Riding the heat wave: transcriptomic insights from yeast

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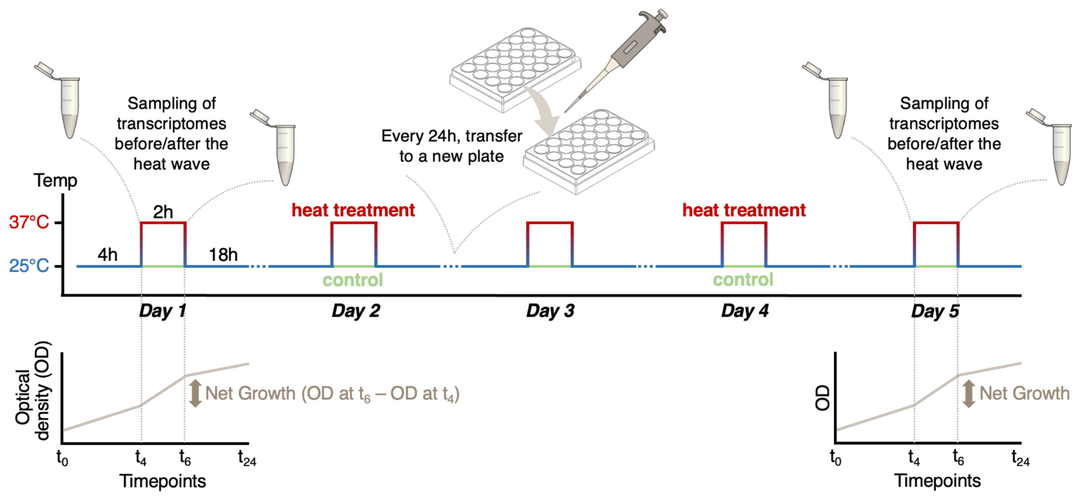
Introduction

- Extreme climatic events, such as **heat waves**, are becoming more frequent and intense under **climate change**.
- Yet, little is known about the mechanisms that enable organisms to cope with **repeated thermal stress**.
- In particular, transcriptional **memory** -where previous exposure modifies subsequent gene expression responses- may contribute to thermal resilience.
- We used **eight** *Saccharomyces* yeast species spanning a broad range of thermal tolerances to investigate how repeated heat waves affect **growth** and **gene expression**.

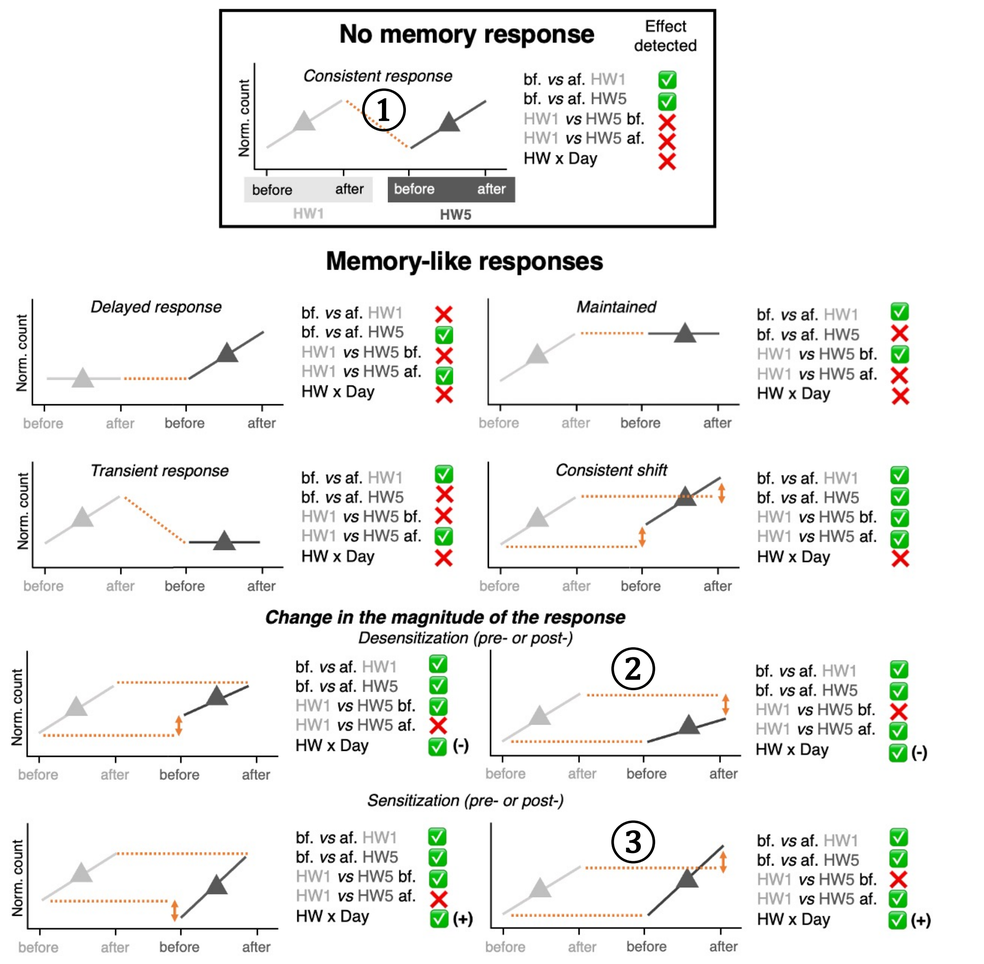
→ Do species with different thermal niches rely on **common** or **divergent transcriptional strategies** to cope with repeated **heat waves**?

Material & Methods

- 8 species of *Saccharomyces* yeasts, 2 strains each:

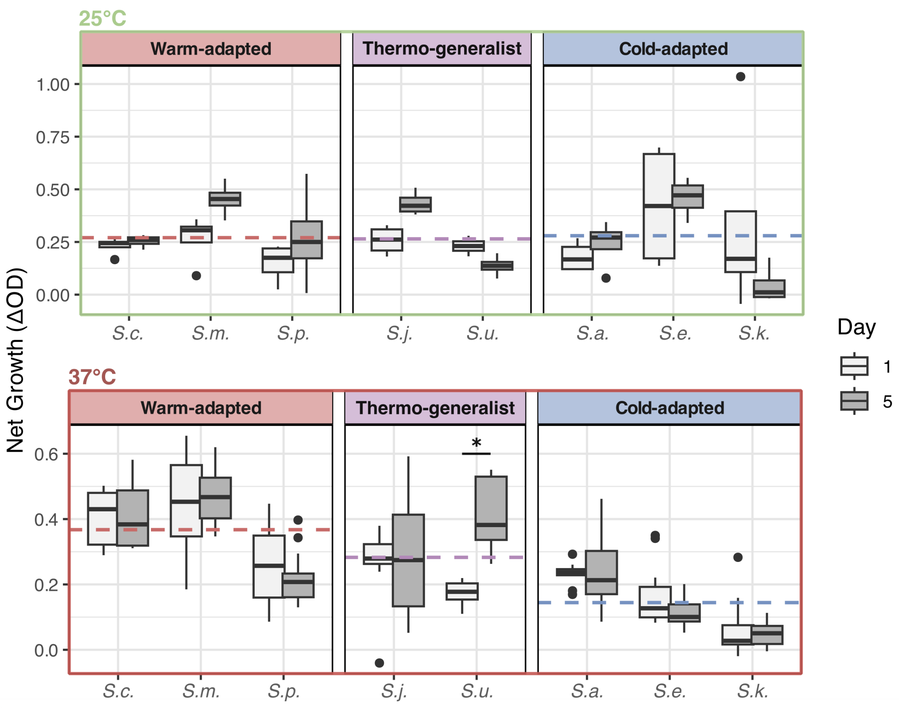


- Conceptual framework to analyse the combinations of effect(s) detected with DeSeq2:



Results

Thermal tolerance predicts heat-wave performance



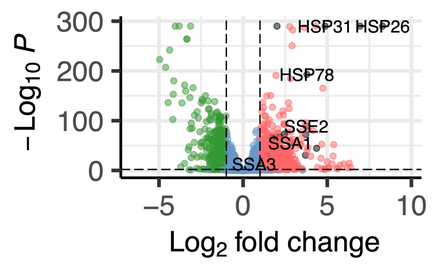
Warm-adapted species maintained the **highest** growth during **heat waves** *whereas* **cold-adapted** species showed **reduced** growth

Conserved 'no memory' responses

Across species, repeated heat waves **consistently** (see ①) triggered:

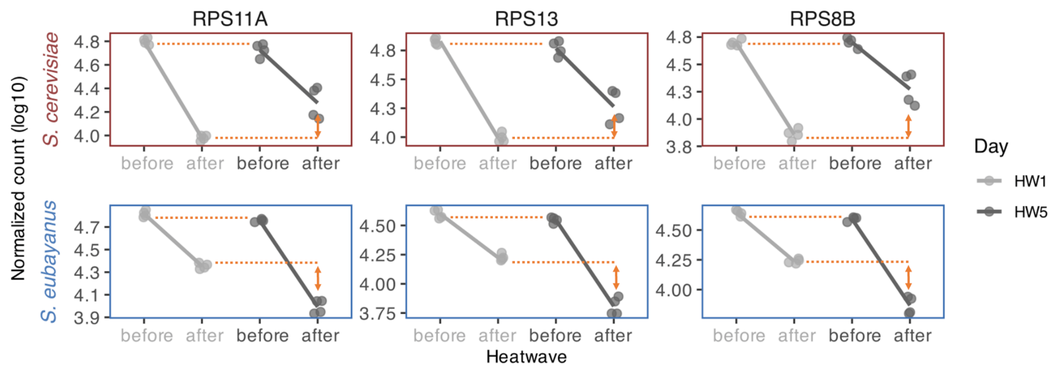
↓ Translation and ribosome biogenesis

↑ Protein folding and proteostasis pathways



They are sharing a common repertoire which mirrors the well-described yeast heat-shock response.

Divergent 'memory-like' responses



Memory-like responses were highly species-specific. The strongest contrast was observed for ribosomal functions between:

- *S. cerevisiae* (warm-adapted): post-**desensitization** (see ②)
- *S. eubayanus* (cold-adapted): post-**sensitization** (see ③)

…indicating ***opposite*** regulatory strategies after repeated heat-wave exposure.

Conclusion

Repeated heat waves trigger **largely conserved core stress** responses but also **contrasting memory-like** gene regulation in *Saccharomyces* species from different thermal niches.

These findings suggest that **thermal resilience** could be achieved through **alternative** regulatory strategies and highlight the importance of comparative approaches for predicting biological responses to **increasingly frequent climate extremes**.

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