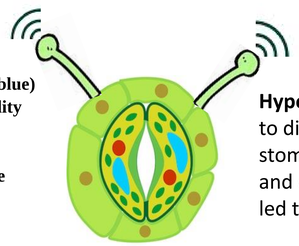
Effects of systemic immunity on diurnal stomatal movement of *Arabidopsis thaliana*

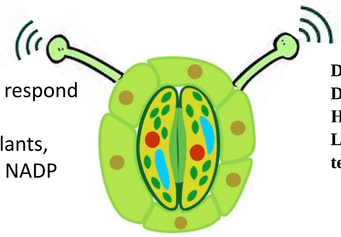
Marral Pourmoghadam, Lisa David, Sixue Chen
Department of Biology, Genetics Institute, University of Florida, Gainesville, Fl 32610

Background



Light (red, blue)
High humidity
Low CO_2
High temperature
SAR

Hypothesis: The primed stomata will still respond to diurnal signals, but maintain a smaller stomatal aperture compared to control plants, and elevated concentrations of NAD and NADP led to stomatal aperture closure.



Dark
Drought
High CO_2
Lower temperature

Stomatal Opening **Stomatal Closure**

- Guard cell functions are essential to plant growth and survival.
- Guard cell and stoma provide conduit for CO_2 uptake and O_2 release, also H_2O release.
- Stomatal opening and closing is a process guard cells use to actively increase and decrease their volume via turgor changes to regulate the pore size in response to environmental stimuli.
- While drought stress induces stomatal closure, pathogens exploit stomatal opening to facilitate entry into the apoplast of the leaf.

Methodology

Arabidopsis thaliana mutant and wildtype lines were grown in growth chambers in 8-hour light/16-hour dark environment at 24°C for 5 weeks from seeds sown.
Arabidopsis thaliana is the model dicot organism for plants since it has all the functions and basic genetic code of the group.

5-week-old *Arabidopsis*, grown in short day (8/16)

↓

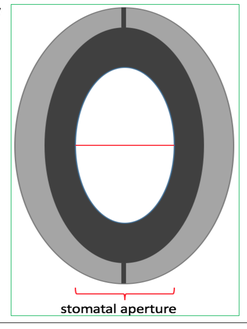
Primary inoculation via injection:
- *Pst* DC3000 (OD600 = 0.02) (primed
- Or 10 mM $MgCl_2$ (mocked)

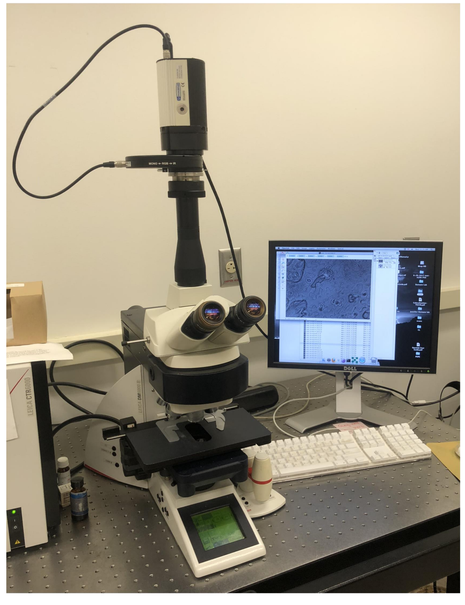
↓

Opposite leaf of 3 plants/time course peeled with tape and imaged immediately

↓

Images collected by confocal microscopy and stomatal apertures were measured





This image was made to represent how the stomata apertures were measured.
After the images were collected using the microscope, we used ImageJ to measure the stomatal apertures.

Results

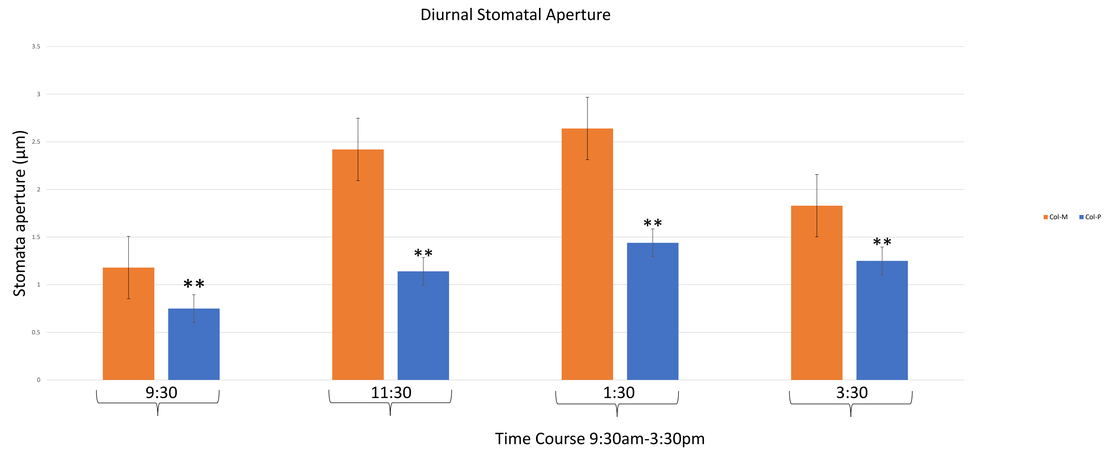
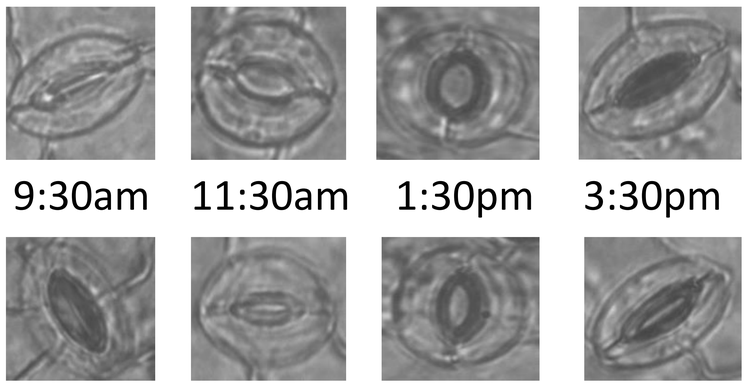


Figure 1. WT primed plants showed no changes in their 8-hour light cycle from 8am to 4pm, circadian cycle, and followed the same pattern as the WT mock plants in the opening and closing of their stomata. The differences we observed are in the diameter of the stomata opening. **The two-tailed P value is less than 0.0001. By conventional criteria, this difference is considered to be extremely statistically significant.



Control

Primed

Ongoing Research

- The Circadian clock is a mechanism that controls plant defense against pathogen infection. Studies showed that the life cycle of both the plant host and some of their pathogens are dictated by the diurnal cycle, thus allowing the host to anticipate an infection when it is a 'predictable event' through signaling molecules, such as NAD and NADP.

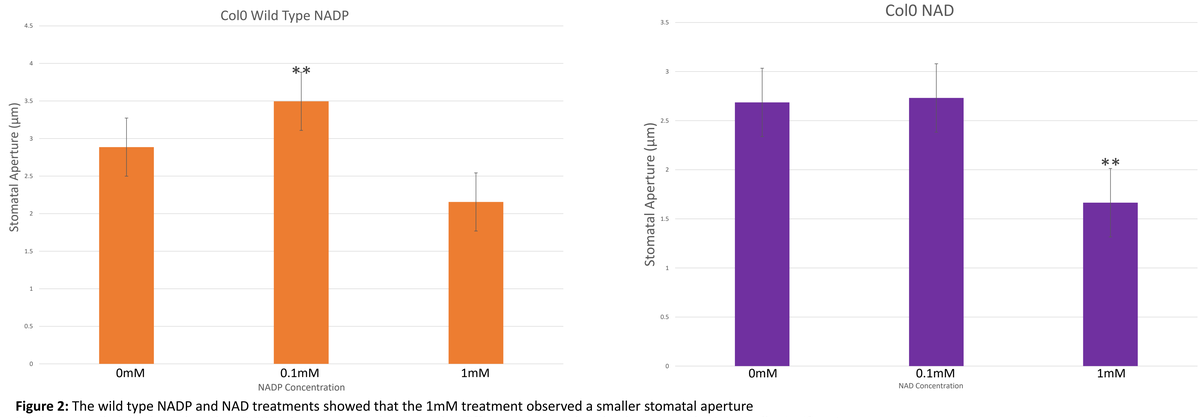


Figure 2: The wild type NADP and NAD treatments showed that the 1mM treatment observed a smaller stomatal aperture
** The two-tailed P value is less than 0.0001 By conventional criteria, this difference is considered to be extremely statistically significant.

Acknowledgements: This work was supported by the National Science Foundation MCB 1758820 to S.C.