

Regulation of plant stem cell activity and growth by energy signals



Christopher Bell, Filipa Lara Lopes, Ana Confraria and Elena Baena-González

Department of Biology, University of Oxford, South Parks Road, Oxford, UK

christopher.bell@biology.ox.ac.uk

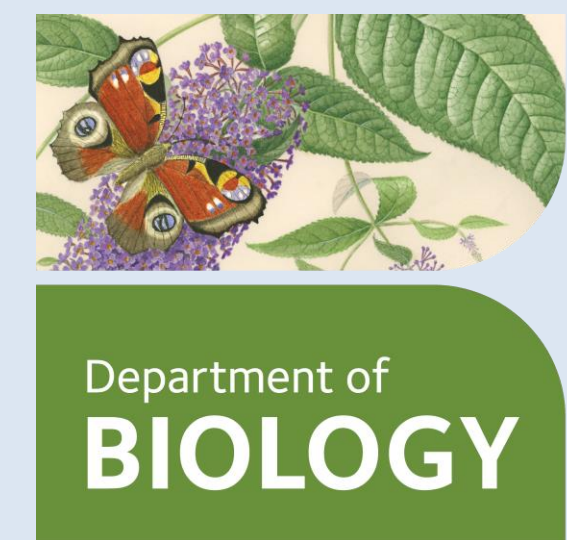


@Christobel99

@Ebaena_Gonzalez



GATSBY



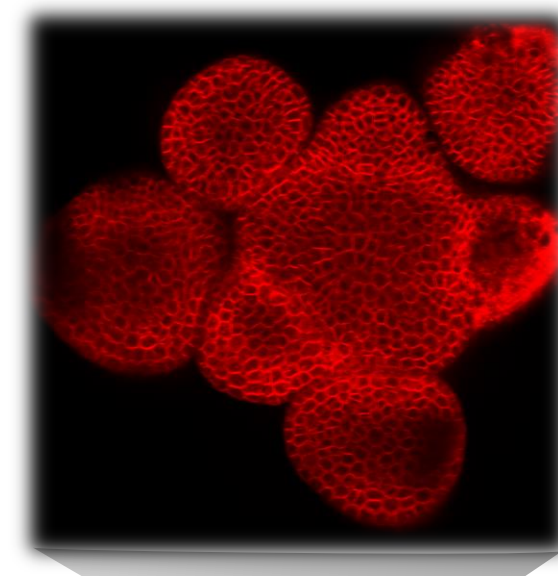
1

Introduction

Plant stem cell reservoir = shoot apical meristem
→ Initiation of all aerial plant organs
→ The WUSCHEL homeobox transcription factor is crucial for meristem maintenance¹⁾

Plant growth & development occur post-embryonically
→ High developmental plasticity
→ Determined by the environment

Environmental stress compromises photosynthesis and respiration, thereby limiting energy availability.



Stress

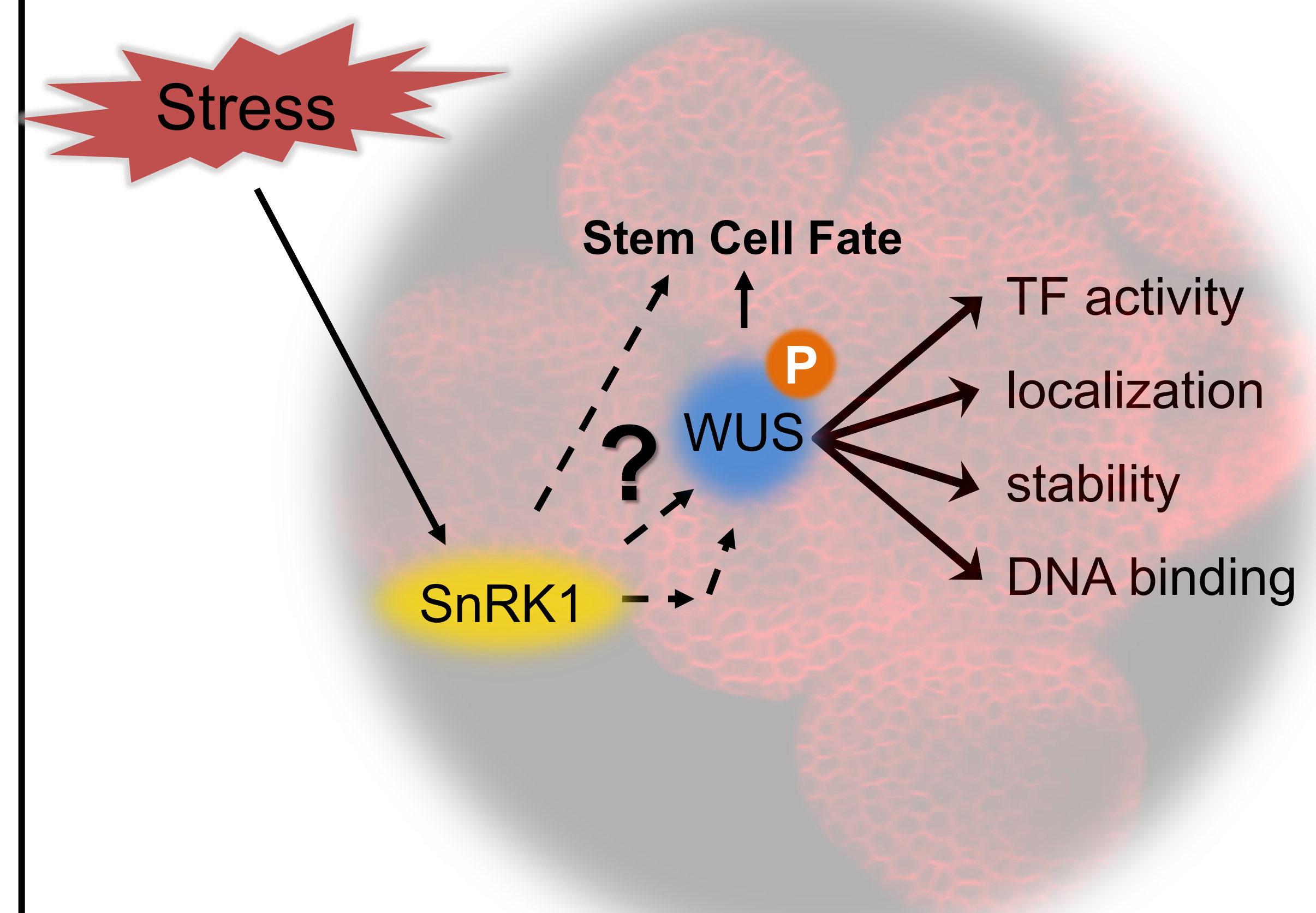
How do environmental conditions influence plant stem cell activity (organogenesis)?

photosynthesis↓
energy levels↓
? stem cells
growth adjustments

4

Possible Model & Conclusion

SnRK1 fine-tunes meristem activity according to the energy state.

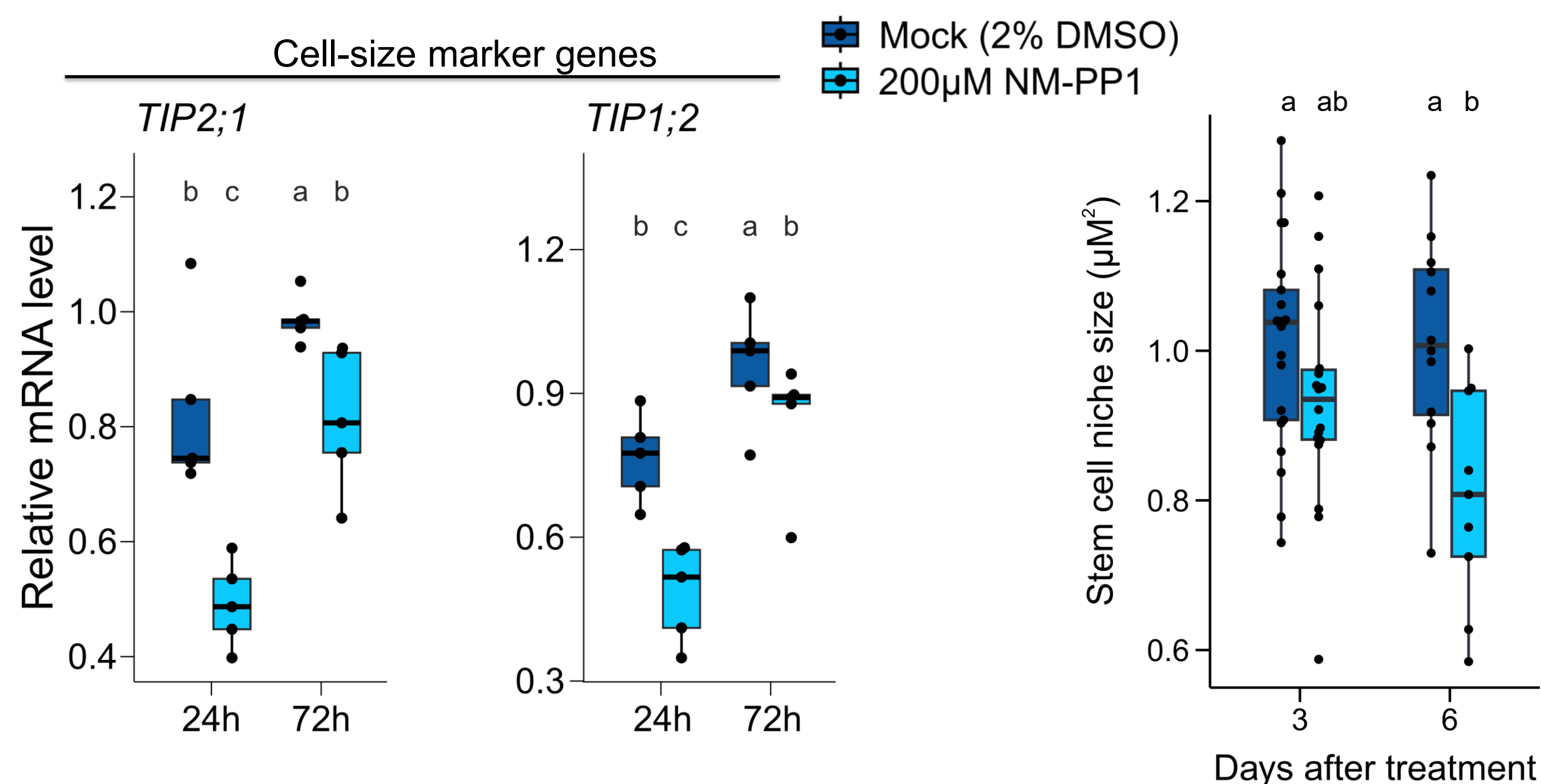
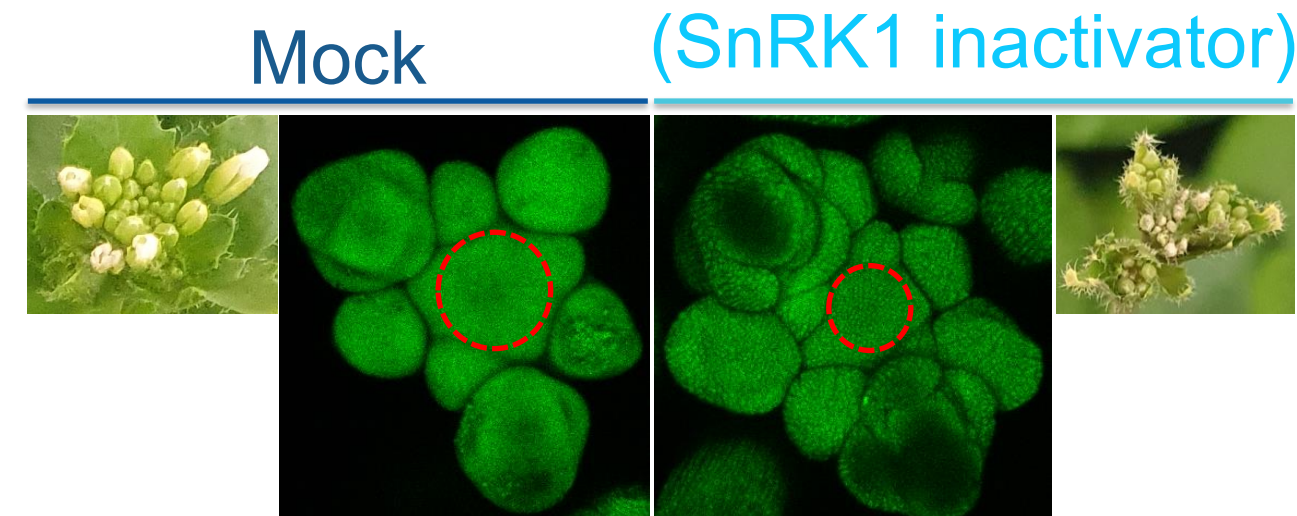
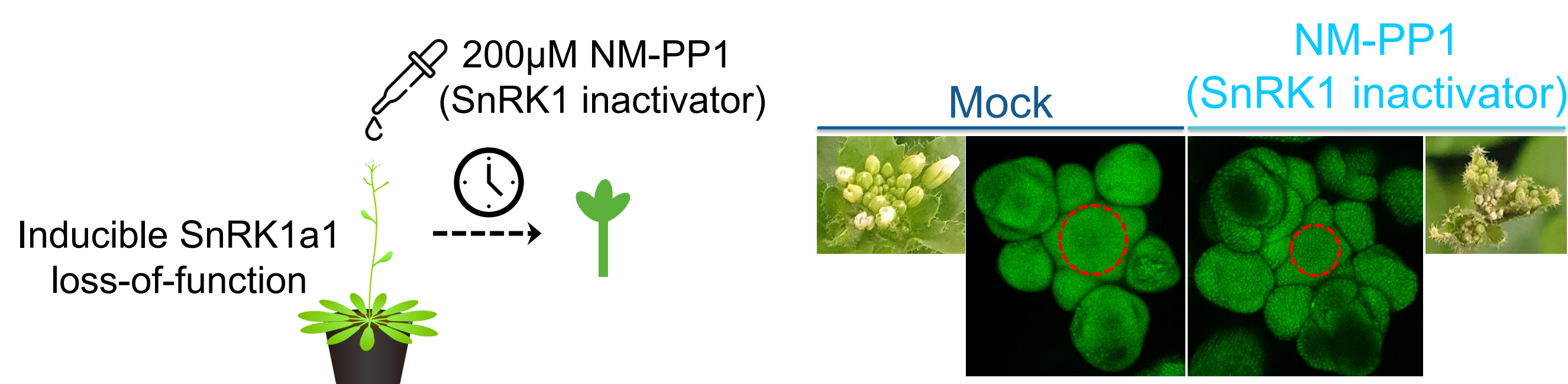


→ Unravelling the impact of SnRK1 on stem cell homeostasis will deepen our knowledge on plant developmental plasticity.

2

Is stem cell activity affected by energy signals?

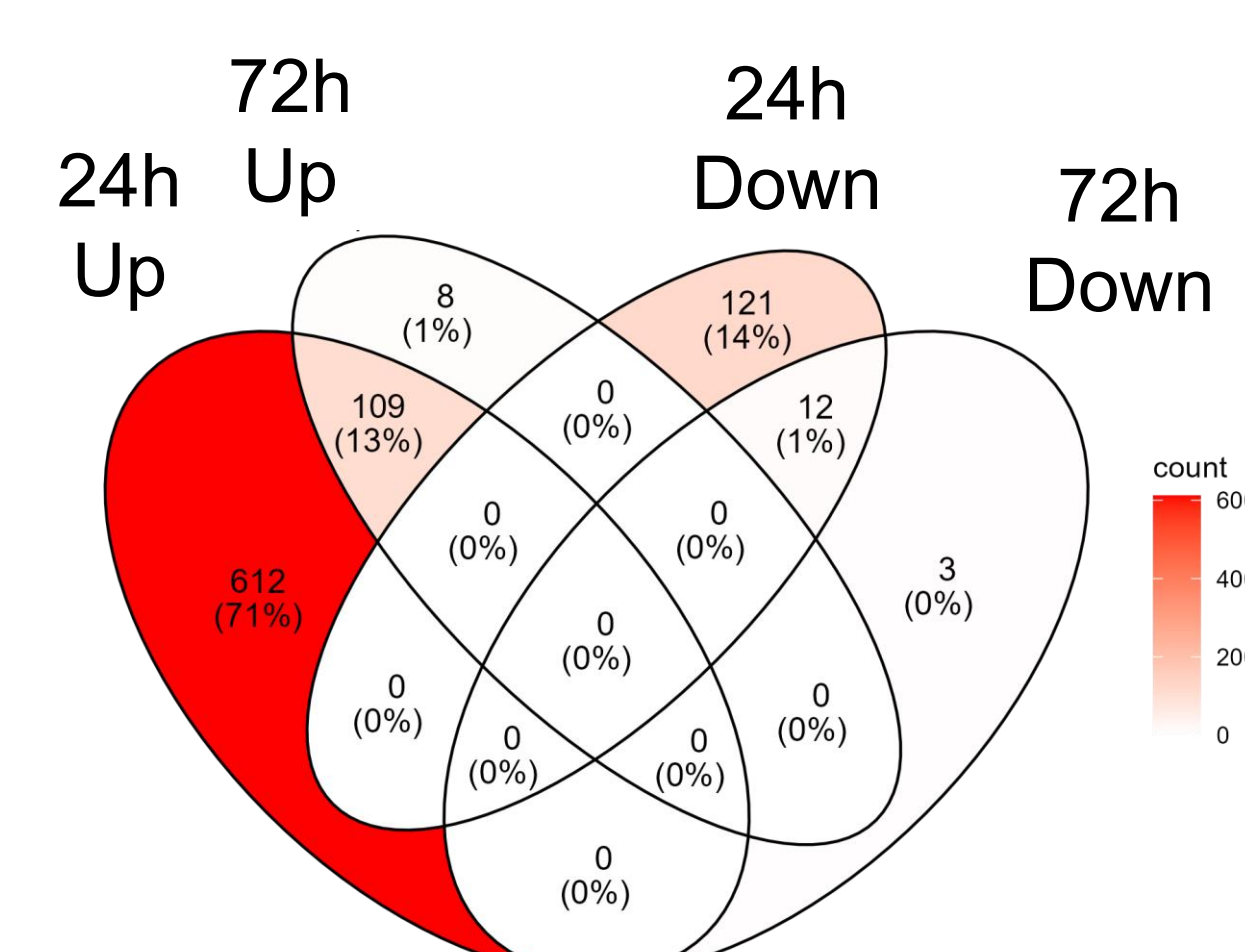
The SnRK1 protein kinase (AMPK ortholog in plants) is activated when energy is scarce to restore cellular energy homeostasis²⁾.



qPCR of stem cell niche RNA:
→ SnRK1 inhibition reduces expression of cell size controlling genes

Microscopy:
→ SnRK1 inhibition reduces the size of the stem cell niche

SnRK1 Inhibition vs. Mock

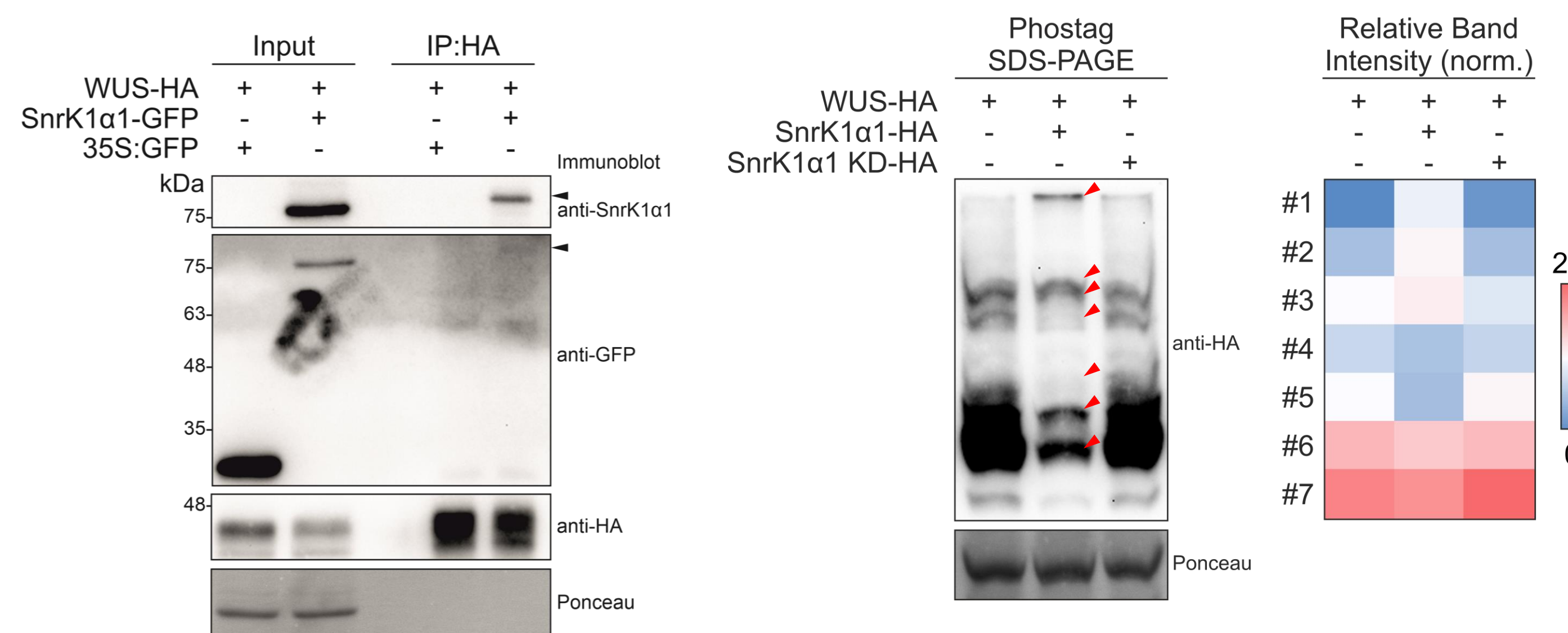


→ BUT: Overall, SnRK1 inhibition leads to a strong transcriptional activation in the stem cell niche

What are SnRK1 targets to integrate the information about the energy status?

3

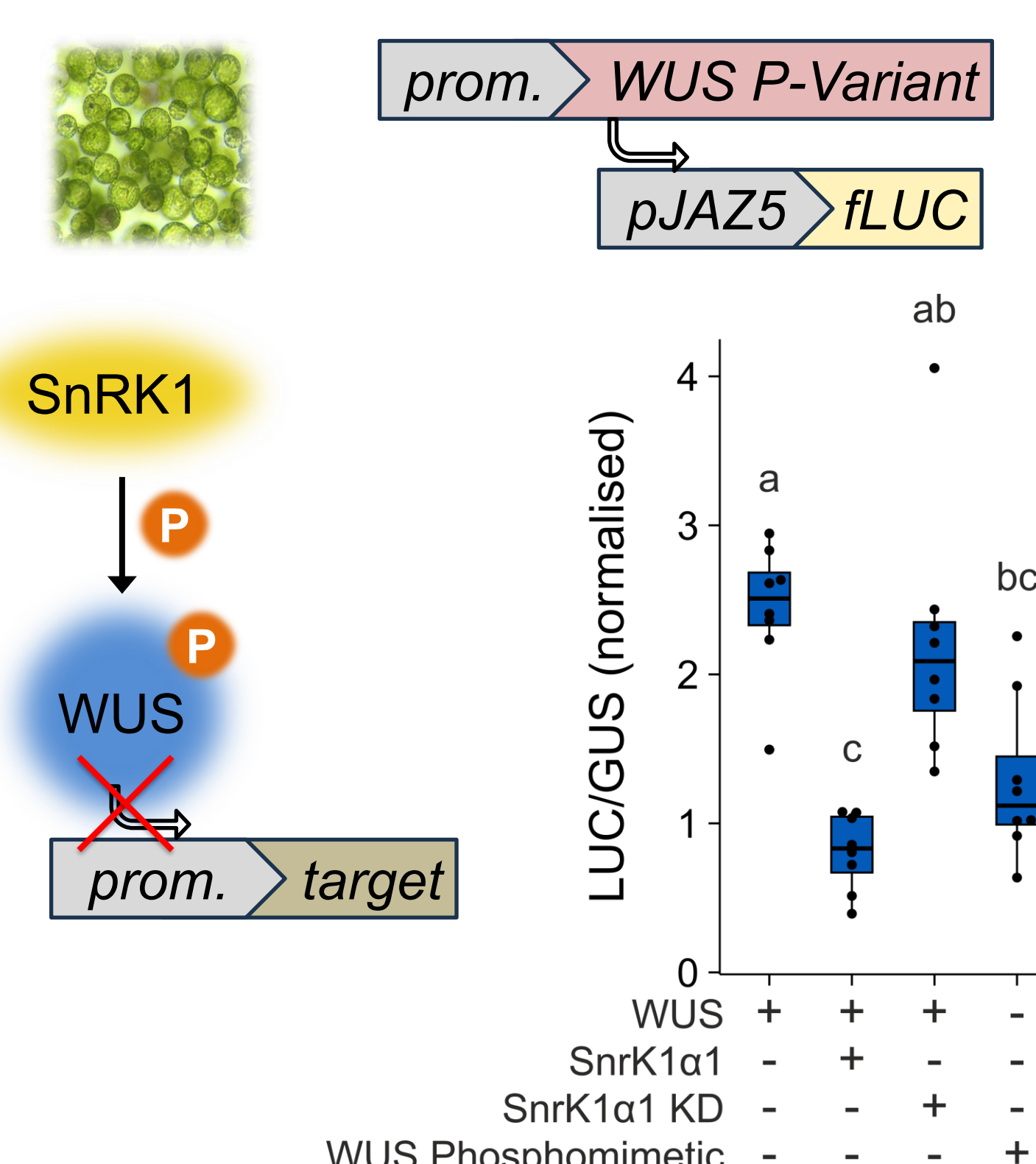
Functional interaction between SnRK1 and a stem cell transcription factor



Co-IP:
→ SnRK1 interacts with WUSCHEL, the homeobox transcription factor for stem cell maintenance

Phostag SDS-PAGE:
→ SnRK1 alters the WUS phosphorylation pattern *in planta*

Does WUS phosphorylation influences its transcriptional activity?



Ongoing research:

- Prime Base Editing of Phosphosites *in planta*
- Analyse tissue-specific localisation of Phosphovariants
- Characterise potential phenotypic variations of phosphovariant plants

We thank our collaborator Henrik Jönsson.

¹⁾ Lopes et al. (2020), JExBot, doi.org/10.1093/jxb/eraa572,

²⁾ Broeckx et al. (2016), JExBot, doi:10.1093/jxb/erw416