Influence of the Circadian Clock on the Arabidopsis Gravitropic Response

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Circadian rhythms are regular oscillations of an organism's physiology with a period of approximately 24 hours. In *Arabidopsis*, circadian rhythms regulate a suite of physiological processes including transcription, photosynthesis, growth, and flowering. Because the circadian clock plays a role in many plant transcriptional responses, we aimed to characterize its role in the plant gravitropic response. An exploratory evaluation of RNA-Seq data from *Arabidopsis* space flight experiments showed an enrichment for clock-related differentially-expressed genes in microgravity. To characterize the effect of the circadian clock on the gravitropic response, we performed a root-bending assay over a 24-hour time course. We identified consistent differences in the response angle dependent on the time of day and selected the two timepoints with the greatest difference for further study. We also identified circadian clock mutants that exhibited different gravitropic responses compared to wild type (WT) plants. To further investigate the interaction between the circadian clock and microgravity, we utilized the random positioning machine (RPM at Kennedy Space Center) and compared the response of WT plants and plants with constitutive, high-level expression of CCA1 (a core component of the circadian clock). We entrained seedlings under two different photoperiods in order expose them to microgravity at the selected timepoints and maintained these lighting schedules during a single, 48-hour RPM run. This allowed for direct comparison of the two photoperiods found to have different response angles in the root bending assay. Root phenotypes of the two genotypes were compared as well as differences between the two photoperiods.