Identification of wine yeast genes that respond to transient temperature changes during fermentation

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Background
- Winemaking processes can expose fermenting yeast to rapid, transient changes in temperature.
- Transient changes are commonly thought to have negligible effects.
- Actual impact and genetic response to these brief exposures has not been studied.

Method
- Past work shows that even a 20 second exposure to high temperatures (≥55°C) can be lethal to yeast.
- Non-lethal extremes may still cause genetic response, such as activating thermo-tolerance mechanisms.
- The system used applies a controlled temperature shift (17°C → 50°C or 30°C → 0°C) for ~20 seconds to an actively fermenting culture

Gene Analysis
- Replicate culture samples were collected 15, 30, and 60 minutes after the exposure.
- Differential expression of key genes is currently being analysed by real time PCR.
- Key candidate genes were selected from previously published microarray studies.
- Genes with the largest increase in transcription shortly after temperature transition were chosen.

Key Gene candidates
- Heat
  - HSP42: heat shock protein
  - BTN2: v-SNARE binding protein
  - TMA10: Protein of unknown function that associates with ribosomes
  - SSA4: Hsp70 family chaperone
  - TSL1: trehalose 6-phosphate synthase/phosphatase complex subunit
- Cold
  - PRM7: pheromone-regulated protein
  - DBP2: DEAD-box ATP-dependent RNA helicase
  - AAH1: adenine deaminase
  - BSC1: Protein of unconfirmed function; similar to cell surface flocculin Flo11p;
  - YKR075C: Protein of unknown function; similar to Reg1p

Conclusion
- This study will test similarities between sustained temperature transition response and transient temperature exposure response and thus provide context for further testing of the genetic response to transient extreme temperature exposures.
- Further work to explore the whole transcriptome response will occur via RNA sequencing.

References

www.agwine.adelaide.edu.au/winemicro/