Mutants deleted for *YAP1* or *SKN7* as well as *MSN2* and *MSN4* genes were found to be unable to induce most antioxidant proteins of the H_2O_2 stimulon, indicating that they were hypersensitive to hydrogen peroxide

[55–58]. Under stress induced by hydrogen peroxide, a strain deficient in *SKN7* behaved identically to a strain lacking *YAP1*, at the same time a $\Delta skn7\Delta yap1$ double mutant demonstrated the properties similar to single mutants deleted for either *YAP1* or *SKN7* [55]. Figure 2 shows that Skn7p controls the expression of a set of antioxidant enzymes also regulated by Yap1p, for instance, catalase T, Cu,Zn-SOD, Mn-SOD and cytochrome c peroxidase [56,59]. The cytosolic catalase T, which may be regulated by either Yap1p or Skn7p, was also found to be a member of the *Msn2/4* regulon in *S. cerevisiae* [58]. This fact justifies a crucial role of catalase T in the yeast defense against hydrogen peroxide. If the expression of abovementioned proteins can be upregulated by a single regulatory protein or both of Yap1p and Skn7p, the induction of thioredoxin 2 (*TRX2*) and thioredoxin reductase (*TRR1*) requires co-operation between Yap1p and Skn7p [55]. On the