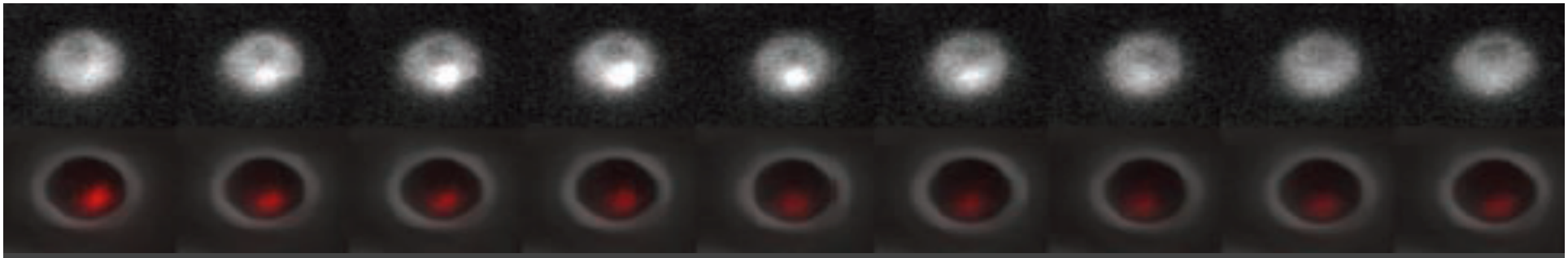

The Frequency Dependence of Osmo-Adaptation in Saccharomyces cerevisiae

Alexander van Oudenaarden Lab

20.309 Final Presentation

Mashaal Sohail

Emily Suter

Motivation

- Cells respond to stimuli using complicated systems of biochemical reactions
- Systems may comprise of hundreds of reactions
- Interest in determining dominant processes that dictate system dynamics

Hog1 MAPK Pathway

High-Osmolarity Glycerol (HOG) Mitogen-Activated Protein Kinase (MAPK) pathway in budding yeast *Saccharomyces cerevisiae*

- Core pathway of the hyperosmotic shock response

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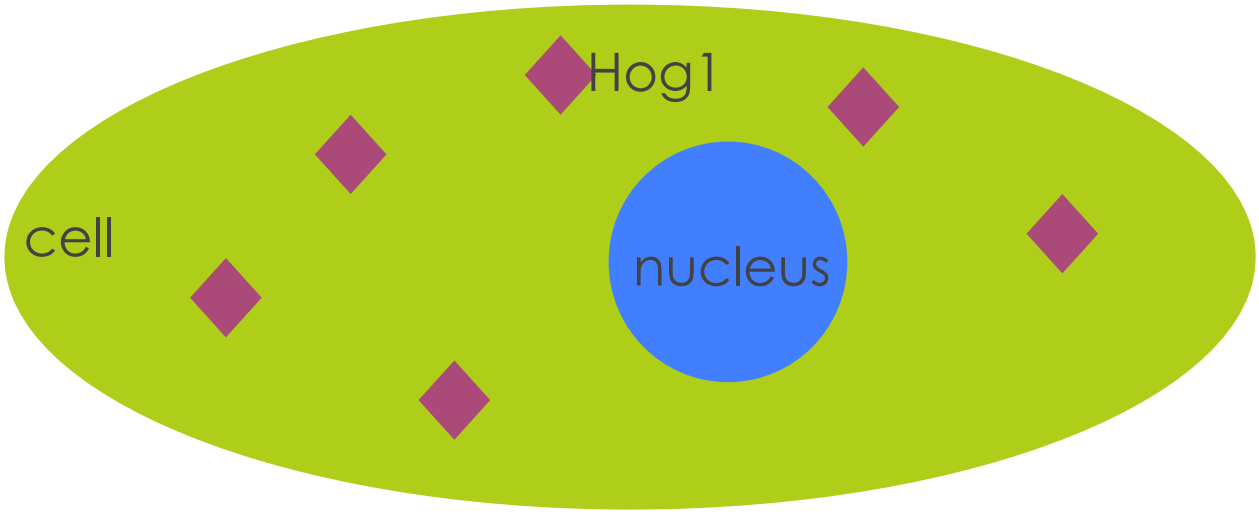

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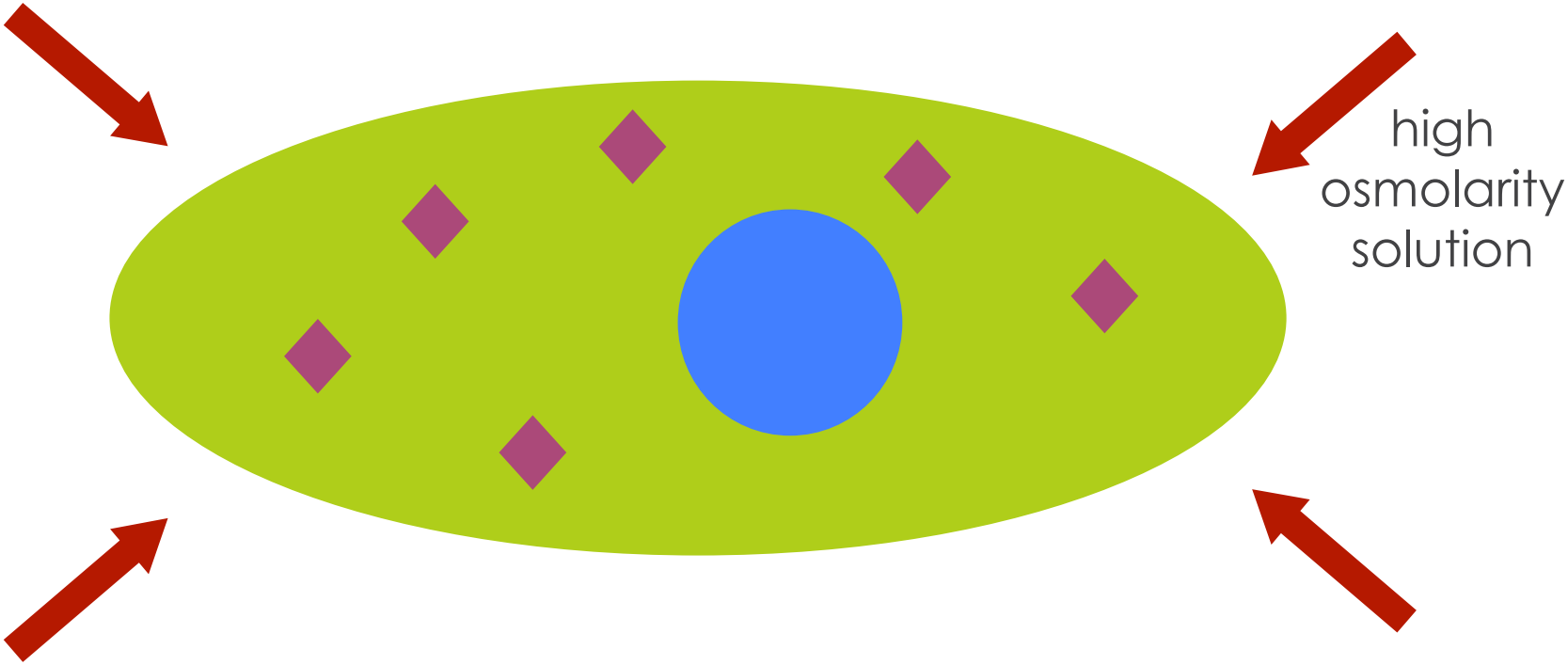

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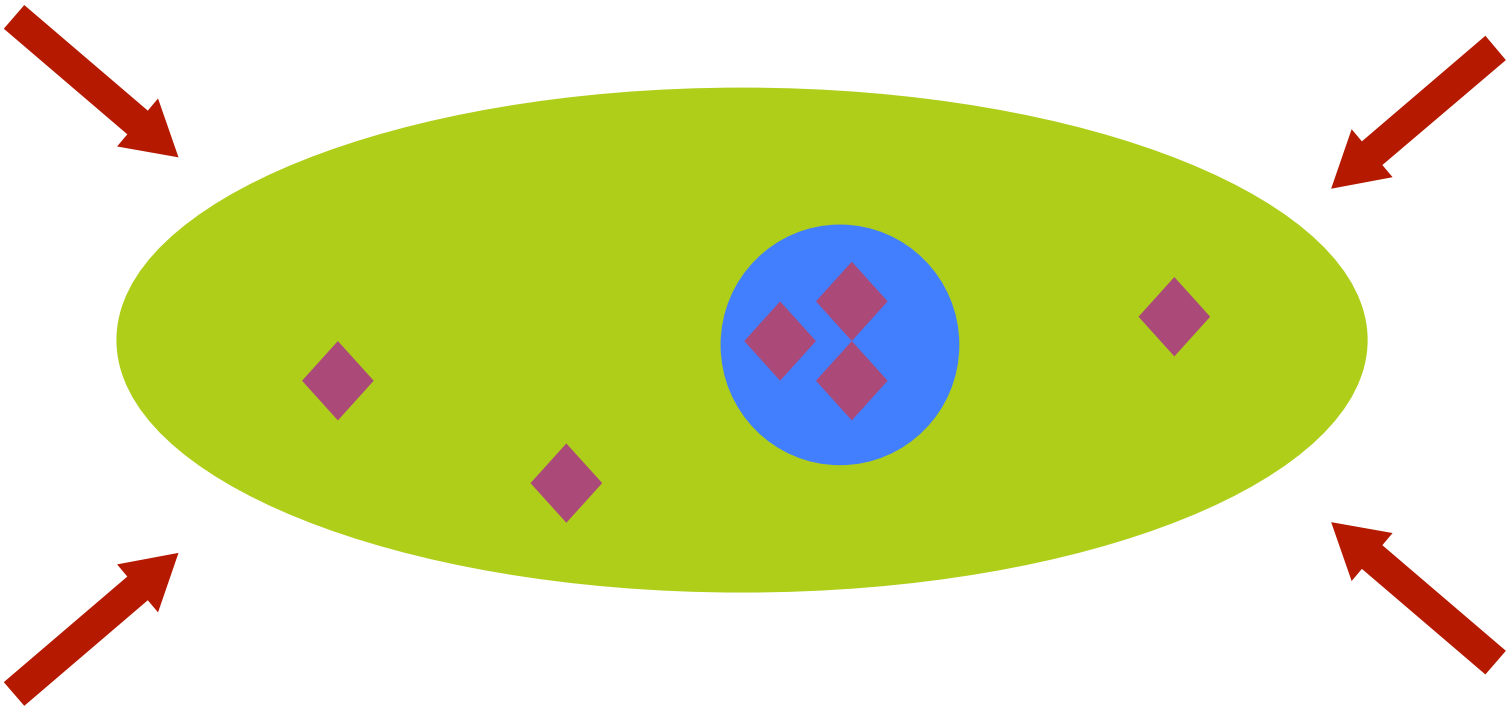

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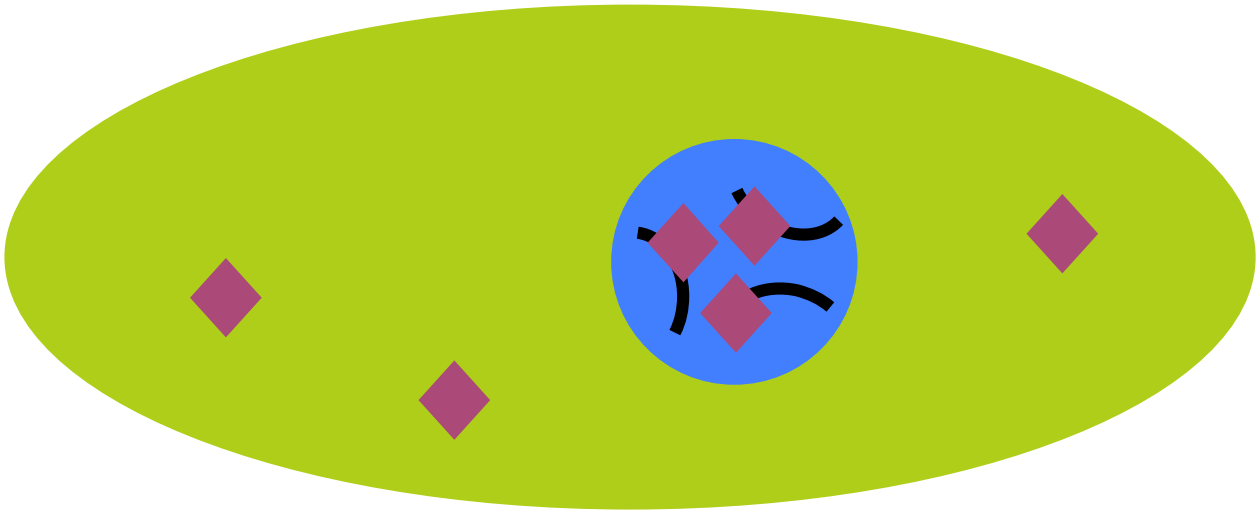

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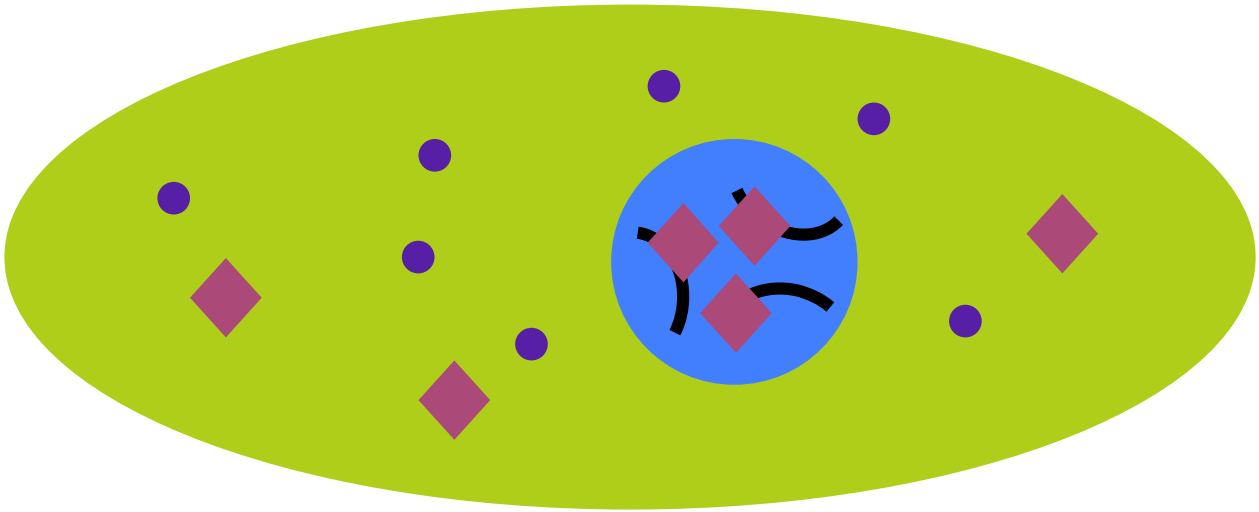
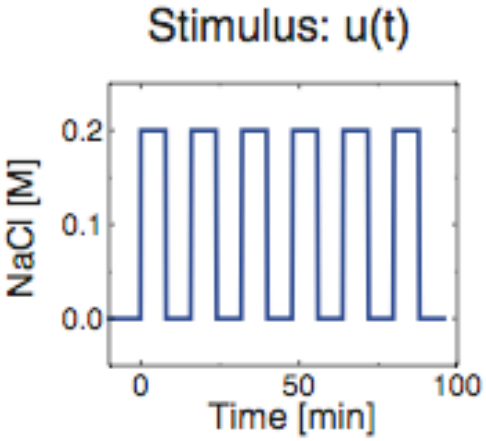


Experimental Setup



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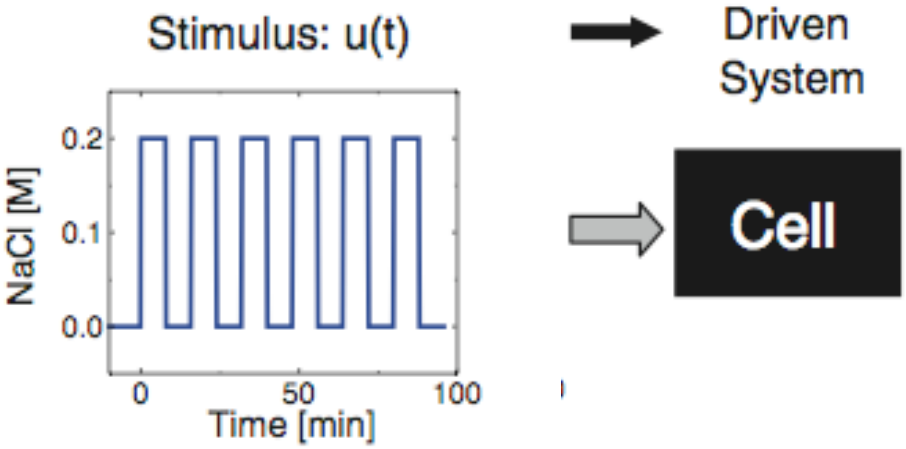

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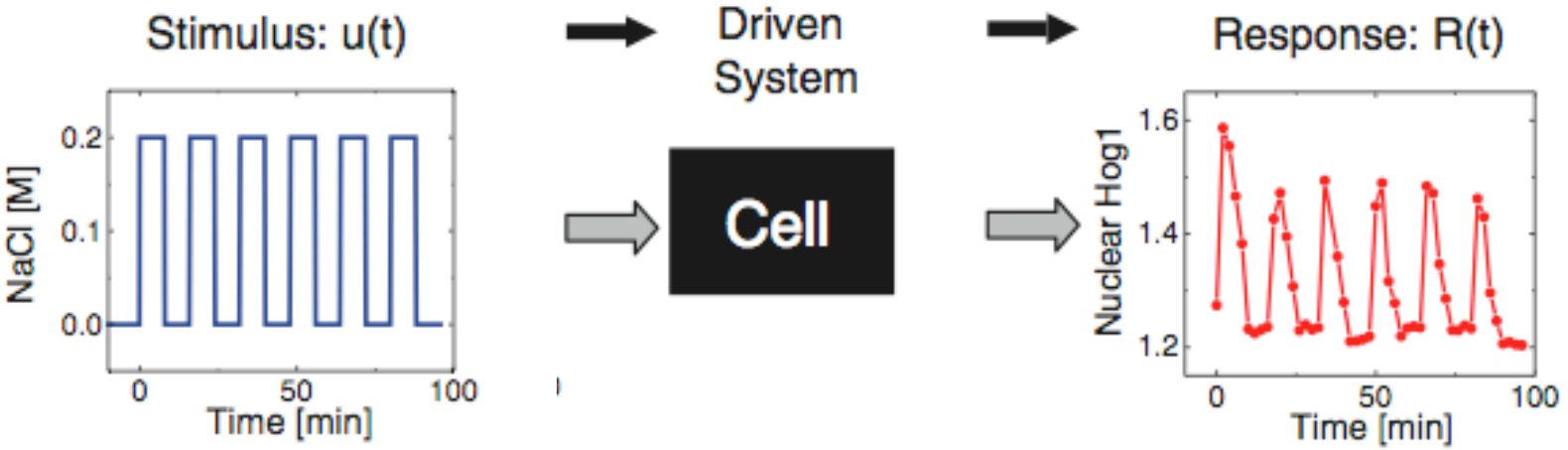

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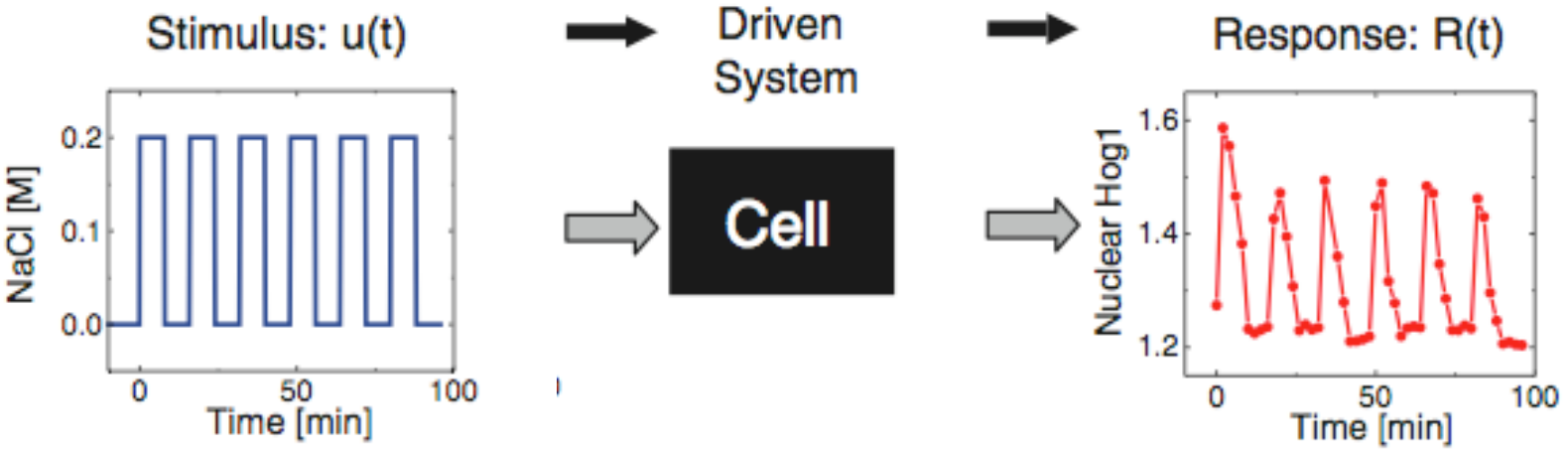
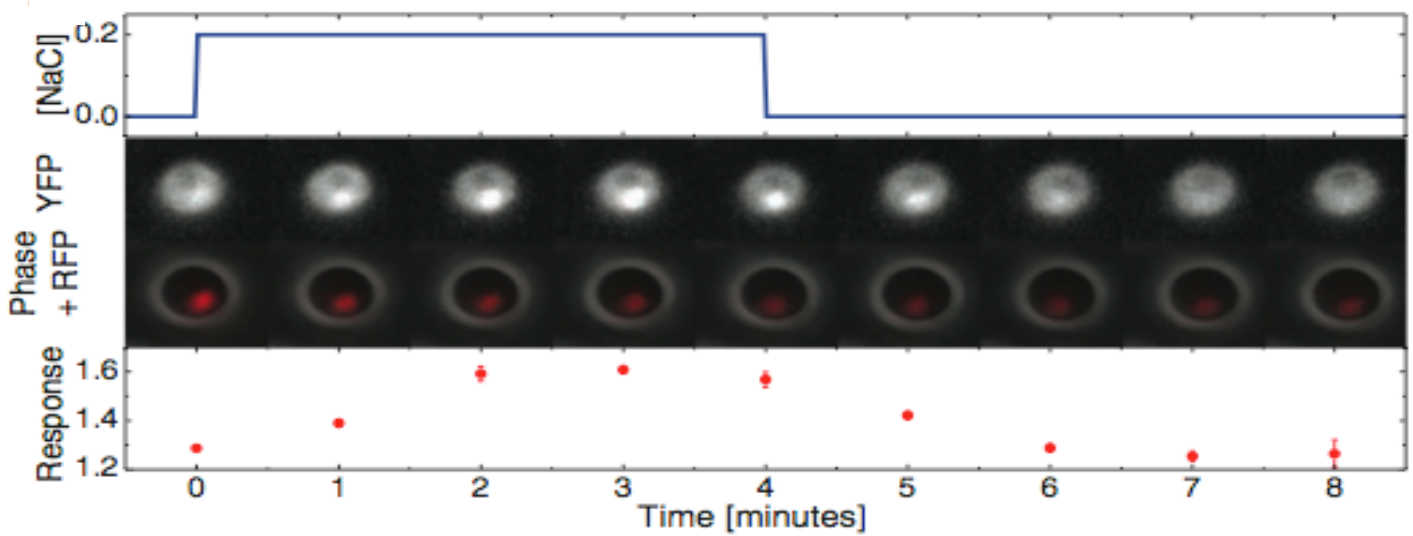
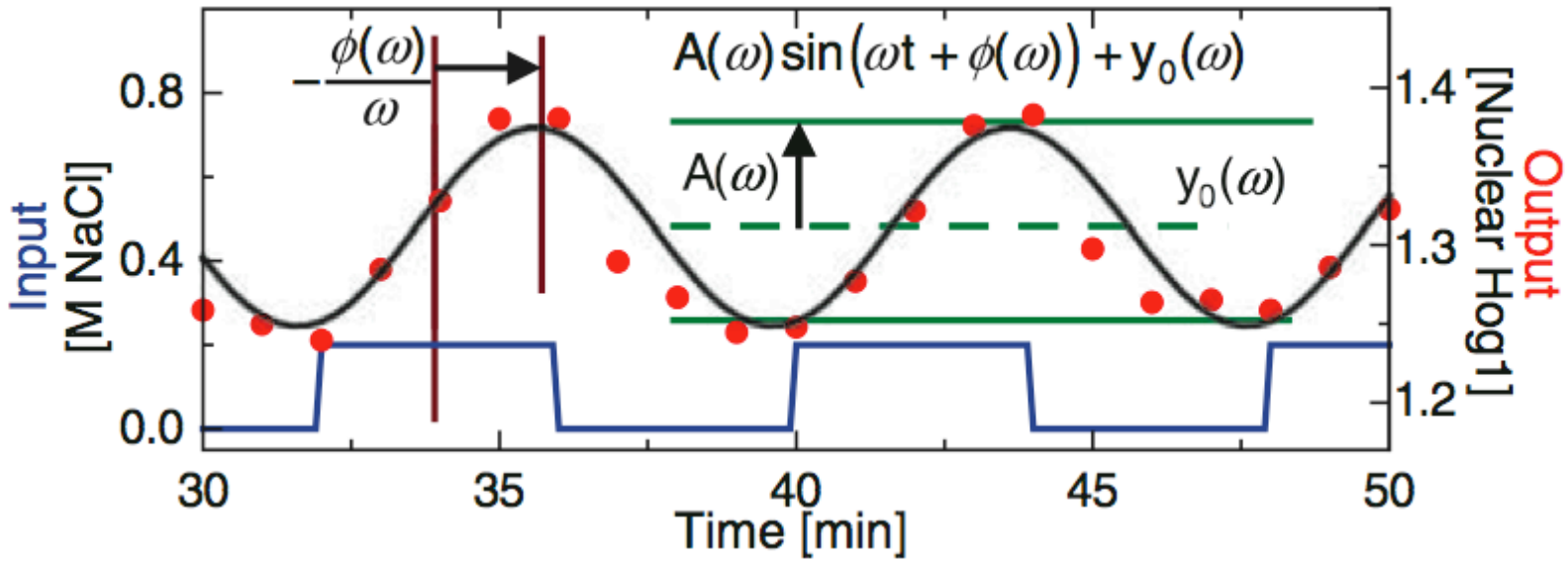
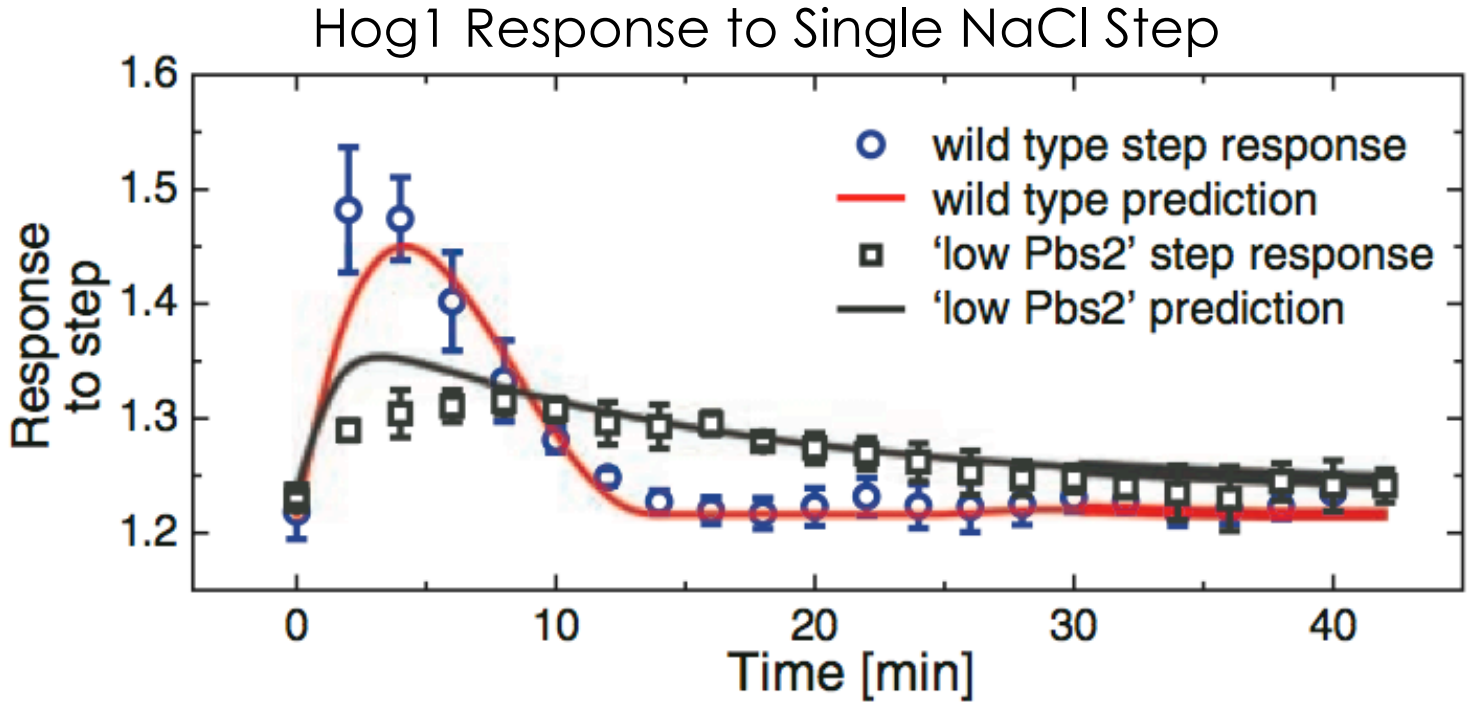




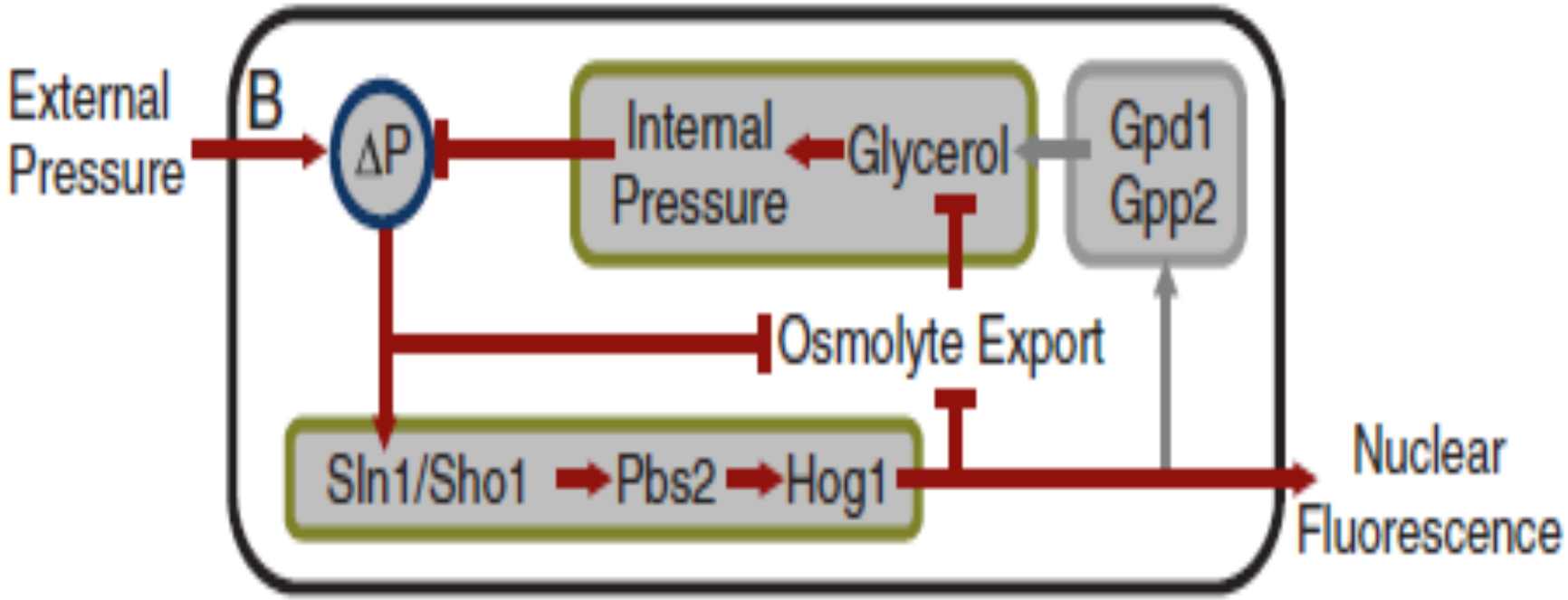
Fourier analysis approximates output signal as sin curve



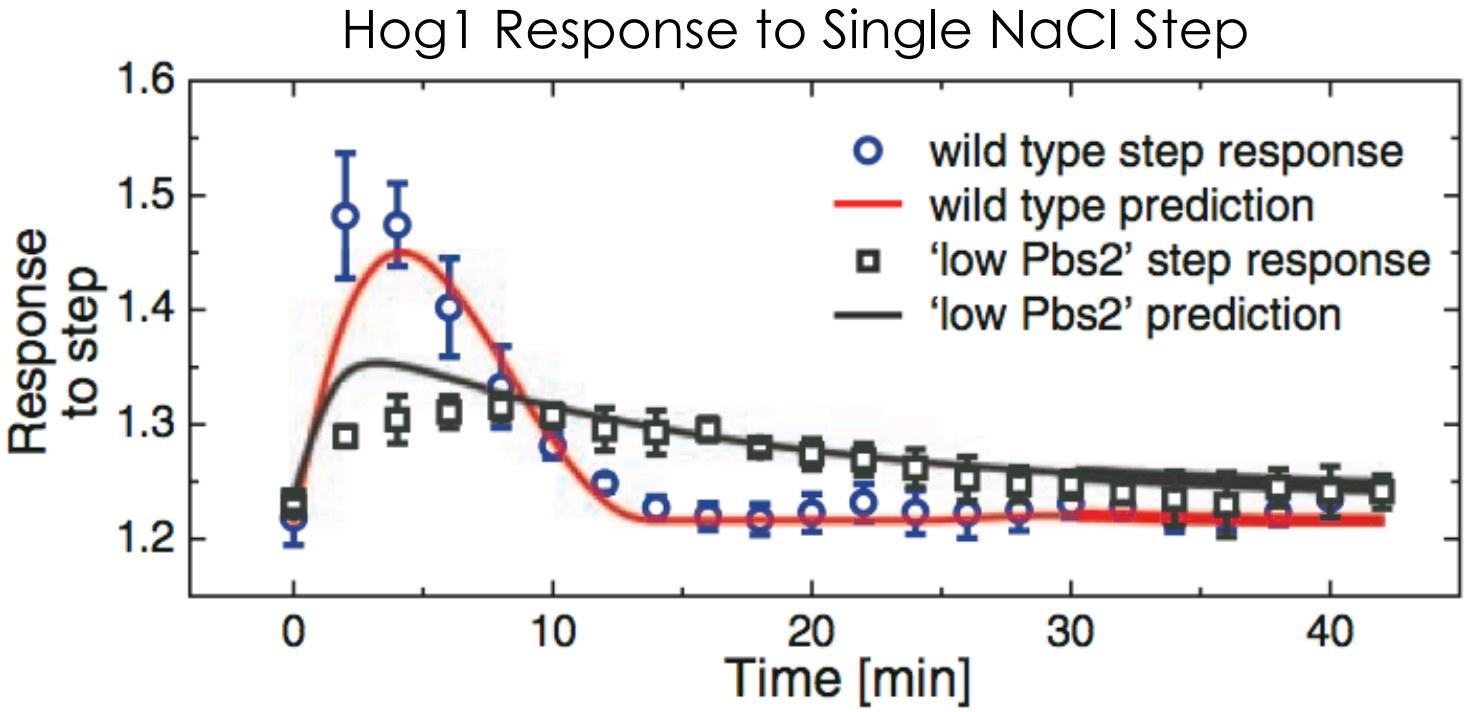
Linear time invariant model predicts system response to input signal



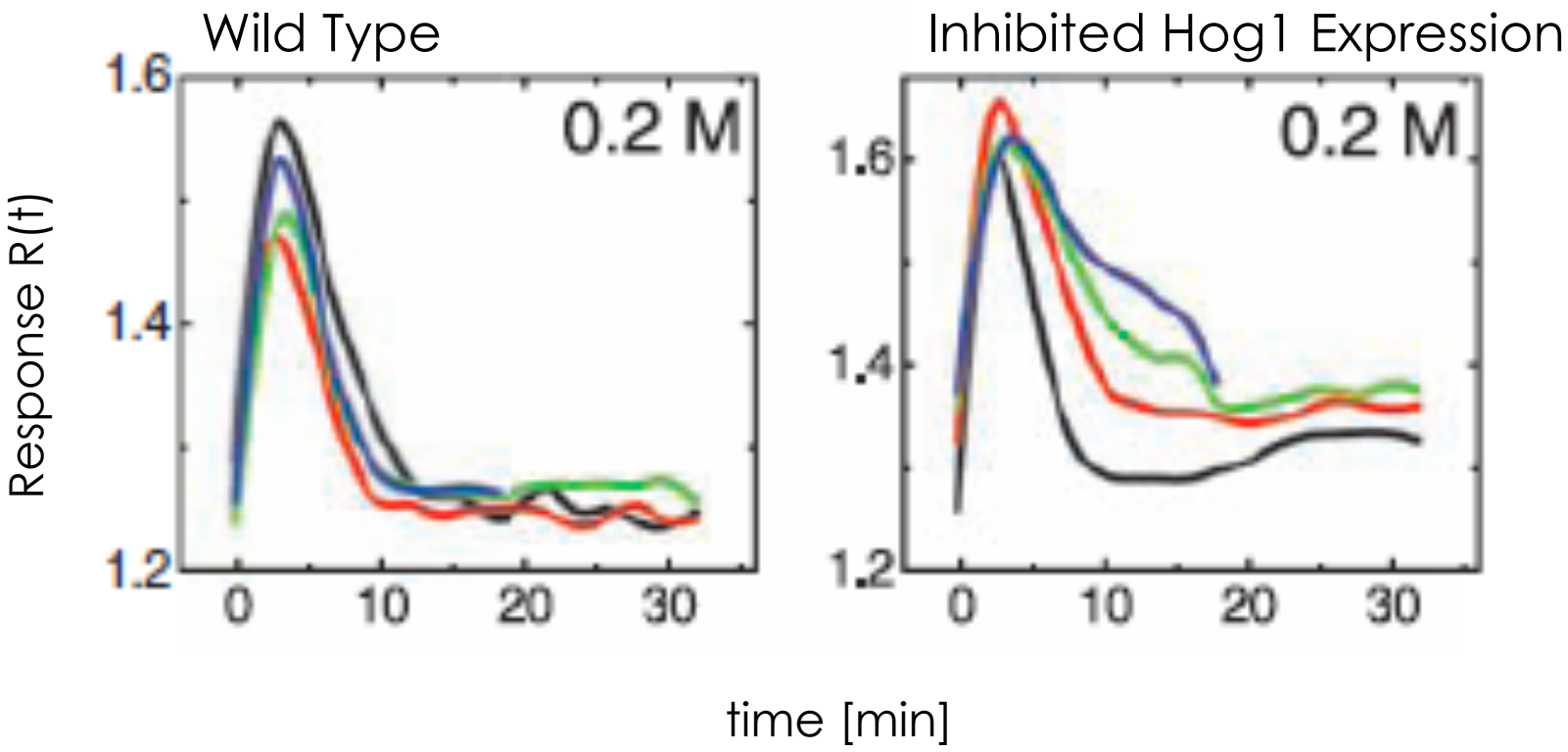
Pulsed-input analysis corresponds to biological network



Hog1-dependent feedback loop plays major role in rapid response



Gene expression facilitates response to osmotic shocks on longer time scales



Significance/Conclusions

- Showed that Hog1 MAPK pathway is governed by two different response time scales
- Demonstrated use of frequency-response analysis on cellular networks
- Utilized engineering principles to predict the response of dynamic stimuli

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Thank you