The transcription factors Hap4 and Swi4 contribute to the regulation of the transcriptional response to cold shock in *Saccharomyces cerevisiae*

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Budding yeast, *S. cerevisiae,* responds to cold shock by changing gene expression. Which transcription factors control this response is unknown. We screened nine transcription factor deletion strains for impaired growth at different temperatures on solid media, and found that the ∆phd1 and ∆gcr2 strains were impaired for growth at all temperatures (15ᵒC, 20ᵒC, 30ᵒC and 37ᵒC), the ∆nrg1 strain was impaired for growth at warm temperatures (30ᵒC and 37ᵒC) and enhanced for growth at cold temperatures (15ᵒC and 20ᵒC), and the ∆ash1, ∆swi4, and ∆hap4 strains were impaired for growth only at cold temperatures. Liquid cultures of the ∆swi4 and ∆hap4 strains were then subjected to cold shock at 13ᵒC, followed by recovery at 30ᵒC. Samples were collected before cold shock (t0), after 30 and 60 minutes of cold shock (t30, t60), and after 30 and 60 minutes (t90, t120) of recovery. DNA microarrays were used to measure global changes in gene expression for four replicates for each strain. An ANOVA test showed that 2233 out of 6189 (36%) genes had a significant change in gene expression at an adjusted p value < 0.05 for the ∆swi4 strain , while 1749 genes (28%) were significantly changed in the ∆hap4 strain. Both strains showed patterns of expression where genes were up-regulated during cold shock and down-regulated during recovery or vice versa. Genes showing these patterns of expression belong to the ribosome biogenesis and glycogen metabolic processes, respectively, processes used by the cell to survive cold shock.

Keywords: Saccharomyces cerevisiae, cold shock, Hap4, Swi4, DNA microarrays