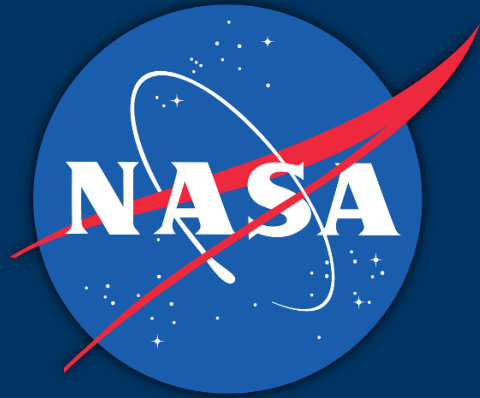
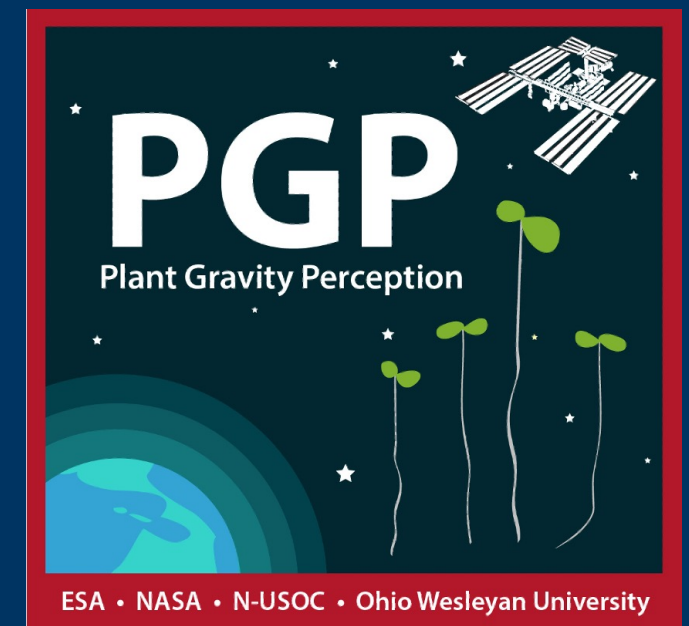




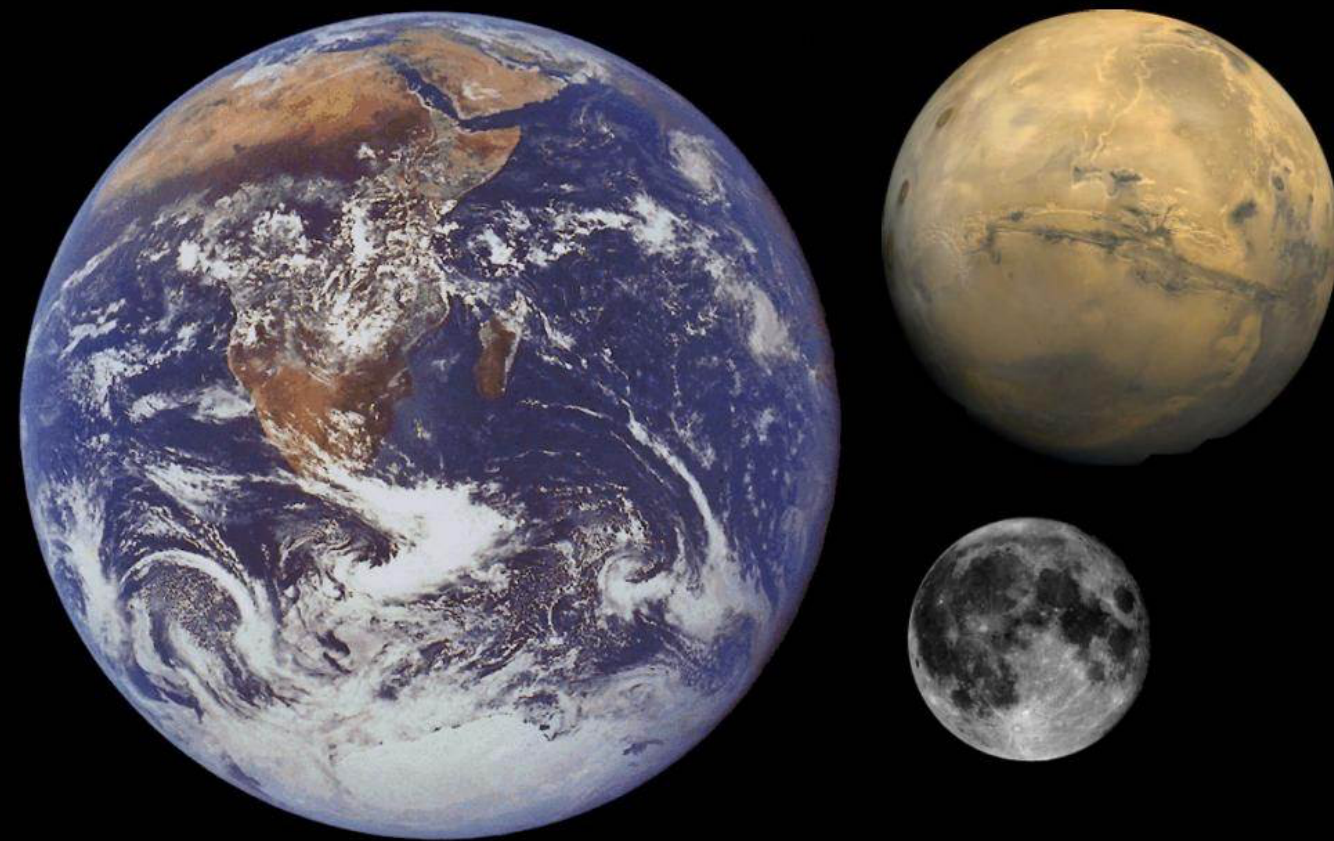
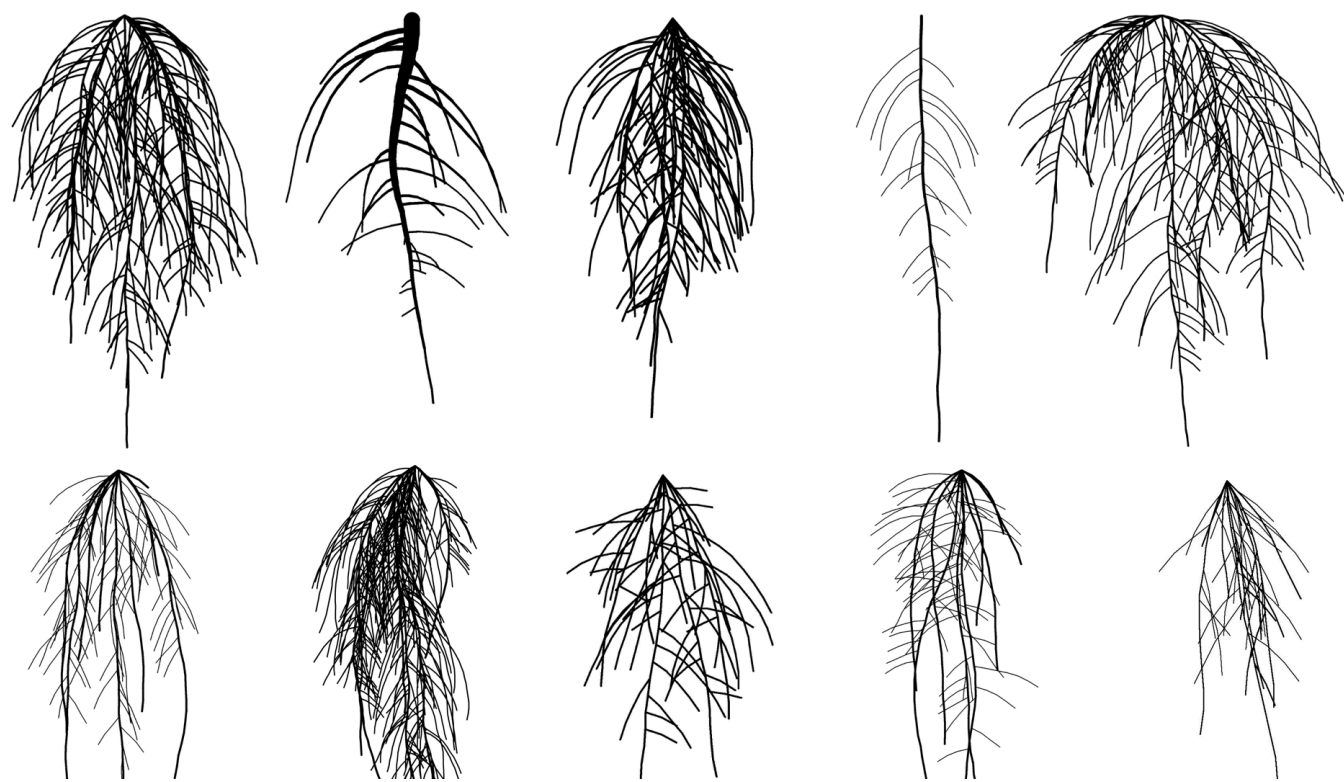
Areas in Space Crops

CBPSS Panel

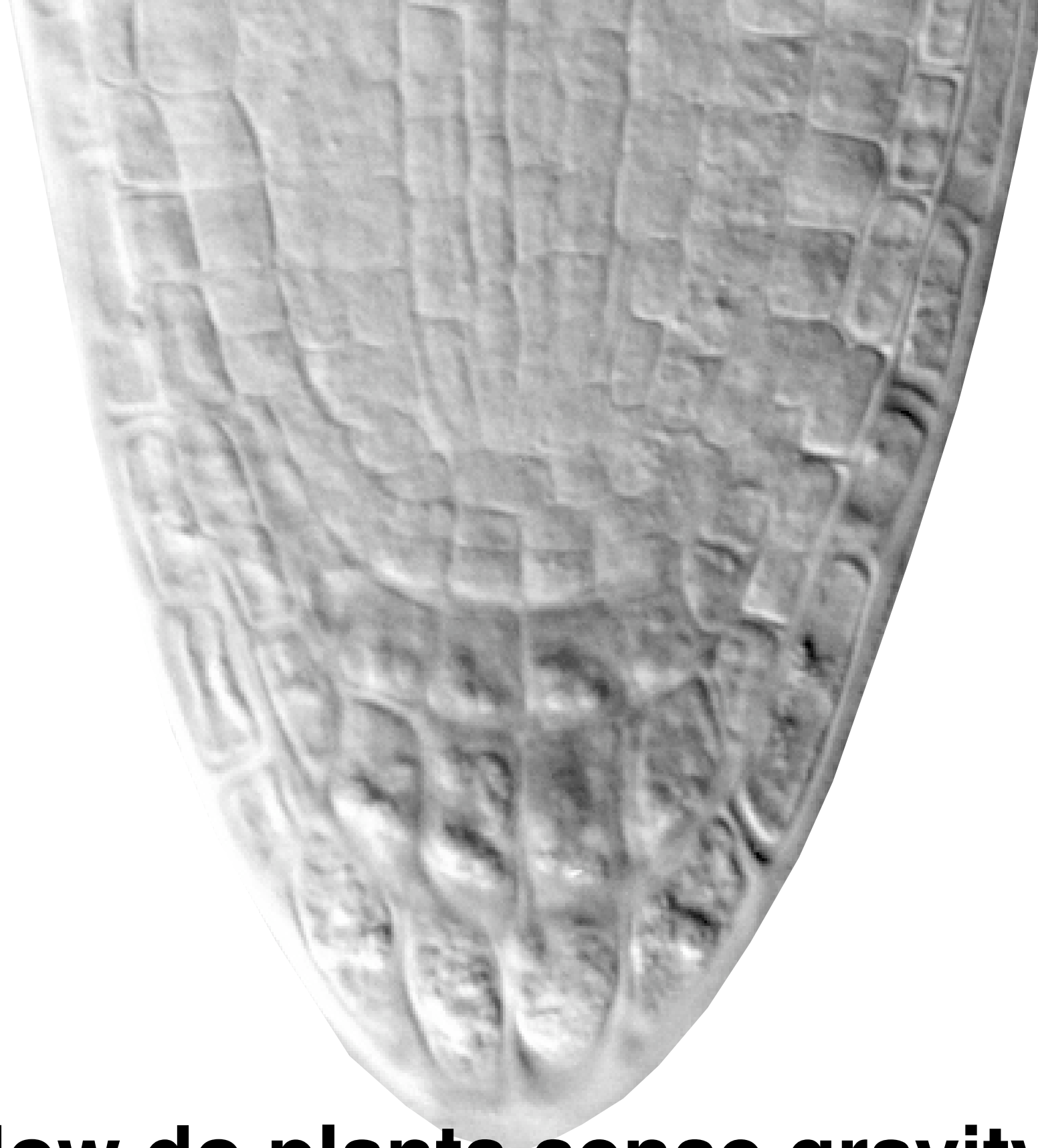


Chris Wolverton, Ohio Wesleyan — Sept 17, 2025

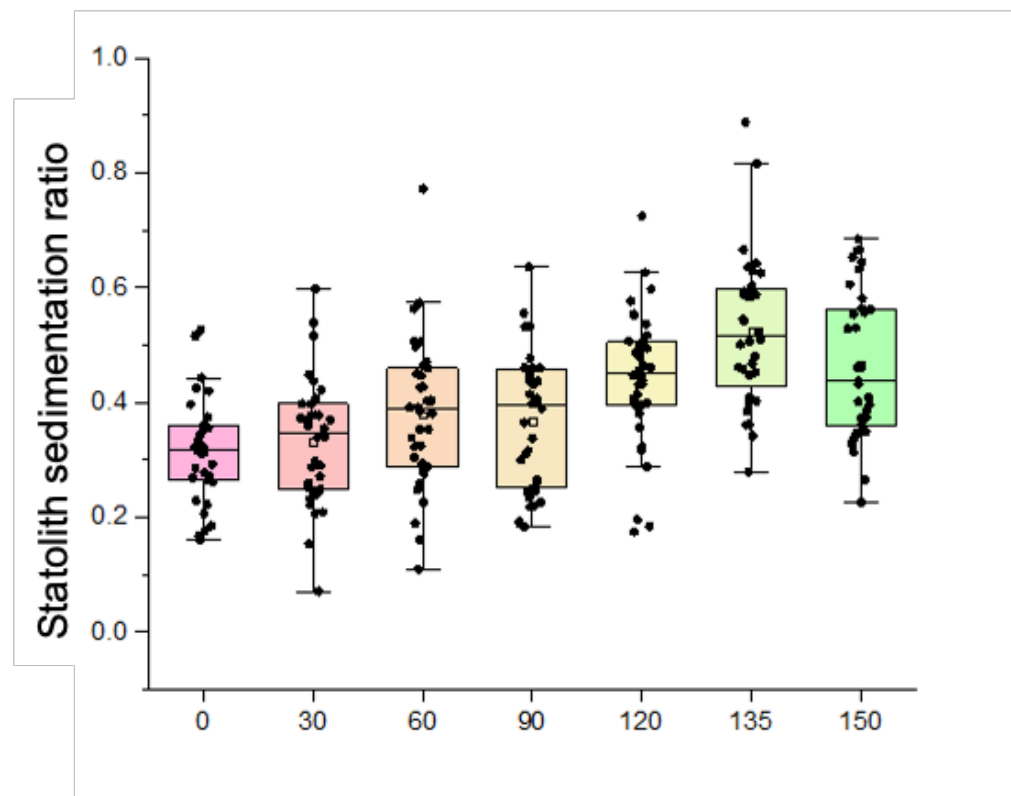
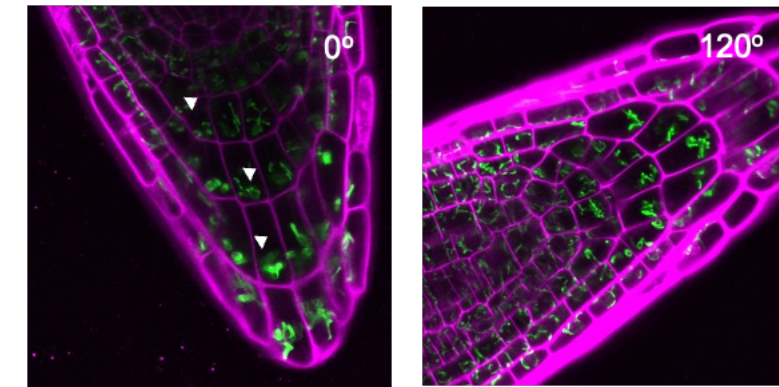
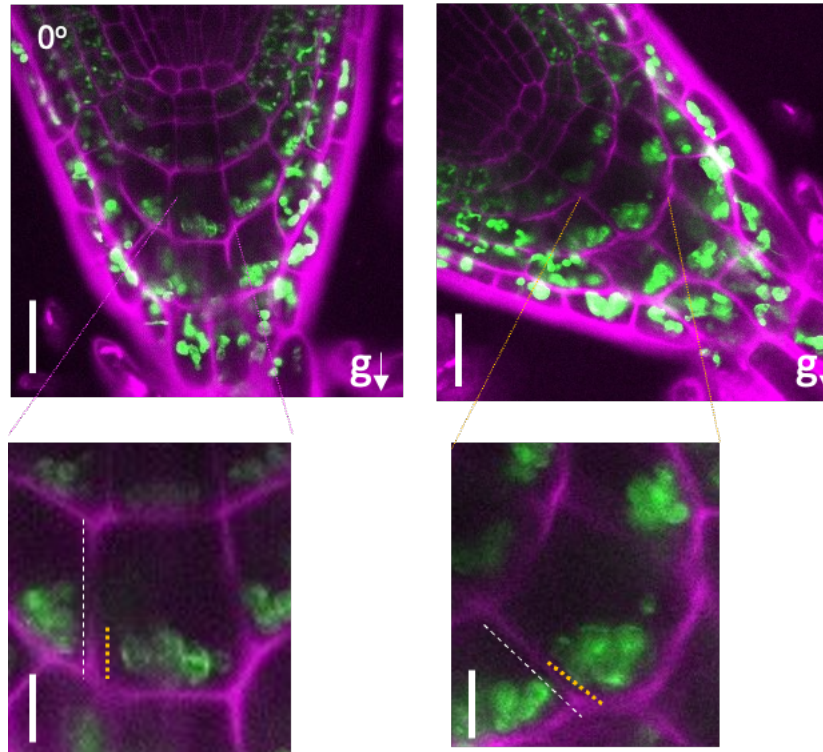
Plant shape on
Earth is
determined by
gravity



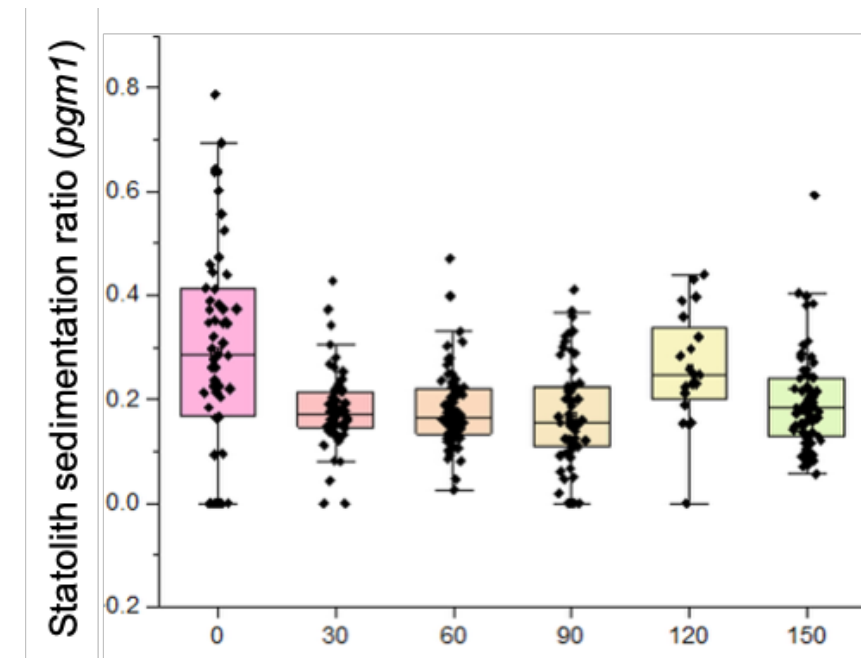
Plant shape off
Earth is
determined by
reduced gravity



How do plants sense gravity?

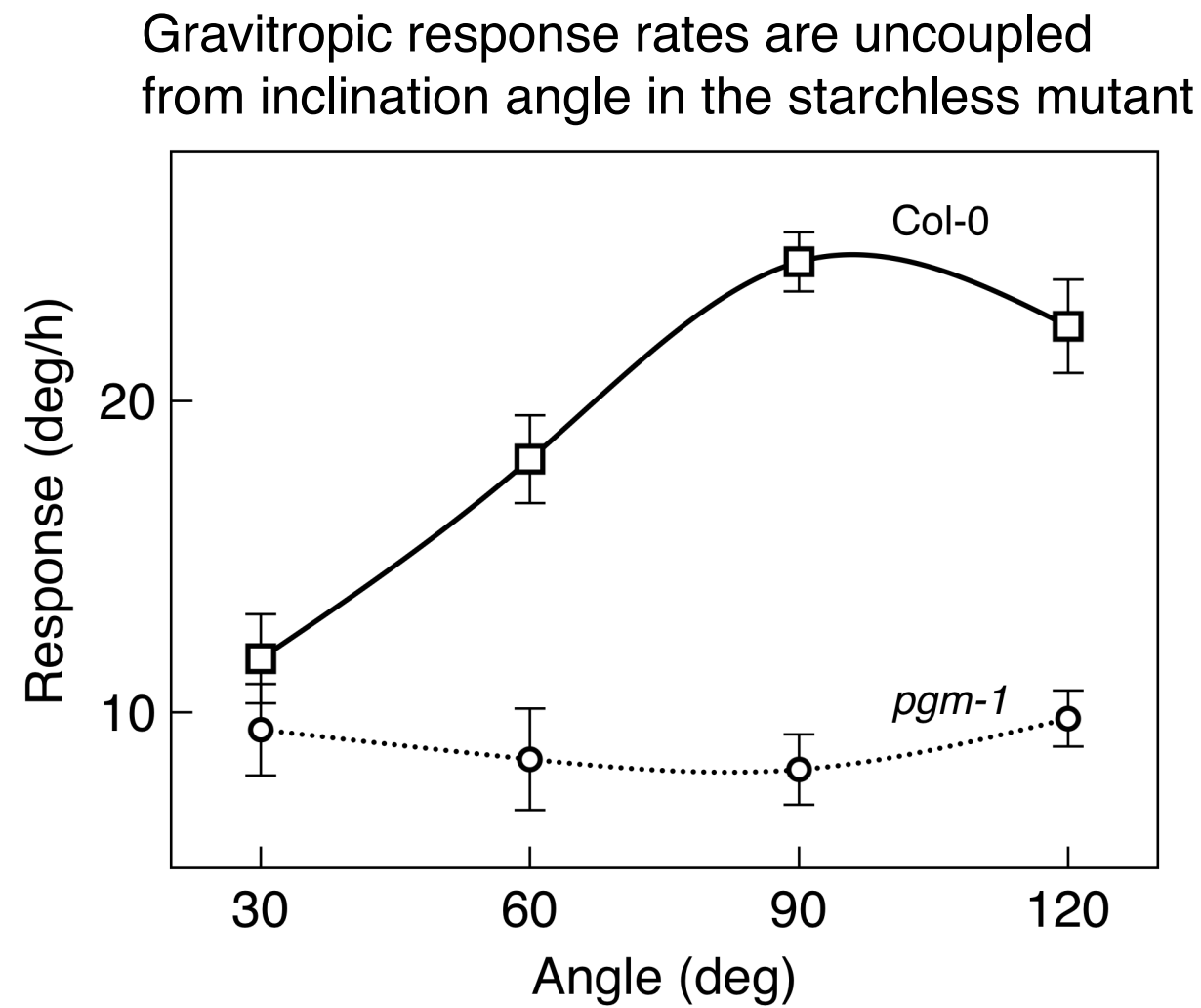
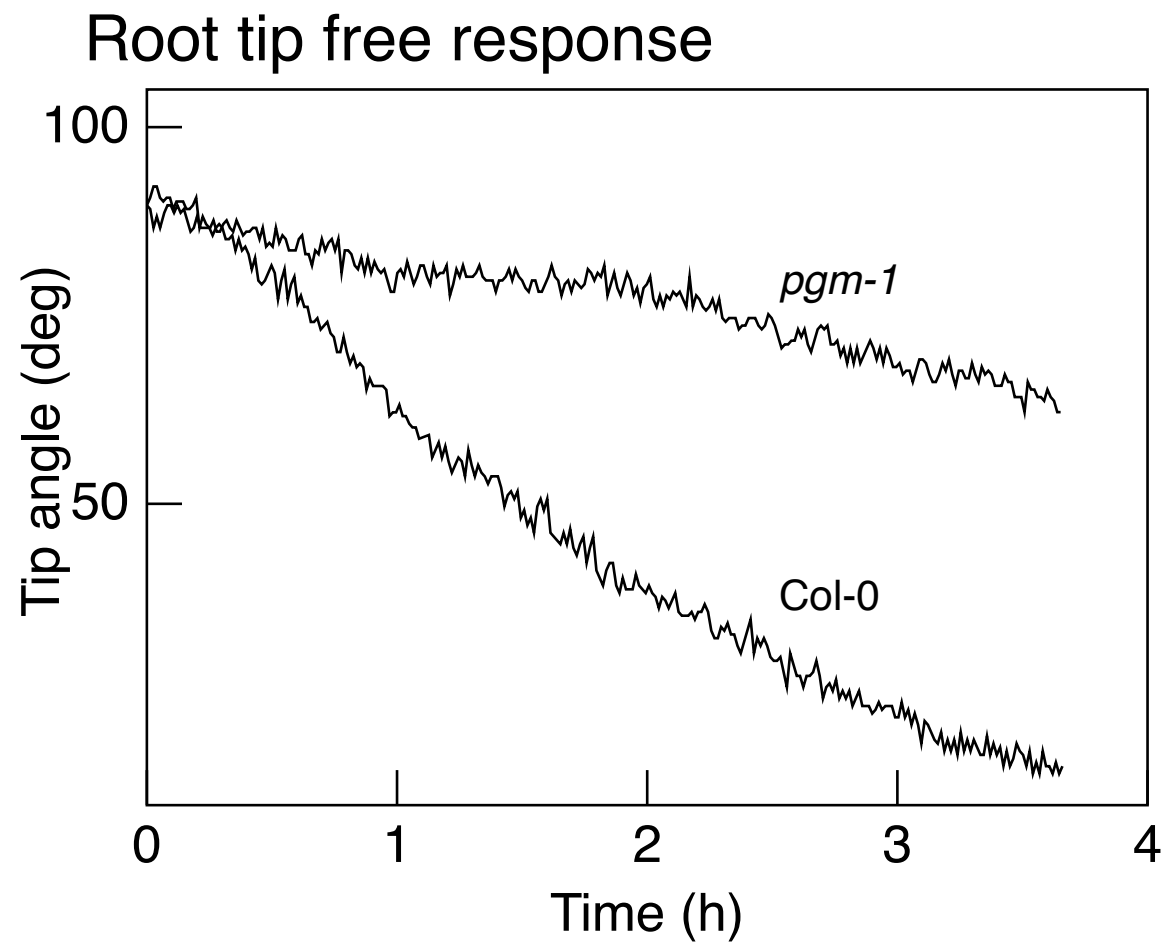


WT statoliths sediment in proportion to stimulation angle.



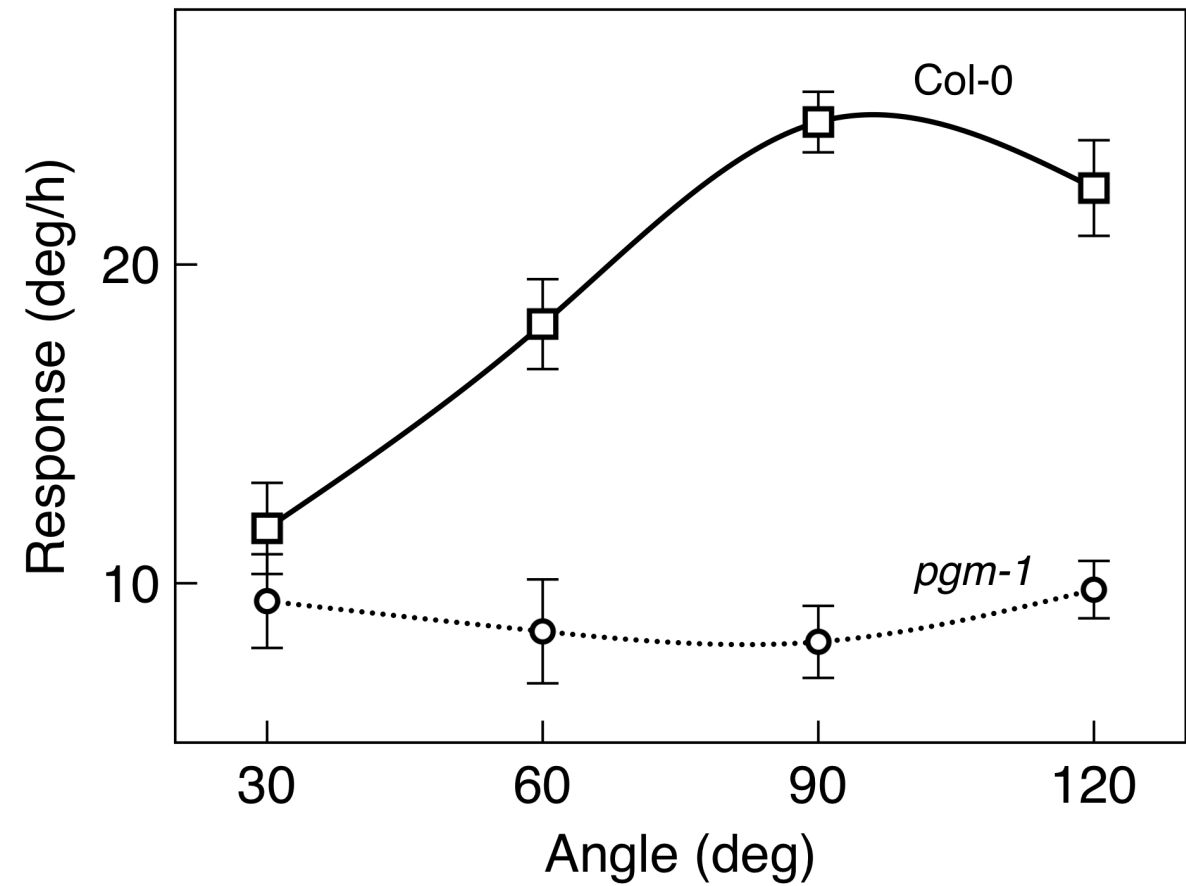
Starchless statoliths fail to sediment at any angle.

Starchless roots show reduced but persistent responses to gravity

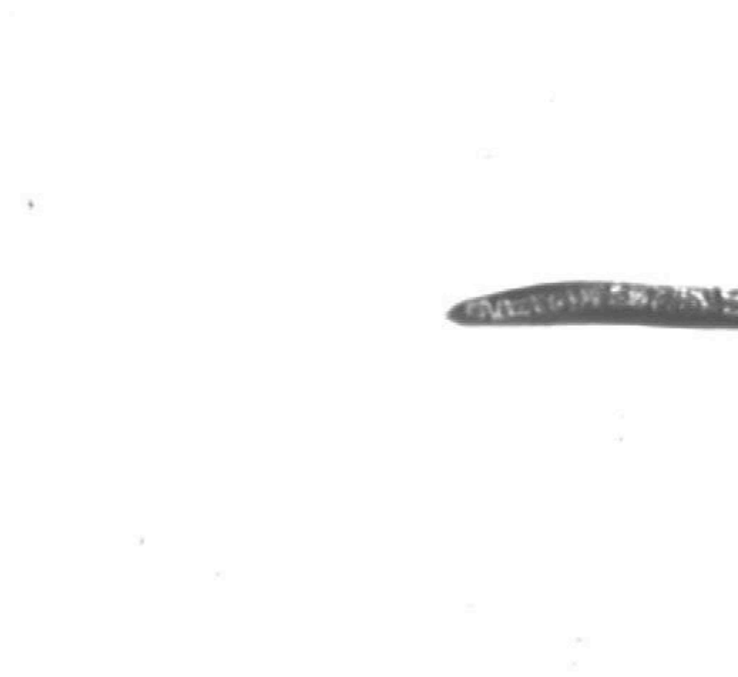


Starchless roots show reduced but persistent responses to gravity

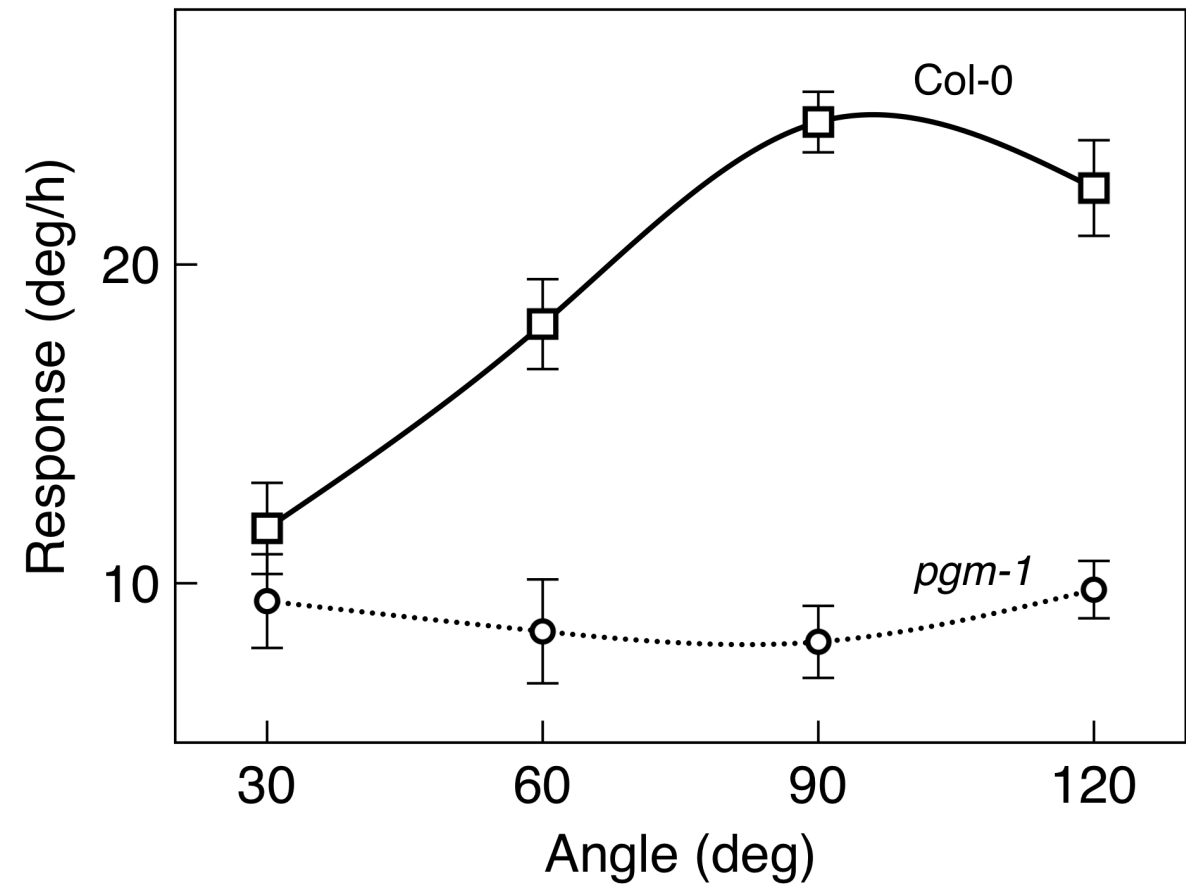
Gravitropic response rates are uncoupled from inclination angle in the starchless mutant



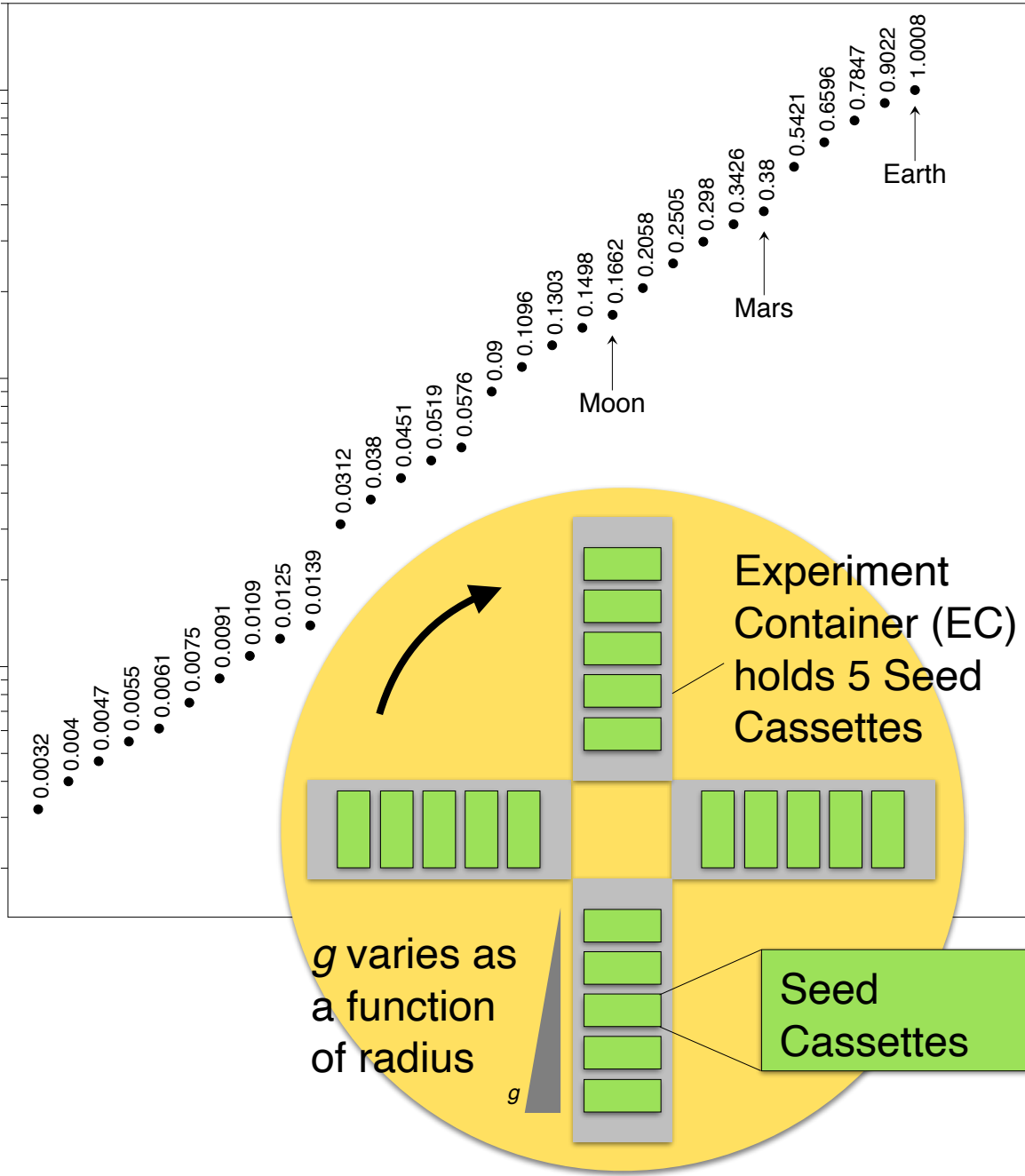
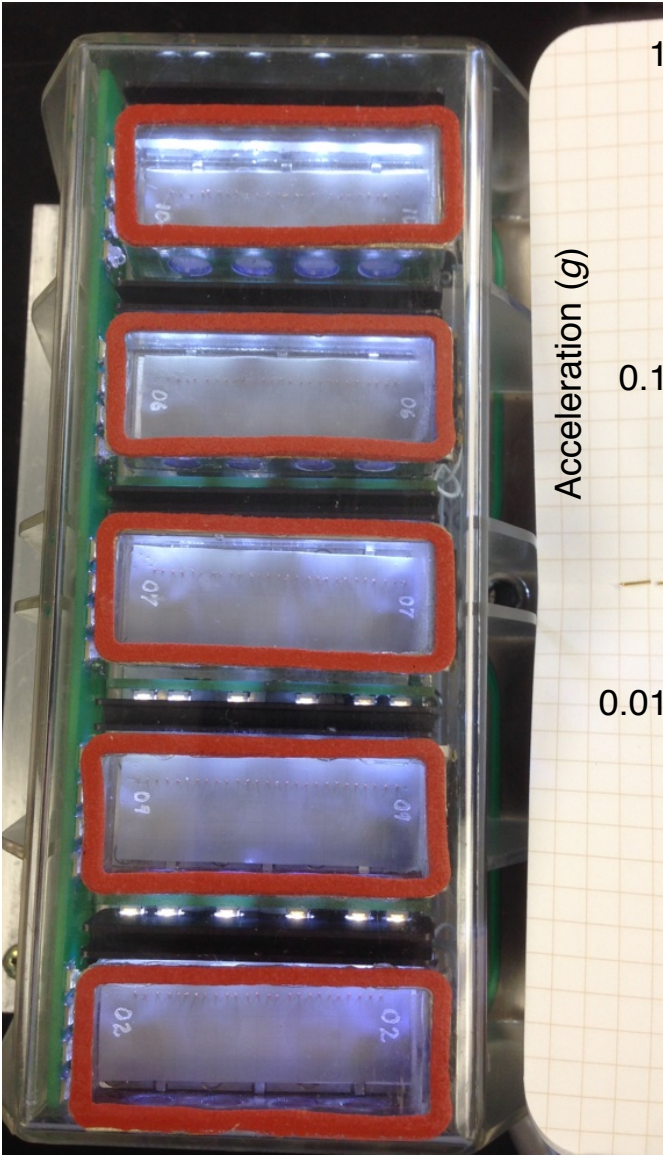
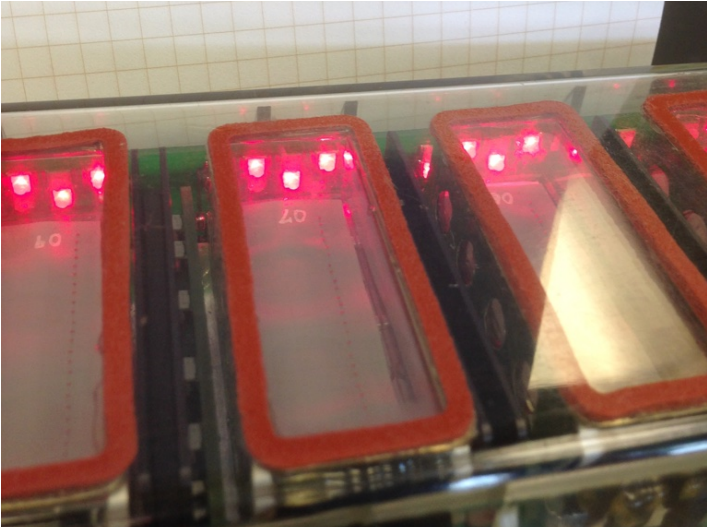
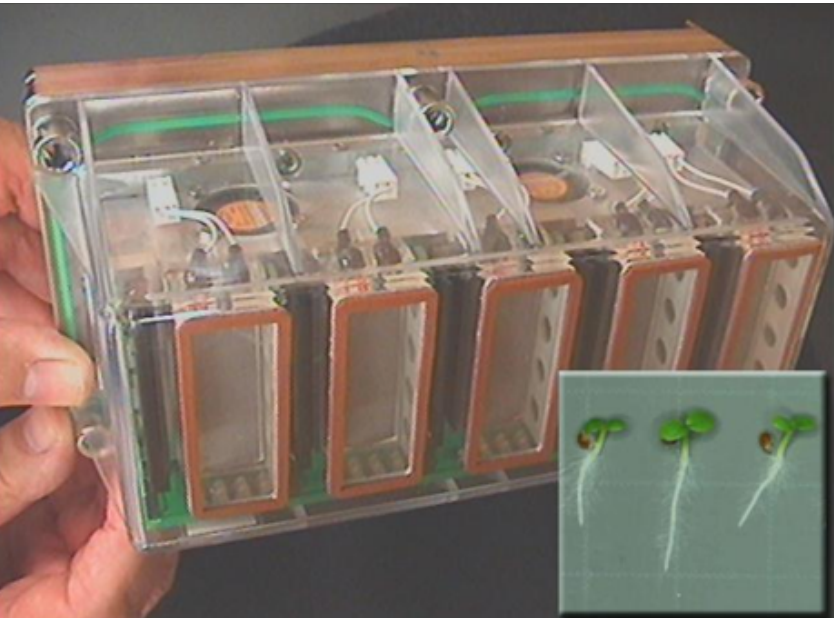
Starchless roots show reduced but persistent responses to gravity

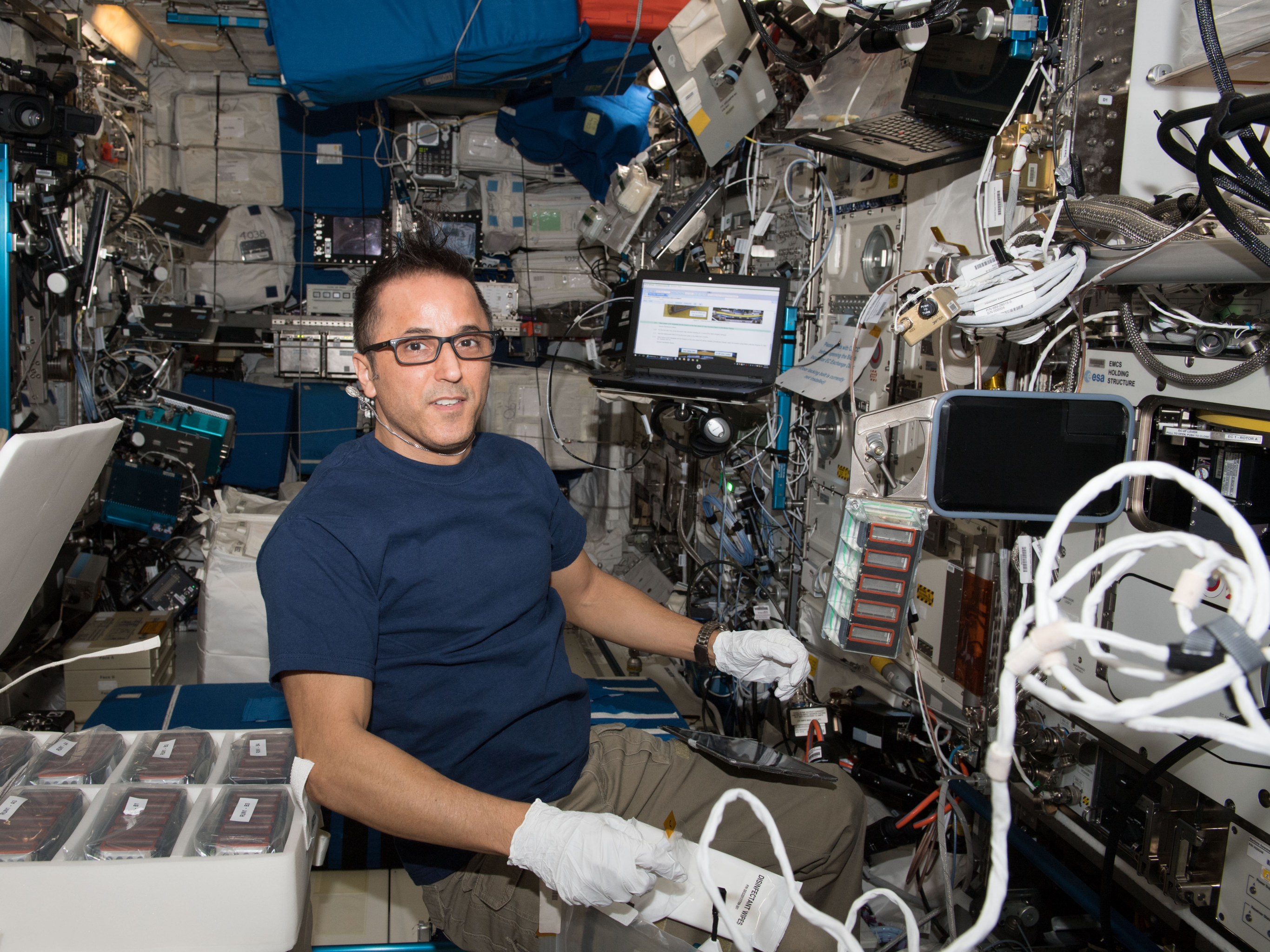


Gravitropic response rates are uncoupled from inclination angle in the starchless mutant



EMCS (ISS) with 'Tropi' Seed Cassettes for Fractional *g* applications

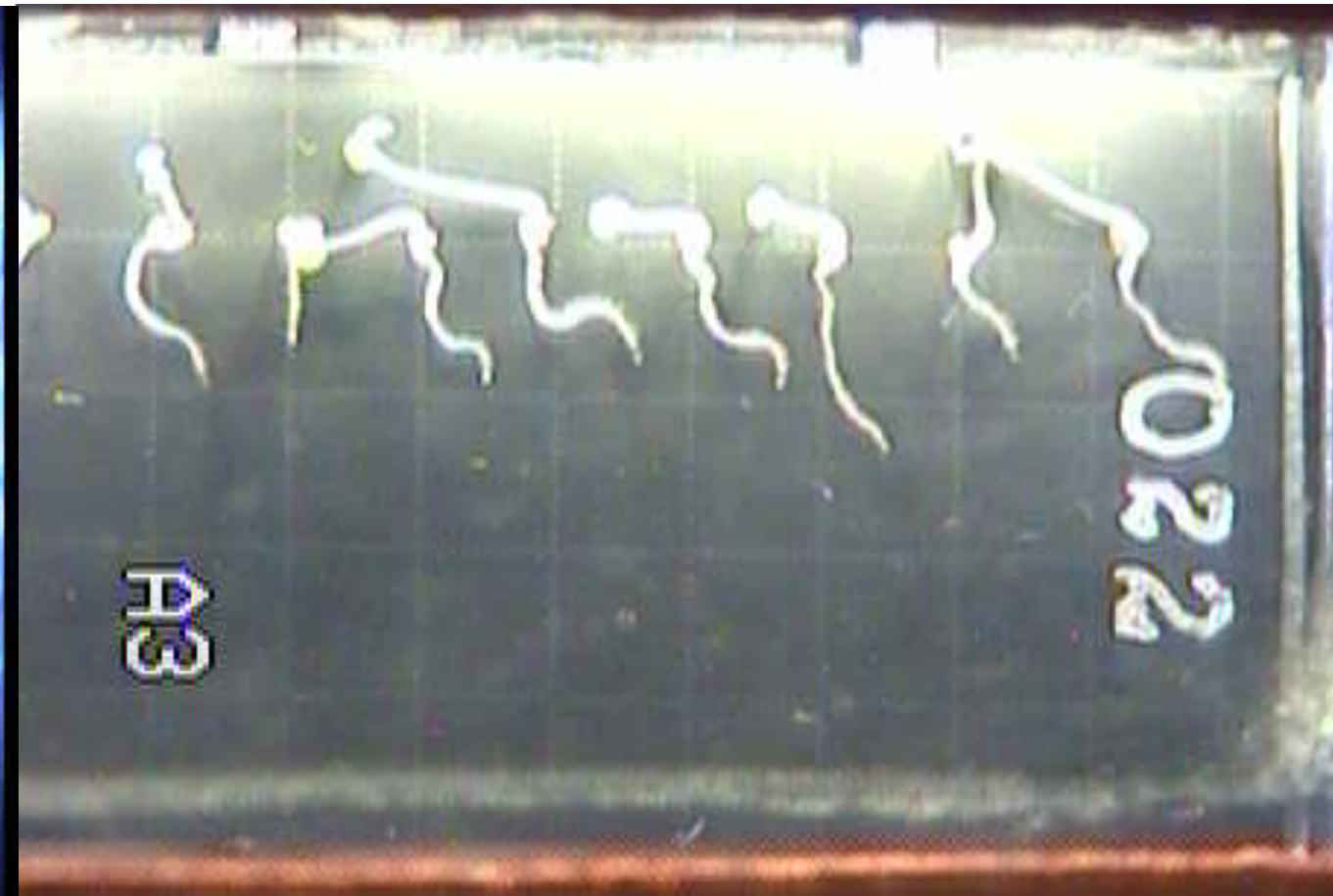




Gravity Responses in Fractional g

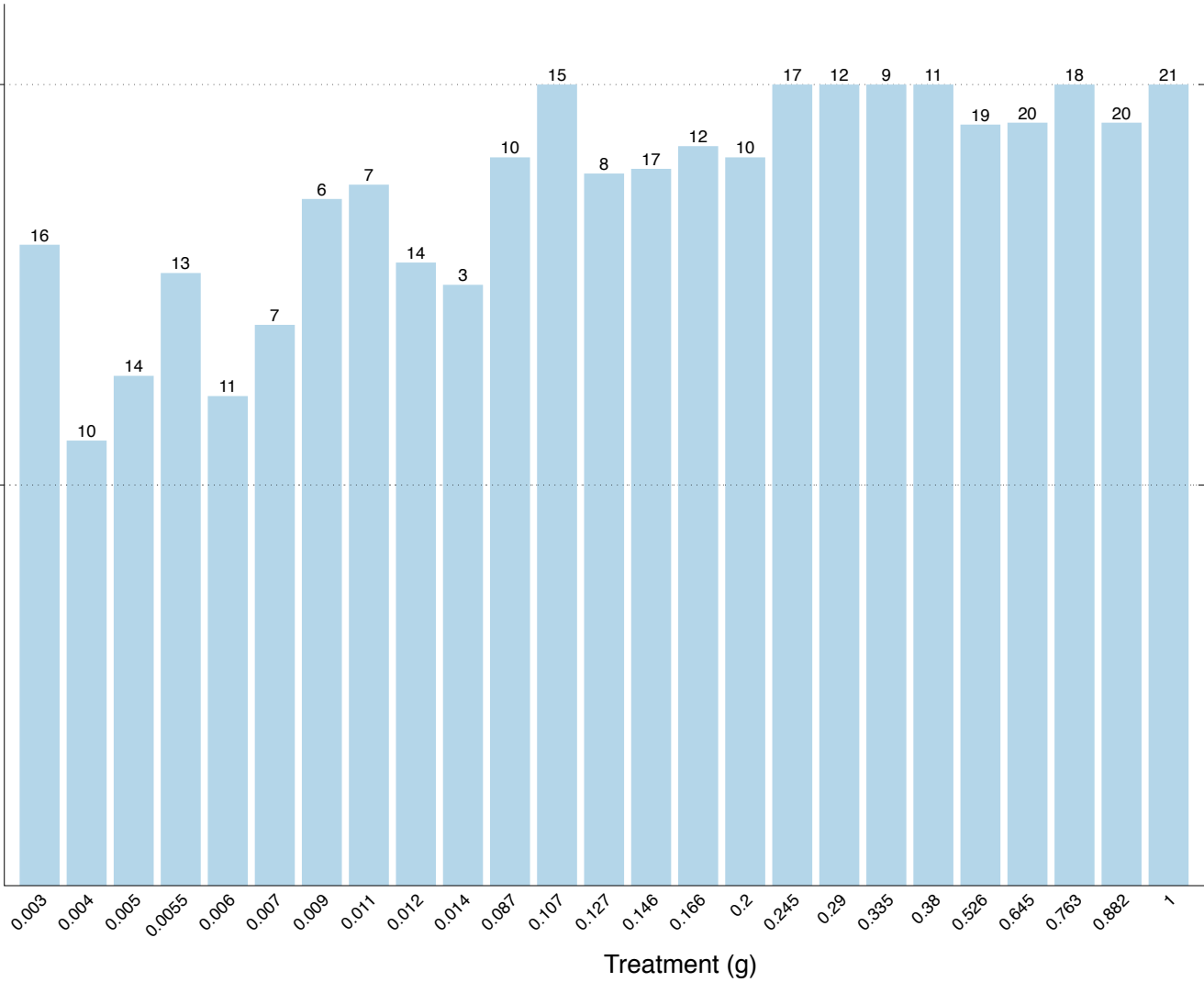


12 h stimulation with blue LED in μg

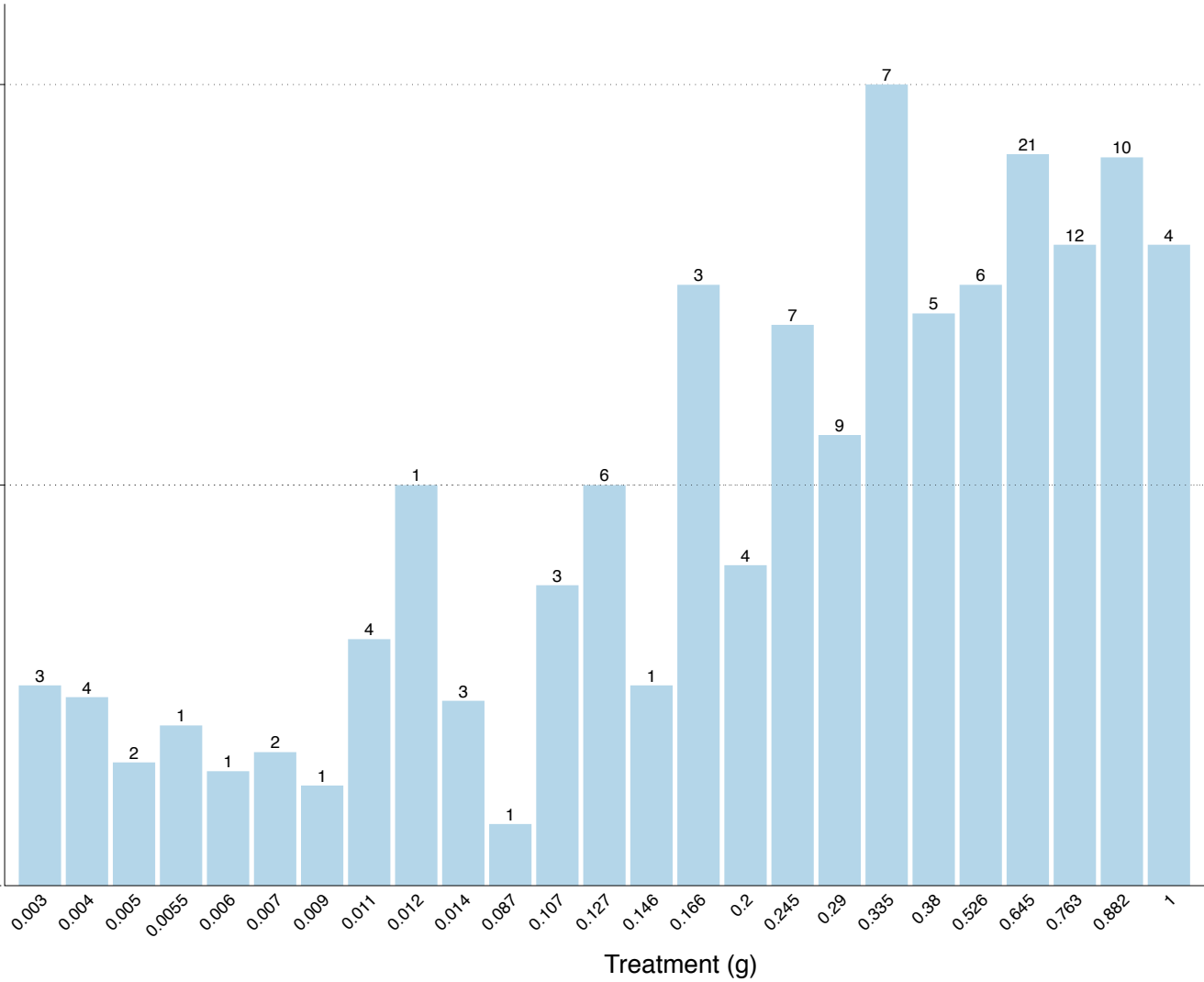


36 h stimulation with 0.107 g

Col-0 Proportion Responding to *g*

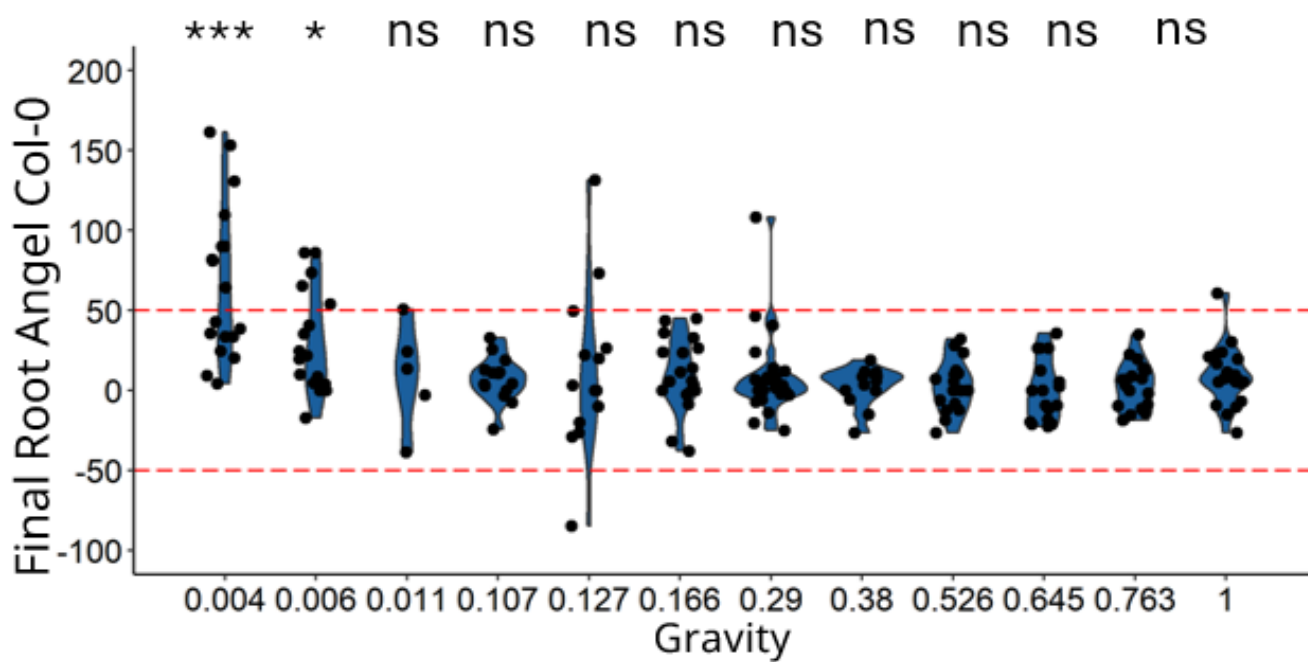


pgm-1* Proportion Responding to *g

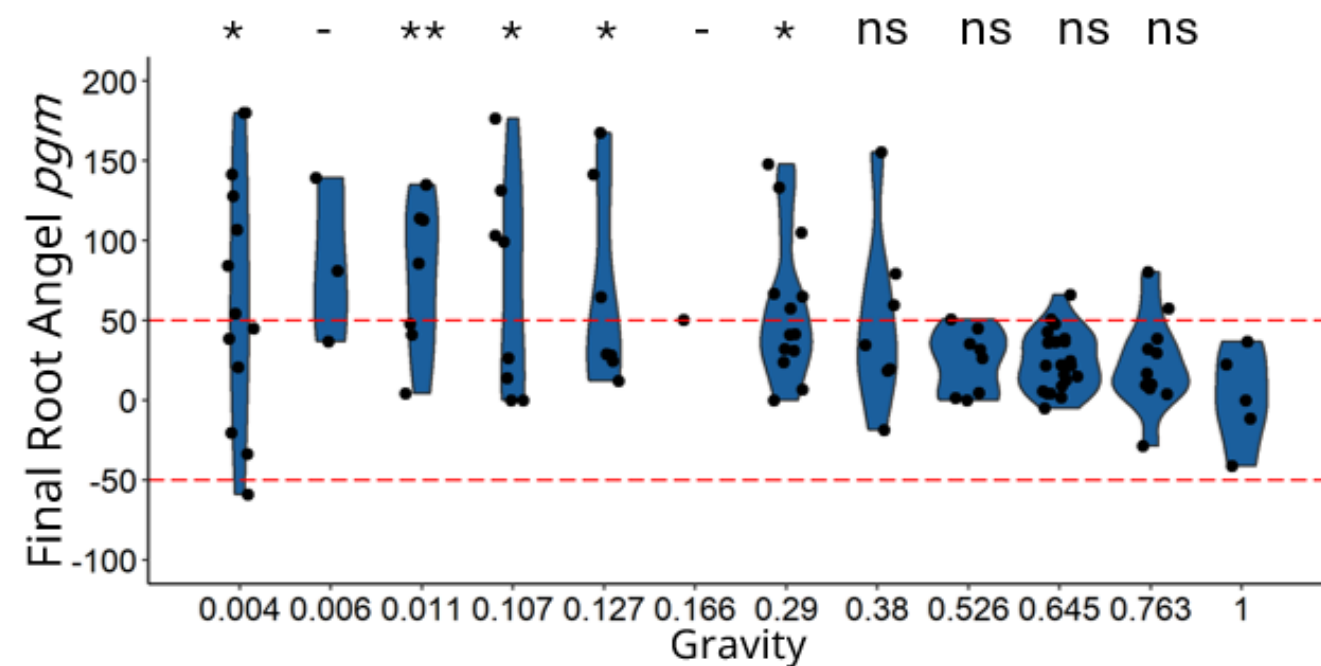


Numbers = number responding for that treatment

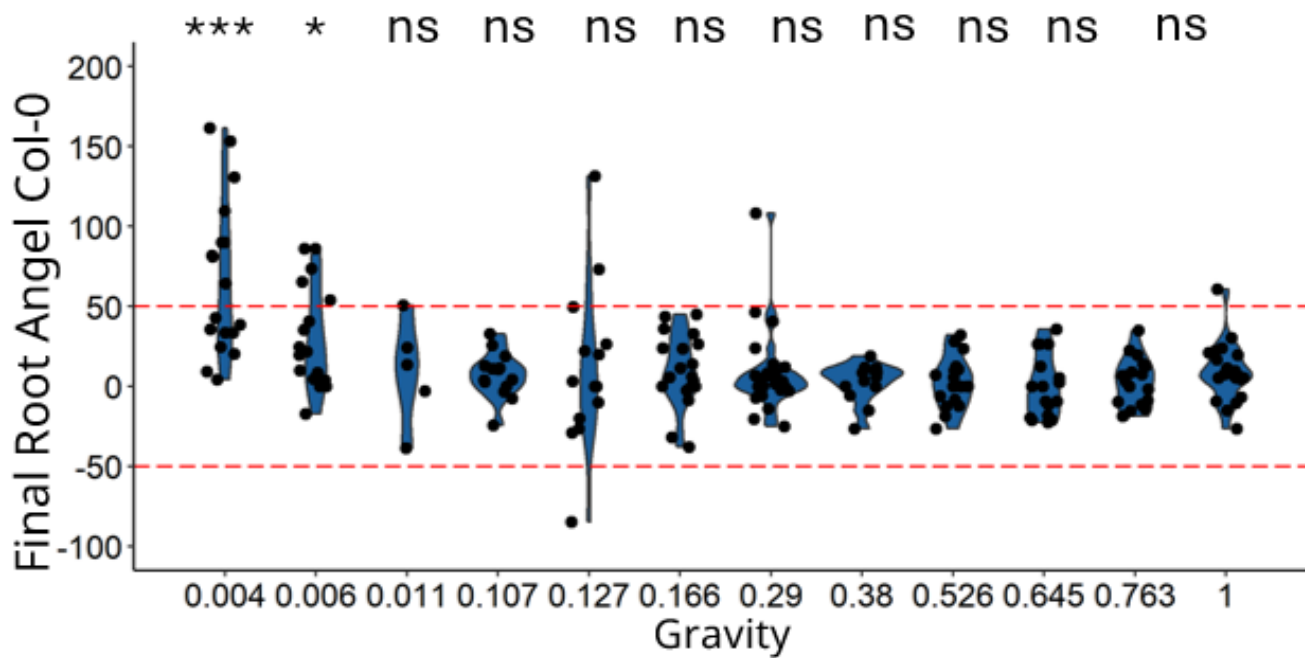
Col-0 Responses



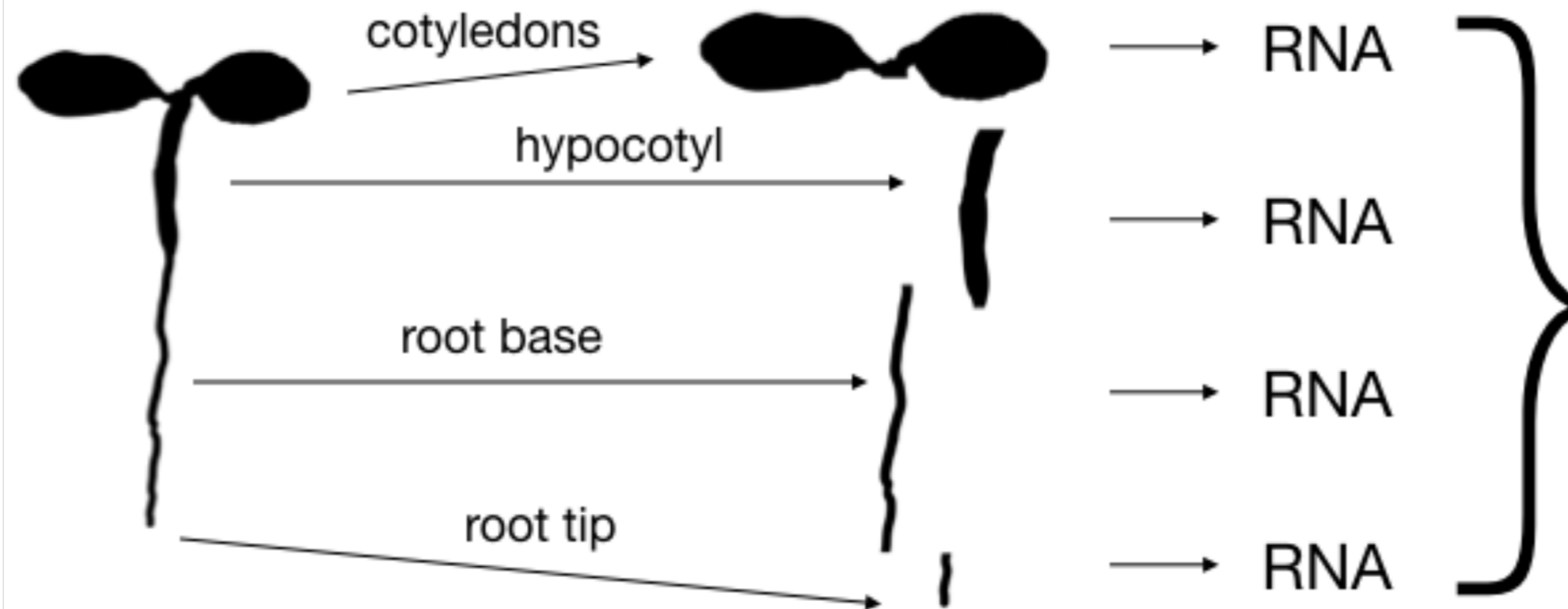
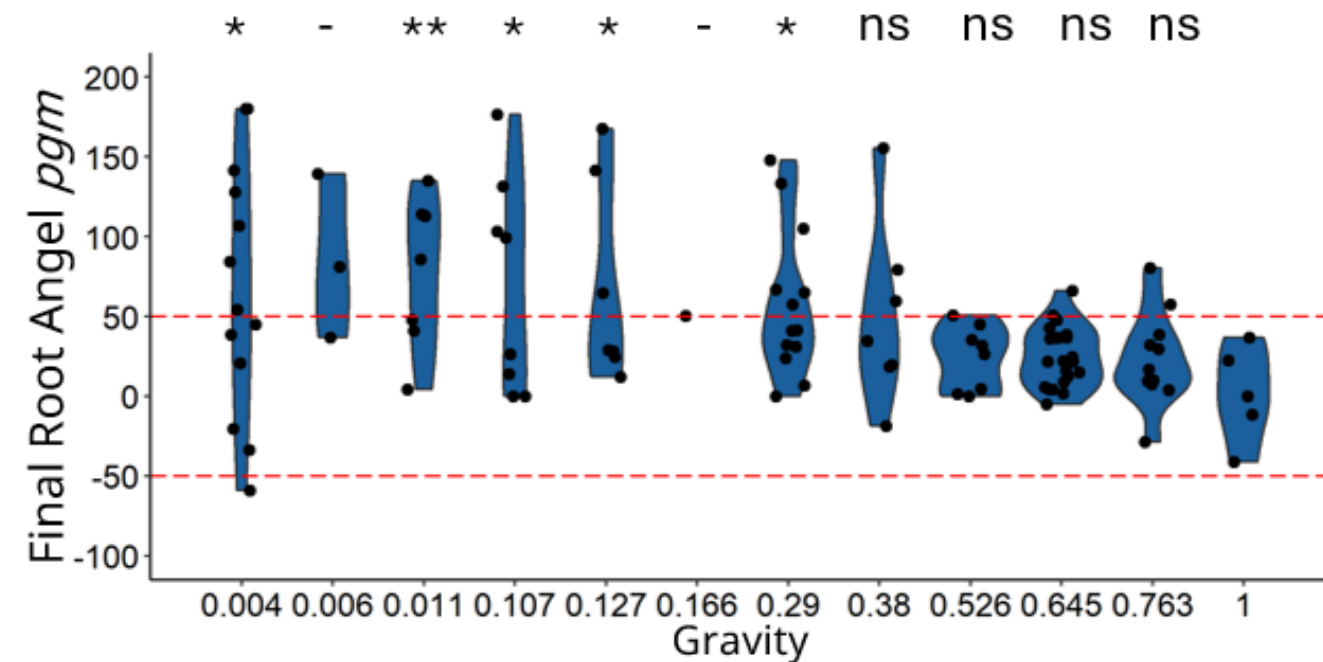
pgm-1 Responses



Col-0 Responses



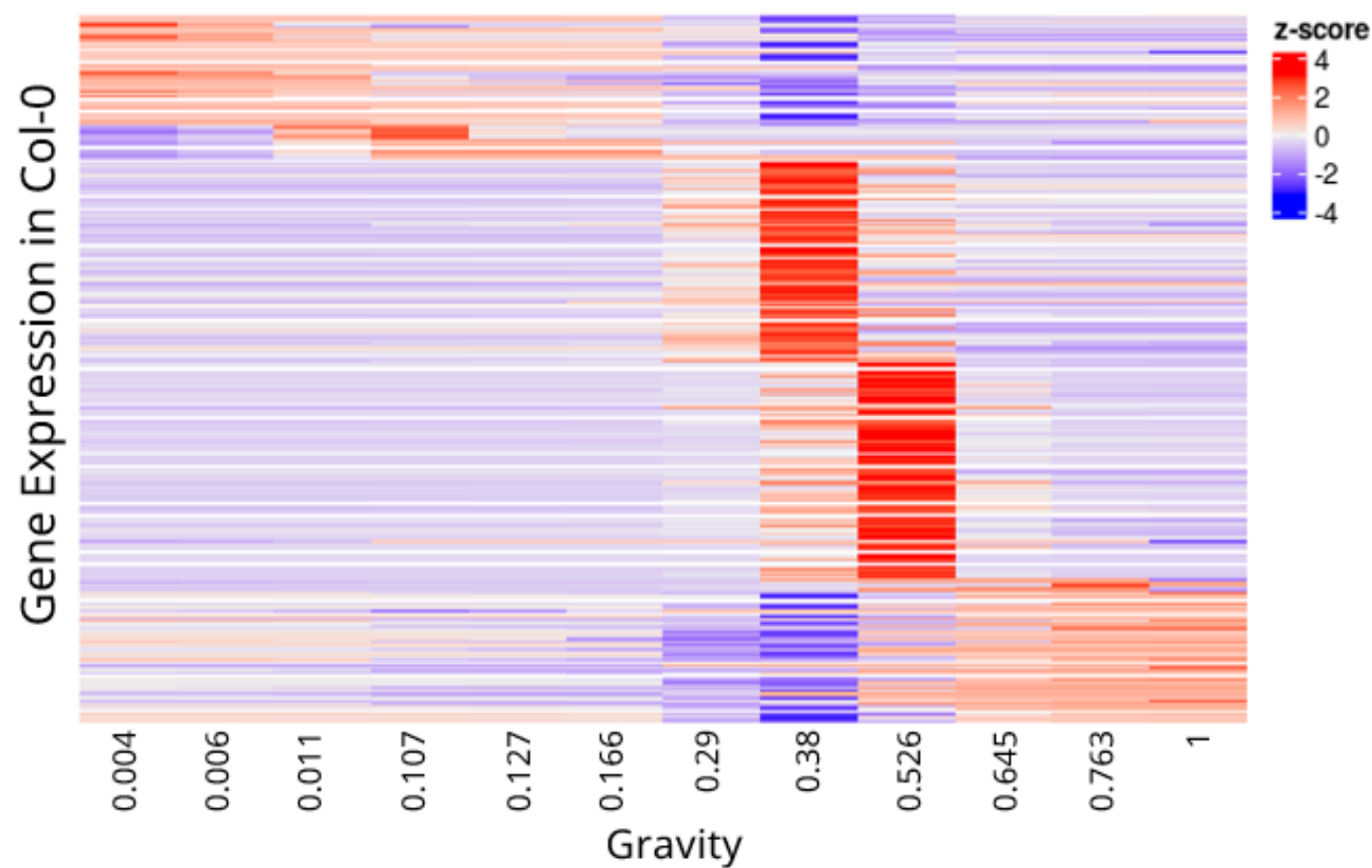
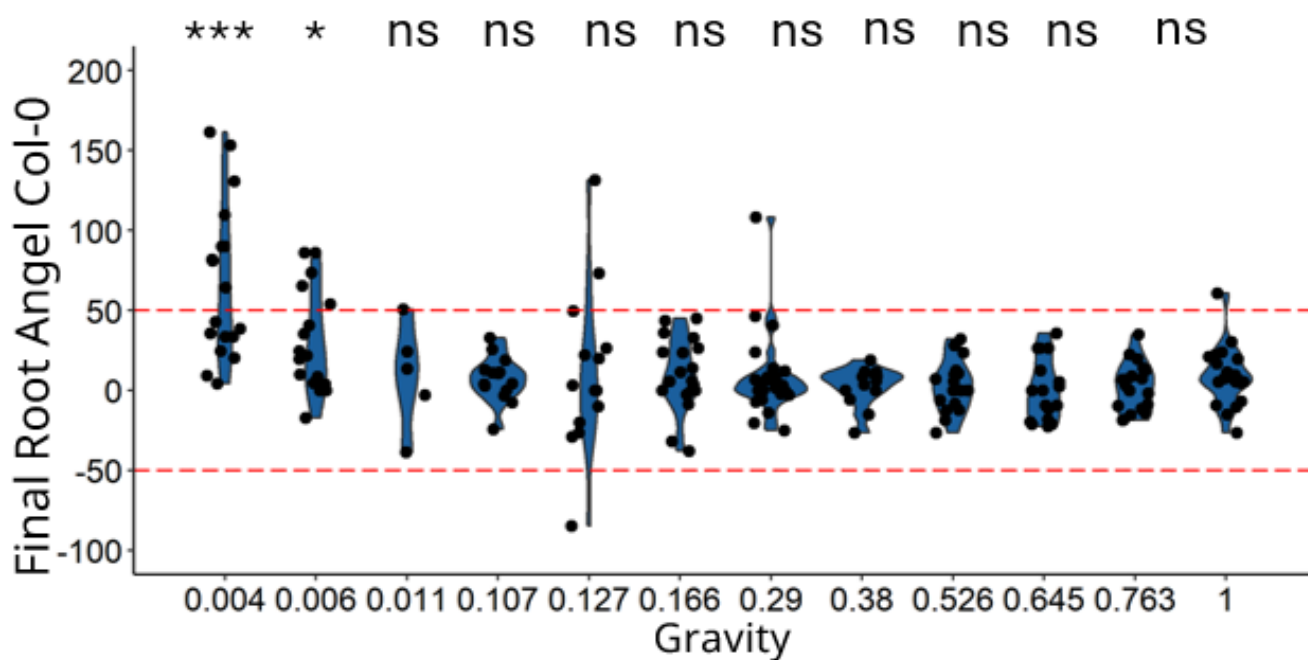
pgm-1 Responses



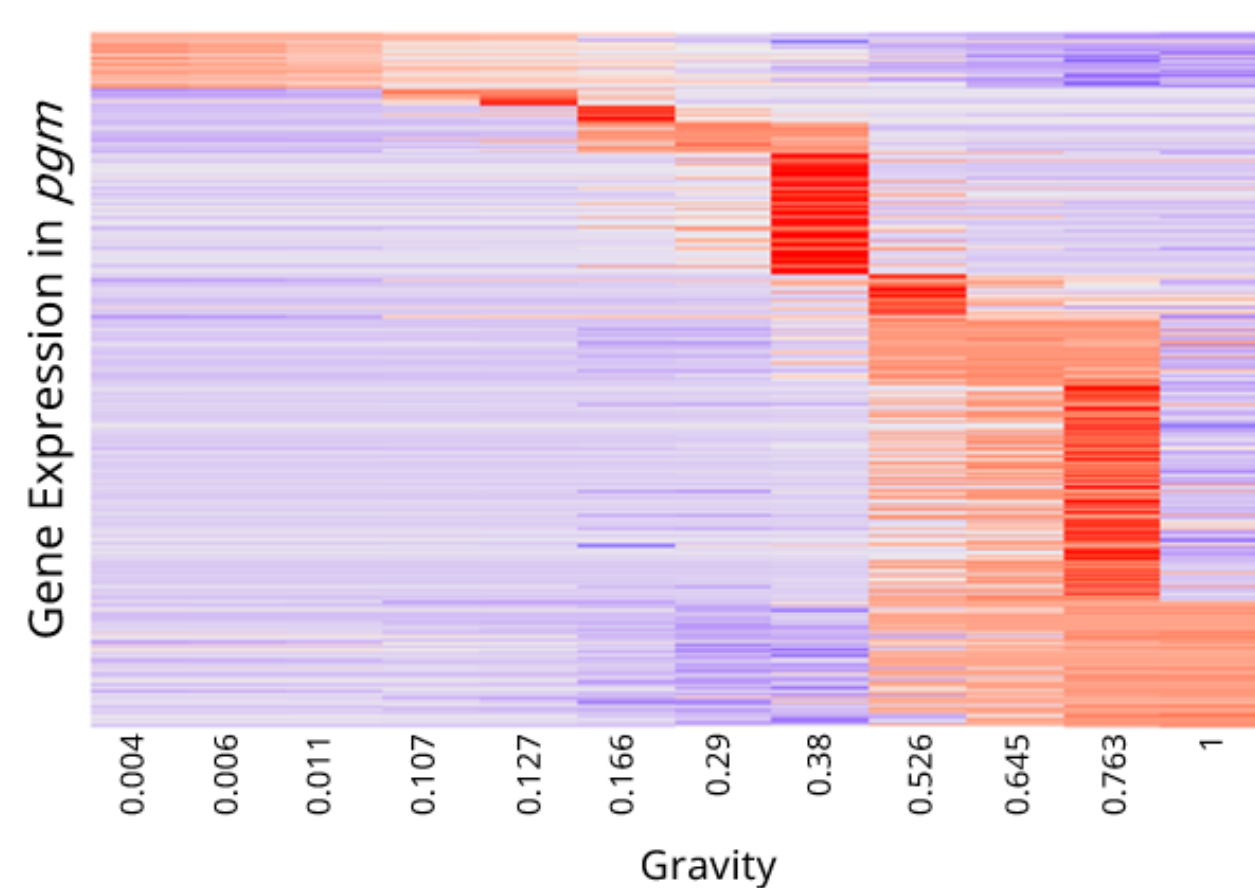
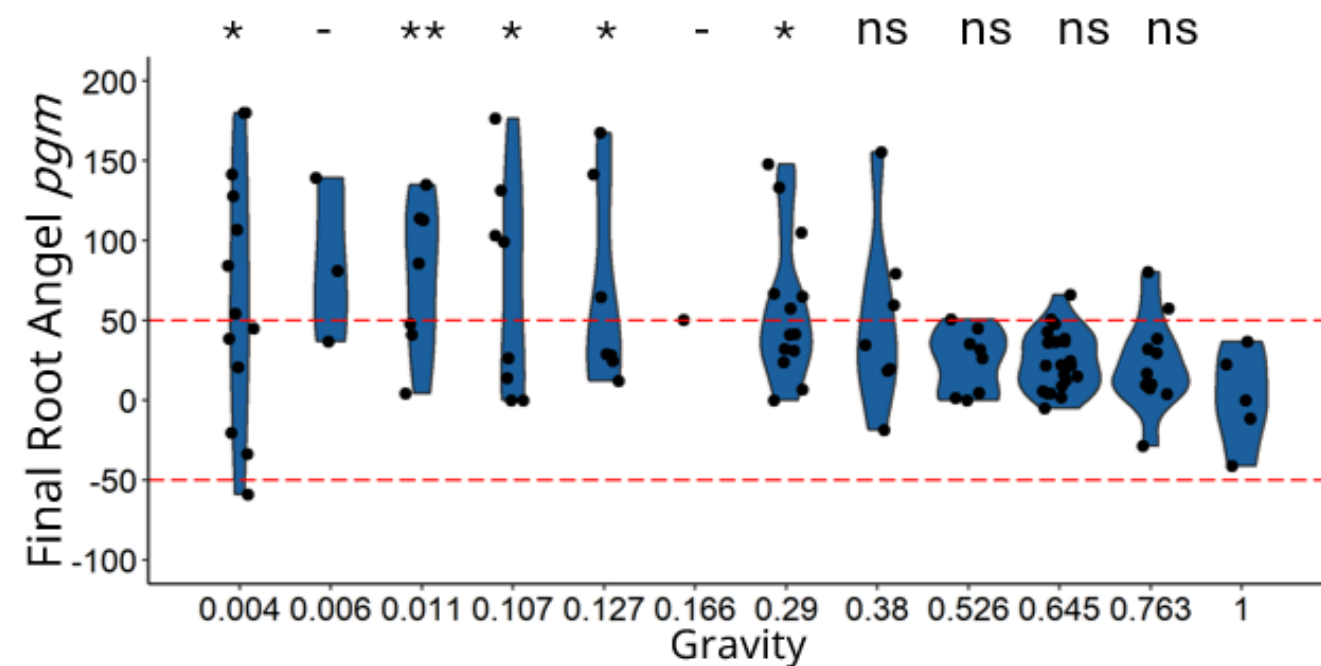
RNAseq Pipeline:

Low-input library prep
NovaSeq 6000 sequencing
Bioinformatics Analysis

Col-0 Responses

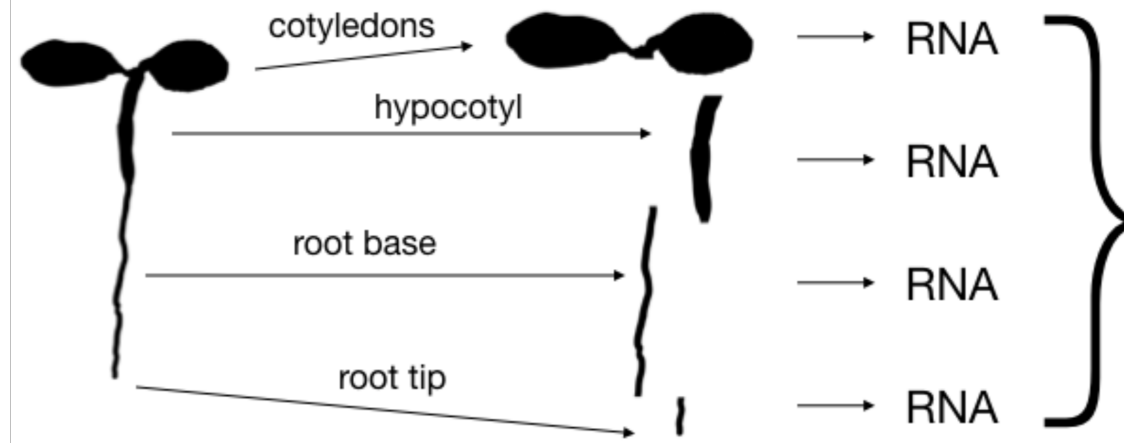
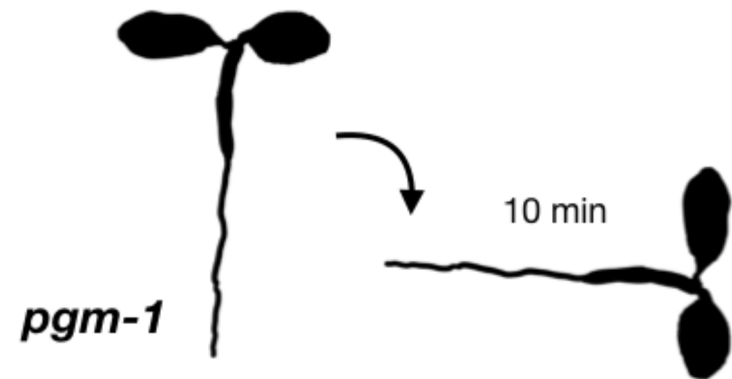
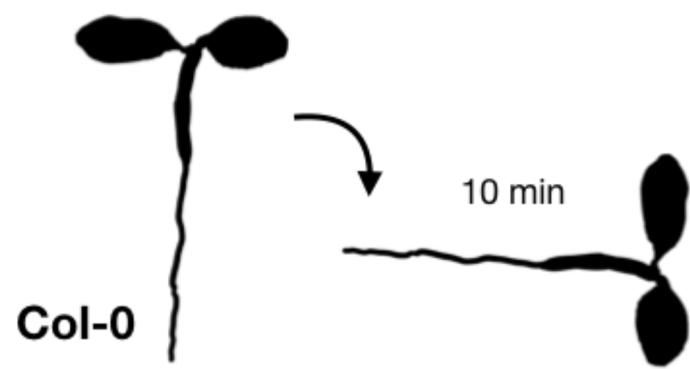


pgm-1 Responses



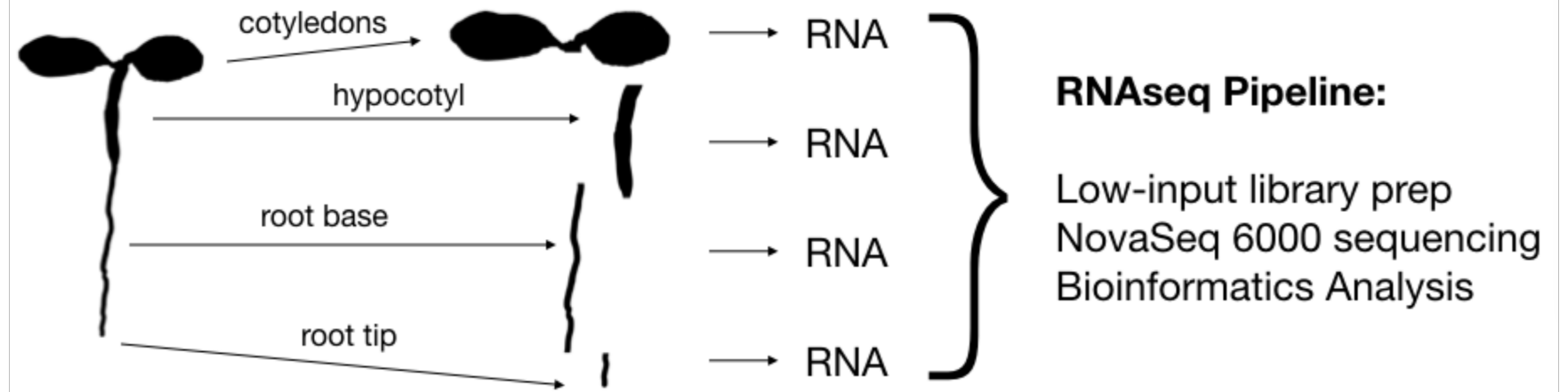
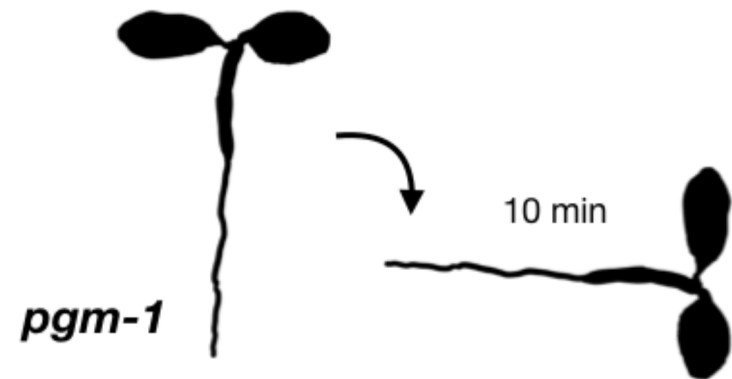
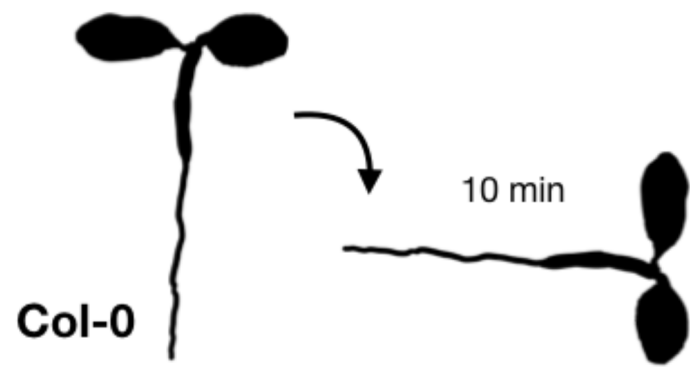
Group	GO Term	Term Size	Overlap	Adj. p
Col-0 0.38	DNA-binding transcription factor activity	1577	23.21%	6.99E-12
	Transcription regulator activity	1677	22.72%	2.55E-11
	DNA binding	2394	20.68%	2.88E-08
	Extracellular region	1772	20.71%	5.72E-08
	Regulation of RNA biosynthetic process	2161	20.78%	5.64E-07
	Regulation of DNA-templated transcription	2161	20.78%	5.64E-07
	Regulation of nucleobase-containing compound metabolic process	2306	20.29%	3.27E-06
	Regulation of RNA metabolic process	2233	20.38%	3.27E-06
	Sequence-specific DNA binding	1038	22.35%	7.48E-06
	Hydrolase activity, acting on ester bonds	1014	22.09%	2.80E-05

Group	GO Term	Term Size	Overlap	Adj. p
<i>pgm-1</i> 0.38	Cell wall organization	544	6.25%	3.14E-15
	External encapsulating structure organization	587	5.79%	1.06E-14
	Cell wall organization or biogenesis	706	5.24%	1.06E-14
	Plant-type cell wall organization	160	10.63%	6.33E-11
	Extracellular region	1772	2.88%	3.58E-09
	Lactoperoxidase activity	76	15.79%	4.01E-09
	Hydrogen peroxide catabolic process	92	13.04%	1.29E-08
	Cell-cell junction assembly	5	100%	1.29E-08
	Cell-cell junction organization	10	60%	1.96E-08
	Plant-type cell wall organization or biogenesis	273	6.59%	1.99E-08

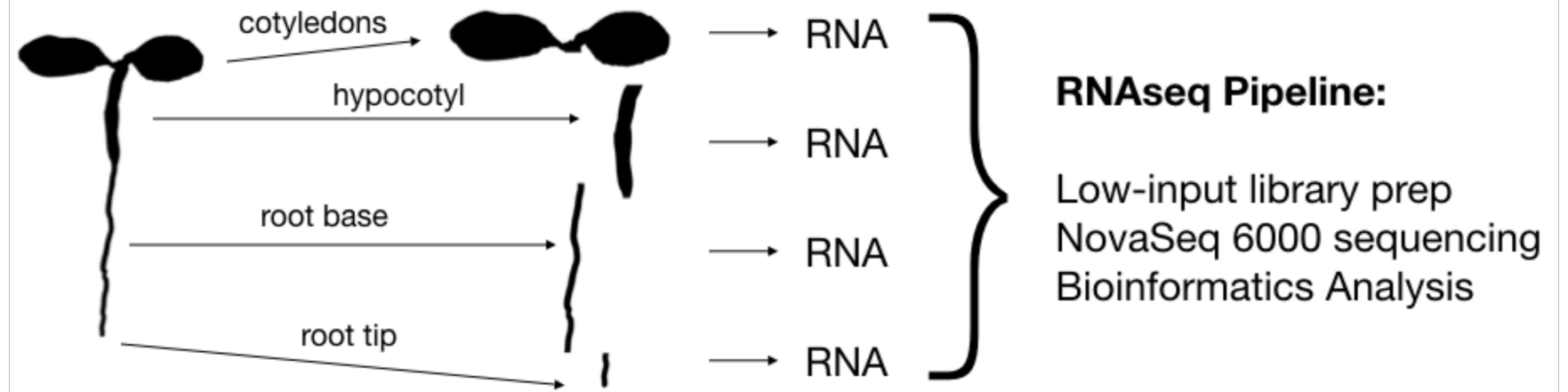
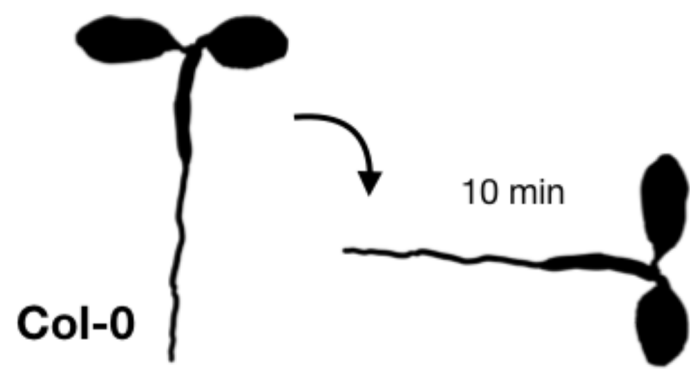


RNAseq Pipeline:

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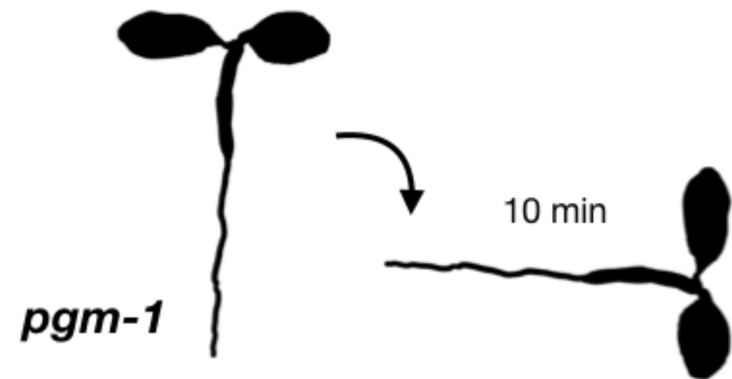


Double DE: Δ Col root tip - Δ *pgm* root tip

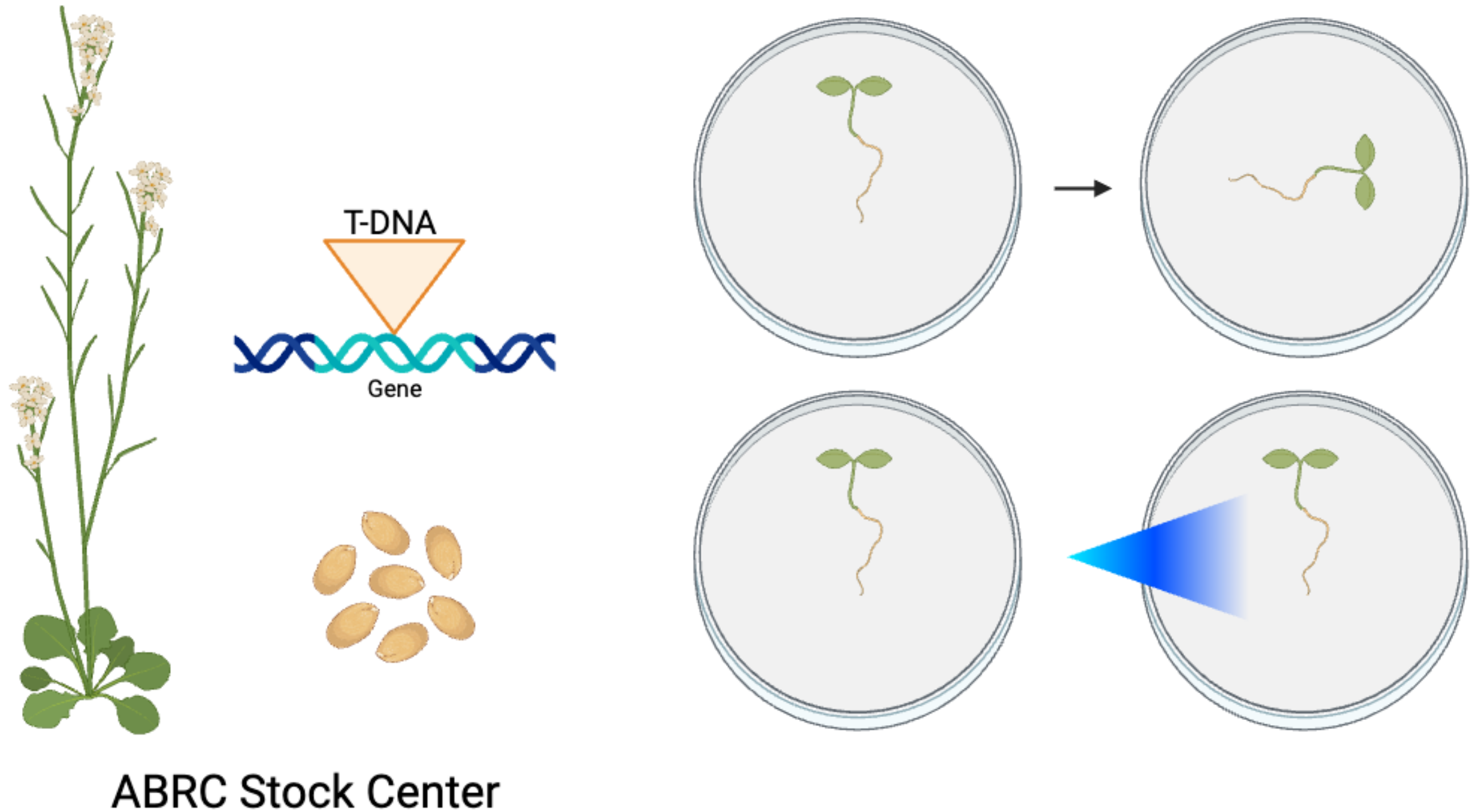


Double DE: Δ Col root tip - Δ *pgm* root tip

124 genes with significant contrasting expression

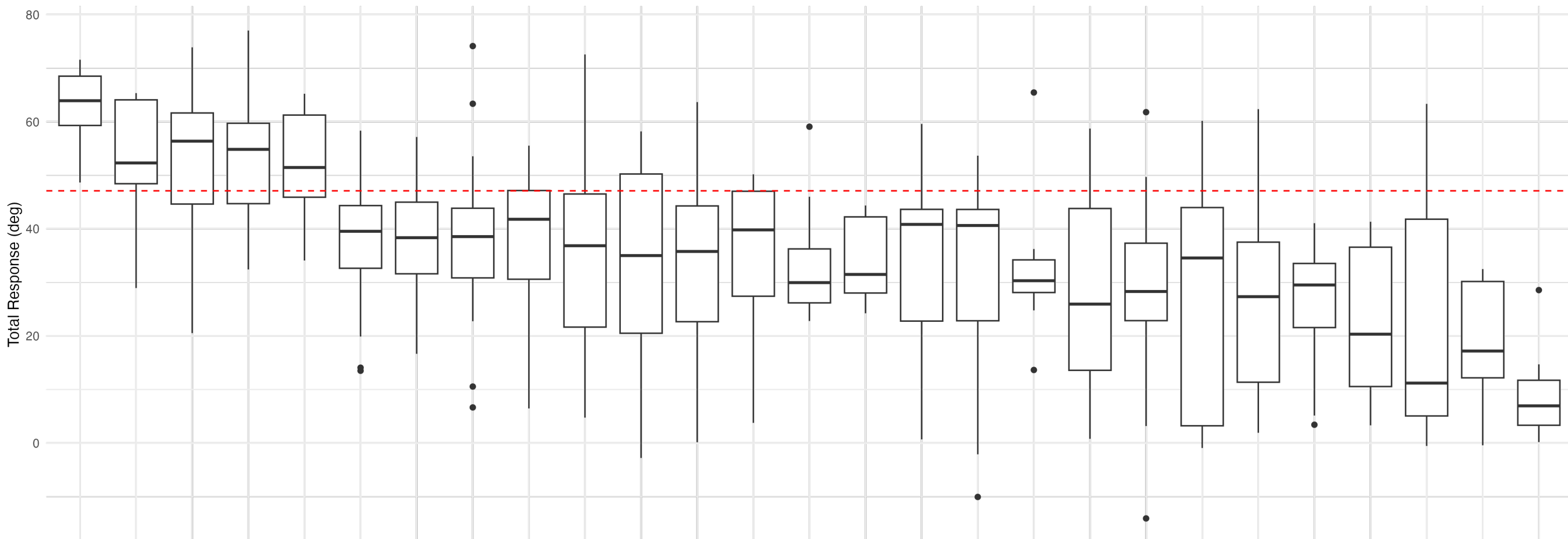


Knock out and test phenotype



88 KO Mutants → Phenotyping Pipeline → 28 mutants show a gravitropic response phenotype

Statistically Significant Different Free Response
Starting Tip Angle $80 < t < 100$, $n > 6$



Space Crops

