

Supplementary Material

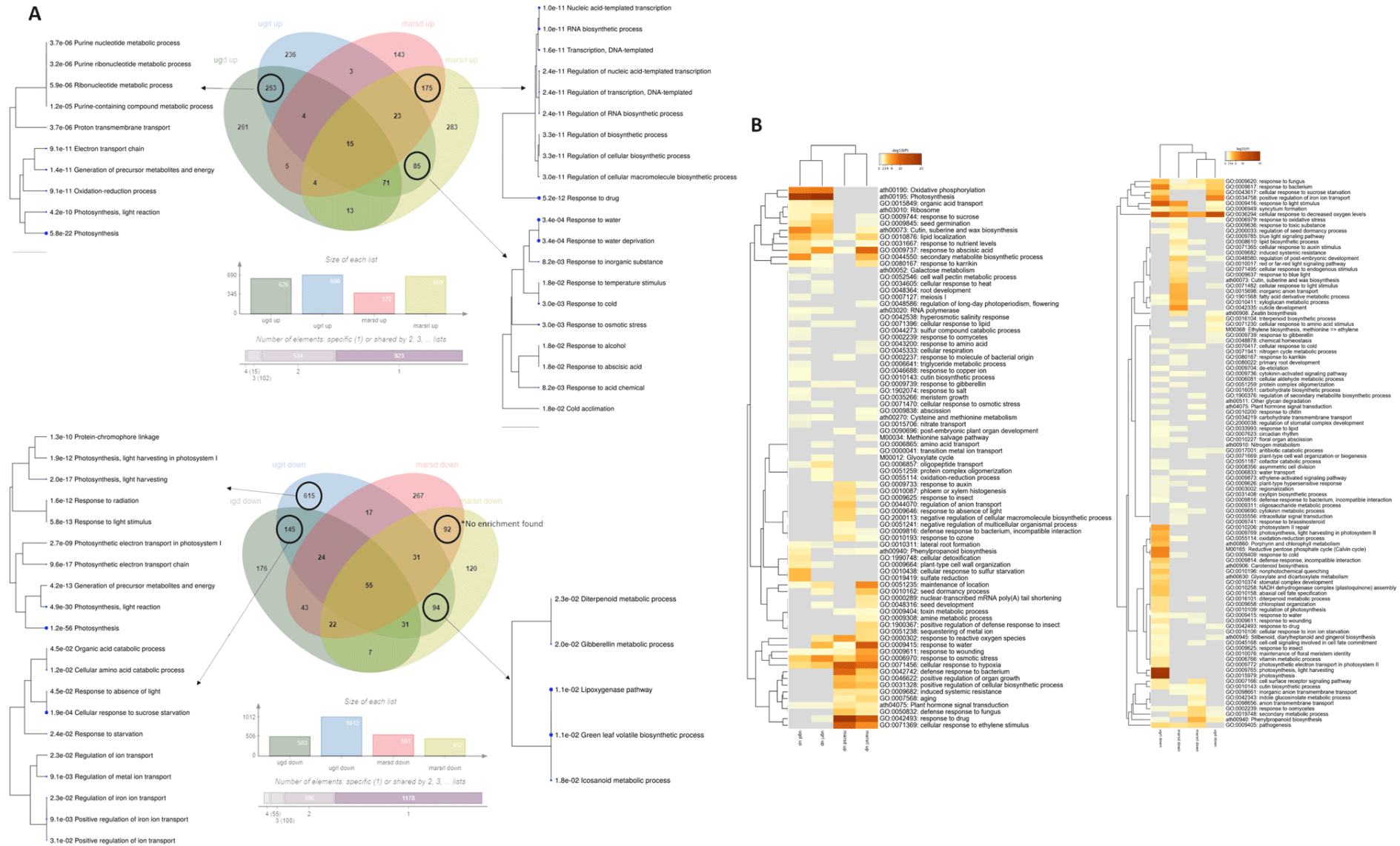


Figure S1. Extended Gene Ontology clusters affected by microgravity or Mars gravity. A) Venn diagrams with up (up) and down (down) DEG with GO Biological process analysis of specific sublists. B) Extended Heatmaps of Gene Ontology Analysis. Top 100 enriched clusters are shown for up and downregulated genes in the comparisons: μ gd-grrd, μ grl-grrrl, marsd-grrd and marsrl-grrrl.

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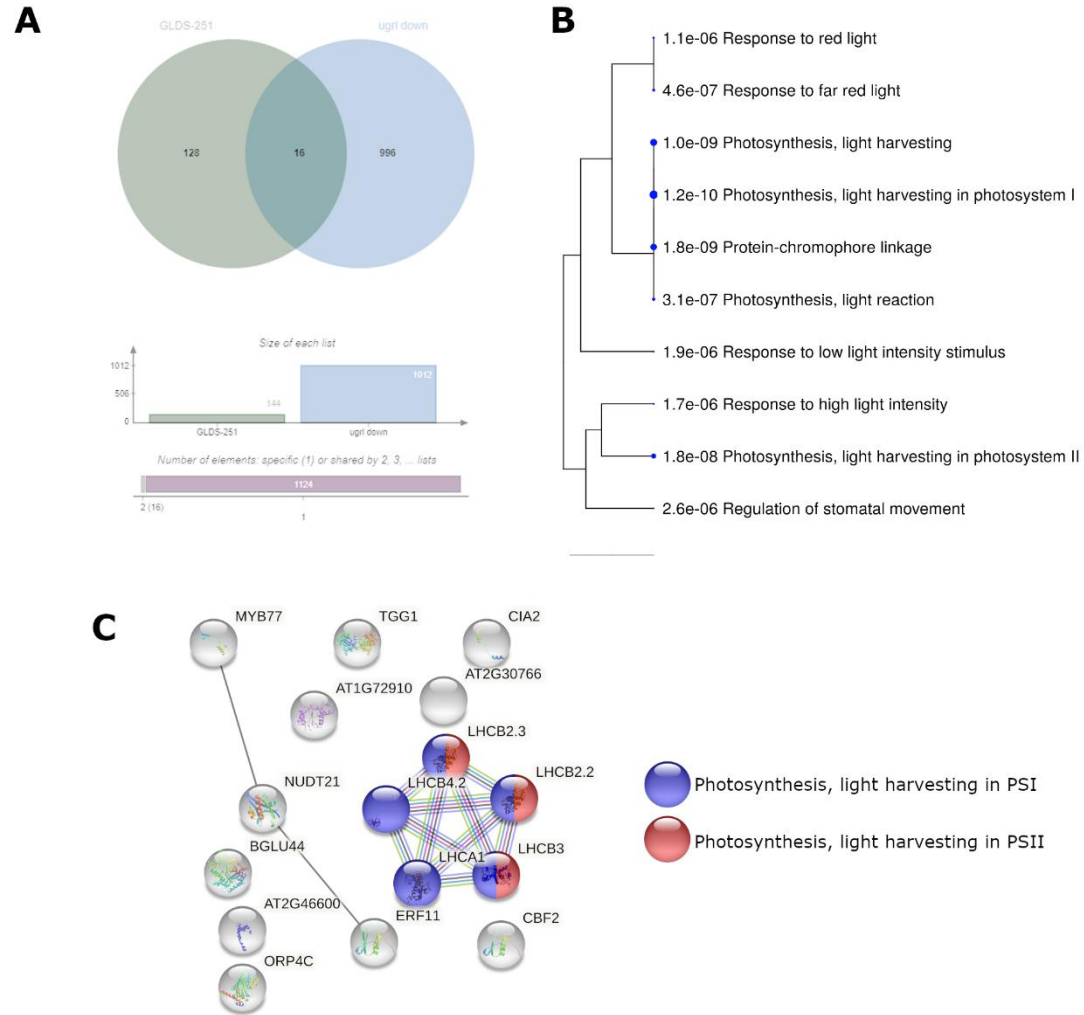


Figure S2. Common microgravity downregulated photosynthesis genes in GLDS-314 (μ gr1-grrr1 comparison, Red photostimulated) and GLDS-251 (Blue photostimulated). A) Venn diagram showing the overlap in the downregulated genes in microgravity from the two studies. B) Biological process Gene Ontology analysis of the 16 common genes. C) Representation of the 16 common genes with String v.11, where PPI are shown. Genes highlighted in blue represent PSI related genes, red: PSII related genes.

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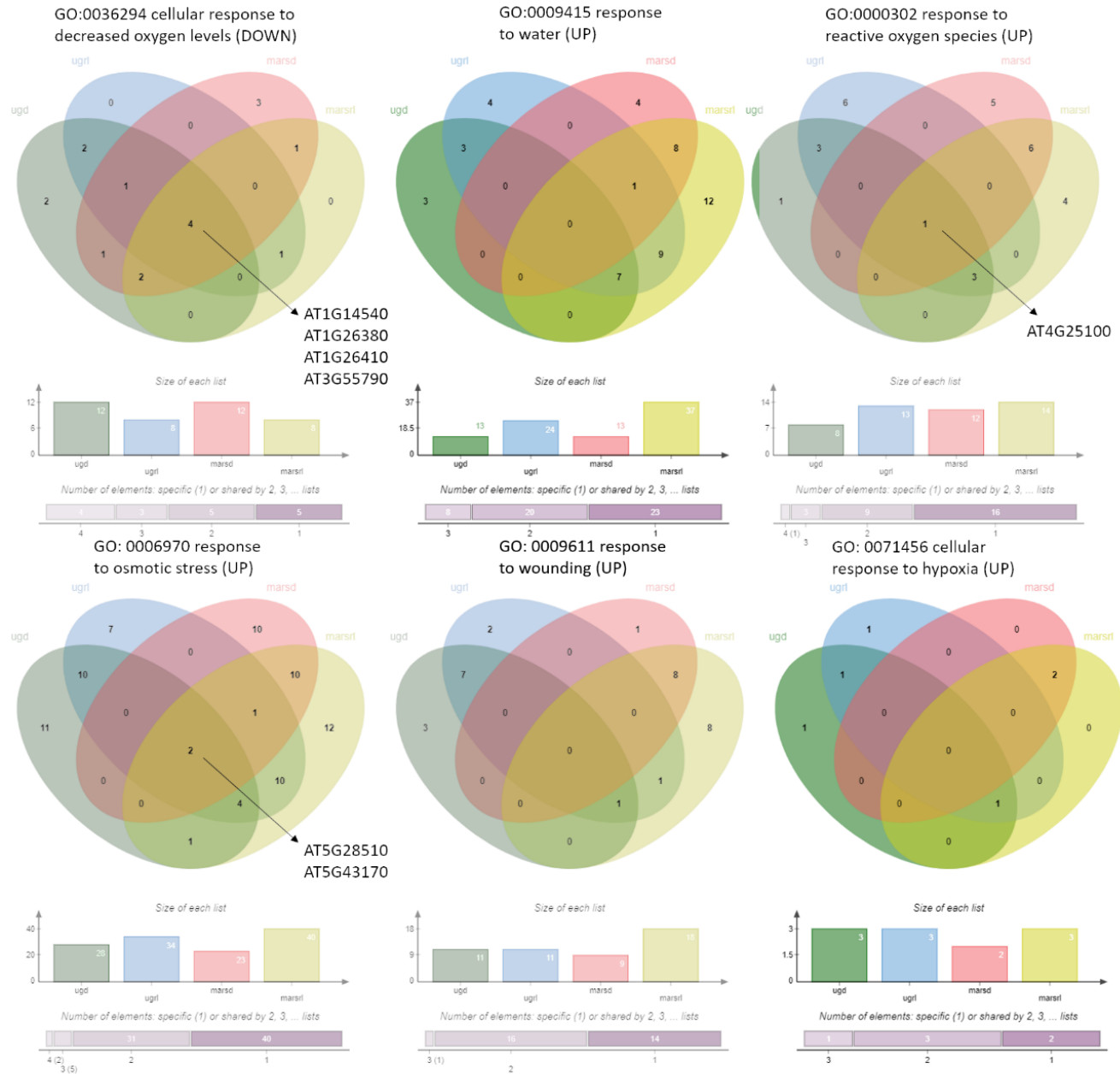


Figure S3. Venn diagrams of DEG in common GO categories to the four comparisons: μ gd-grrd, μ grl-grrl, marsd-grrd and marsrl-grrl.

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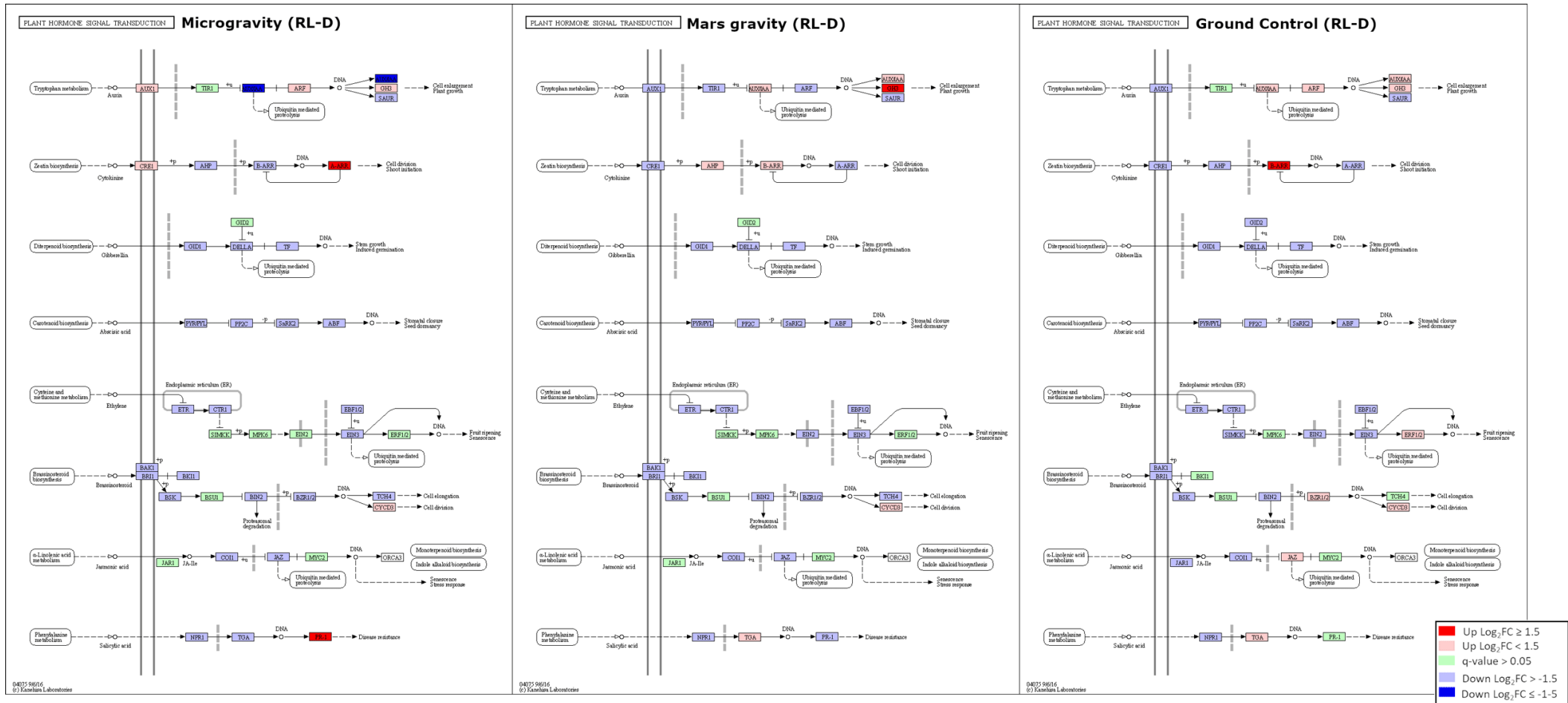


Figure S4. Hormone signal transduction changes in red light compared to darkness. KEGG ath04075 pathway.

Plastid and Mitochondrial genes

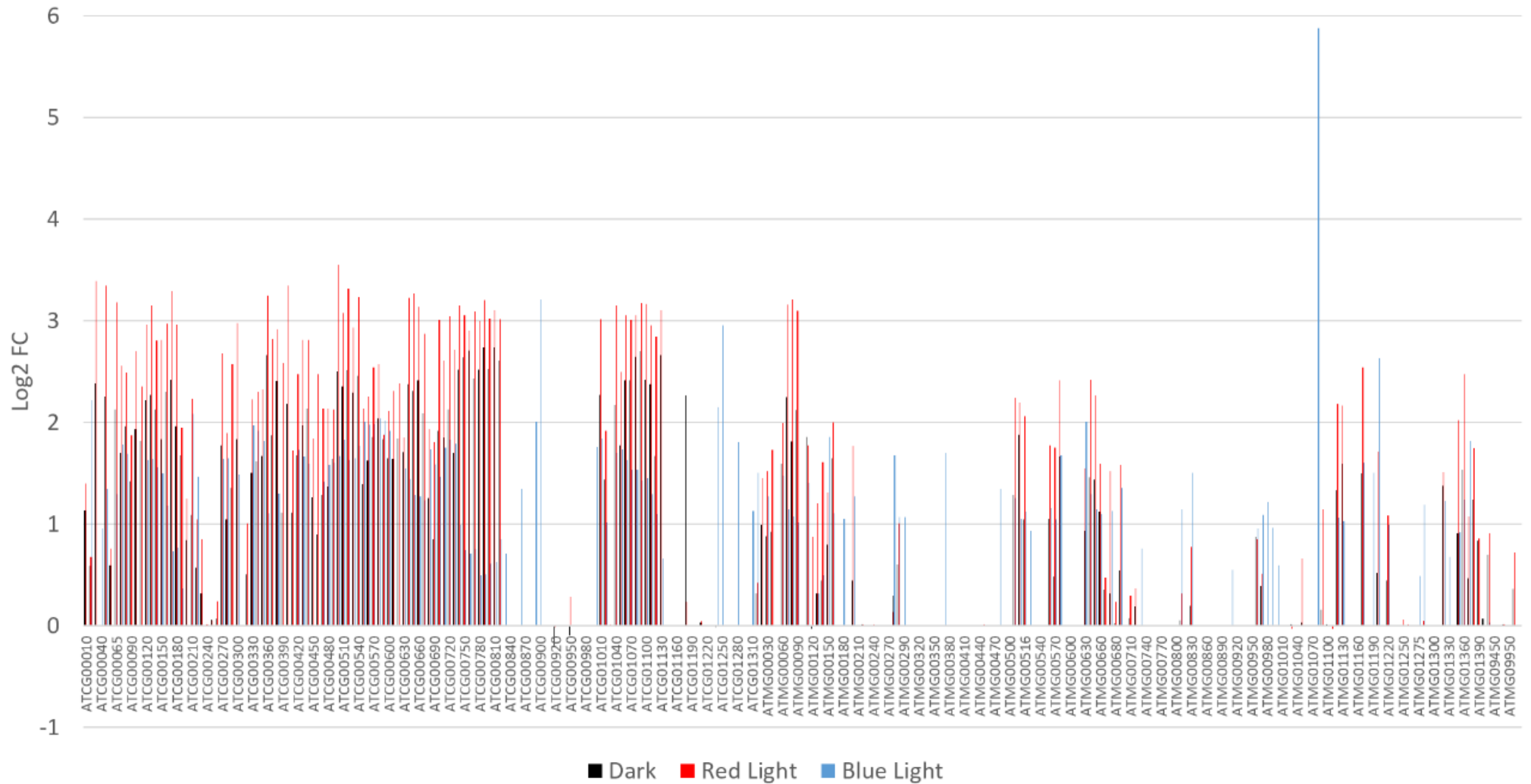


Figure S5. Plastid and Mitochondrial genome expression. Log₂FC representation of all plastid and mitochondrial genome expression in three comparisons: μ gd-grrd, μ grl-grrrl and GLDS-251 blue light stimulated seedlings (microgravity compared to 1g control).

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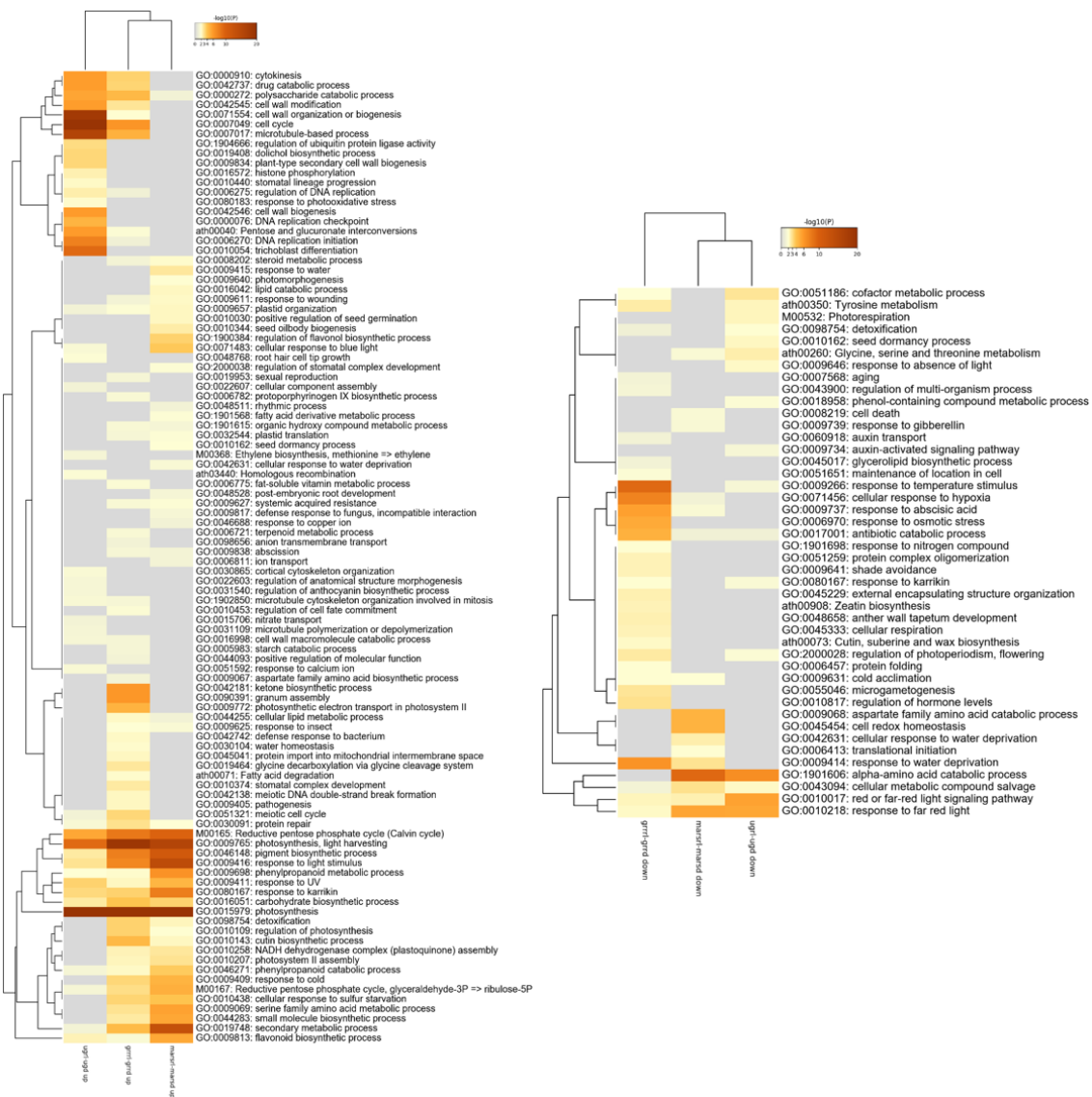


Figure S6. Extended heatmaps of Gene Ontology Analysis of the effect of red light photostimulation across gravity levels. Top 100 (or total number) of enriched clusters for down and upregulated genes in the comparisons: ugrl-ugd, marsrl-marsd and grrrl-grrd.

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Supplementary table 1. List of the genes and the Log₂FC values of the dysregulated in microgravity (μ gd_grrd, μ grl_grrrl comparisons). Bold values are statistically significant (q – value < 0.05).

Name	ID	μ gd_grrd Log ₂ FC	μ grl_grrrl Log ₂ FC
AHP3	AT5G39340	0.48	0.43
AHP4	AT3G16360	2.59	1.69
PIF4	AT2G43010	-1.16	-1.72
PIL6	AT3G59060	-1.16	-0.83
HAI2	AT1G07430	0.81	2.03
HAI3	AT2G29380	1.76	3.25
BSU1	AT1G03445	-0.57	-1.99
TCH4	AT5G57560	-1.18	-1.65
JAZ4	AT1G48500	2.85	3.06
AIB	AT2G46510	-1.56	-1.45
PR1-like	AT2G19990	-2.69	-3.18
-	AT1G50060	-2.22	1.06
TG	AT1G36060	-1.72	-0.78
CBF1	AT4G25490	-3.52	-3.2
CBF2	AT4G25470	-4.18	-3.53
ERF72	AT3G16770	-1.3	-1.91
ANAC017	AT1G34190	-0.4	-0.47
SIB1	AT3G56710	-1.04	-0.55
WRKY45	AT3G01970	-0.92	-1.12

Supplementary table 2. List of the genes and the Log₂FC values of the dysregulated in Mars gravity (marsd_grrd, marsrl_grrrl comparisons). Bold values are statistically significant (q – value < 0.05).

Name	ID	marsd_grrd	marsrl_grrrl
HK2	AT5G35750	-1.67	-0.97
HAI2	AT1G07430	2.06	2.84
HAI3	AT2G29380	2.38	4.02
SNRK2.9	AT2G23030	1.54	0.90
SNRK2.5	AT5G63650	1.32	0.85
ERF1	AT3G23240	3.21	3.01
ERF2	AT5G47220	3.94	2.84
BSU1	AT1G03445	-1.78	-1.95
TCH4	AT5G57560	-0.93	-1.45
JAZ1	AT1G19180	1.67	1.81
-	AT4G33720	0.46	2.89
SIB1	AT3G56710	2.53	1.67
WRKY45	AT3G01970	1.2	0.81
OM66	AT3G50930	2.58	3.27
WRKY40	AT1G80840	2.13	1.82
DIC1	AT2G22500	1.39	1.78
DIC2	AT4G24570	2.07	1.49

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Supplementary table 3. Upregulated pastid and mitochondrial genes in microgravity dark (compared to grrd), microgravity red light (compared to grrl) and the Genelab databases: GLDS-251 (in microgravity), GLDS-38 and GLDS-44. ✓: gene upregulated in the indicated dataset. -: gene not upregulated.

Gene ID	Microgravity Dark	Microgravity RL	GLDS-251 Microgravity	GLDS-38	GLDS-44
ATCG00010	-	-	-	✓	-
ATCG00020	-	-	✓	-	✓
ATCG00030	✓	✓	-	-	-
ATCG00050	✓	✓	-	-	✓
ATCG00065	✓	✓	-	-	✓
ATCG00070	✓	✓	✓	-	✓
ATCG00080	✓	✓	✓	-	✓
ATCG00090	-	✓	-	✓	-
ATCG00100	✓	✓	-	-	-
ATCG00110	✓	✓	-	-	-
ATCG00120	✓	✓	✓	-	✓
ATCG00130	✓	✓	✓	-	✓
ATCG00140	✓	✓	-	-	✓
ATCG00150	✓	✓	✓	-	✓
ATCG00160	✓	✓	-	-	-
ATCG00170	✓	✓	-	-	✓
ATCG00180	✓	✓	-	-	-
ATCG00190	✓	✓	-	-	✓
ATCG00210	-	✓	✓	-	✓
ATCG00220	-	-	✓	-	-
ATCG00230	-	-	-	✓	-
ATCG00270	✓	✓	✓	✓	✓
ATCG00280	-	✓	-	-	✓
ATCG00290	-	✓	-	✓	-
ATCG00300	✓	✓	-	-	✓
ATCG00310	-	-	-	✓	-
ATCG00320	-	-	-	✓	-
ATCG00330	✓	✓	✓	-	✓
ATCG00340	✓	✓	✓	-	-
ATCG00350	✓	✓	✓	-	✓
ATCG00360	✓	✓	-	-	✓
ATCG00370	✓	✓	-	✓	-
ATCG00380	✓	✓	-	✓	-
ATCG00390	-	✓	-	-	-
ATCG00400	✓	✓	-	-	-
ATCG00410	-	✓	-	-	-
ATCG00420	✓	✓	✓	-	✓
ATCG00430	✓	✓	✓	-	✓
ATCG00440	✓	✓	✓	-	-
ATCG00450	-	✓	-	-	-

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ATCG00460	-	✓	-	✓	-
ATCG00470	-	✓	✓	-	-
ATCG00480	-	✓	✓	-	-
ATCG00490	✓	✓	-	-	✓
ATCG00500	✓	✓	✓	✓	✓
ATCG00510	✓	✓	✓	-	-
ATCG00520	✓	✓	✓	✓	✓
ATCG00530	✓	✓	✓	✓	✓
ATCG00540	✓	✓	✓	✓	-
ATCG00550	-	✓	✓	✓	-
ATCG00560	✓	✓	✓	-	-
ATCG00570	✓	✓	✓	✓	-
ATCG00580	✓	✓	✓	-	-
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Table 1 References list

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