

Table S1. Description of the light treatment conditions.

num	symbol	description of light treatment
1	AL	4 d darkness -> 5 min UV-A light -> 4 h darkness (long-term)
2	AS	4 d darkness -> 5 min UV-A light -> 40 min darkness (short-term)
3	BL	4 d darkness -> 4 h continuous blue light (long-term)
4	BS	4 d darkness -> 45 min continuous blue light (short-term)
5	FL	4 d darkness -> 4 h continuous far-red light (long-term)
6	FS	4 d darkness -> 45 min continuous far-red light (short-term)
7	PL	4 d darkness -> 1 min red light -> 4 h darkness (long-term)
8	PS	4 d darkness -> 1 min red light -> 44 min darkness (short-term)
9	RL	4 d darkness -> 4 h continuous red light (long-term)
10	RS	4 d darkness -> 45 min continuous red light (short-term)
11	UL	4 d darkness -> 5 min UV-A/B light -> 4 h darkness (long-term)
12	US	4 d darkness -> 5 min UV-A/B light -> 40 min darkness (short-term)
13	WL	4 d darkness -> 4 h continuous white light (long-term)
14	WS	4 d darkness -> 45 min continuous white light (short-term)

Table S2. Significantly altered pathways (p value ≤ 0.05) in each of the fourteen light treatments.

AL (4 d darkness -> 5 min UV-A light -> 4 h darkness)		
Number	Pathway name	p value
1	photosynthesis, light reaction	4.14E-27
2	photosynthesis	3.94E-19
3	glucosinolate biosynthesis from tryptophan	5.54E-06
4	chlorophyllide a biosynthesis	2.54E-05
5	glucosinolate biosynthesis from phenylalanine	2.14E-04
6	leucine degradation	8.25E-04
7	valine degradation	2.40E-03
8	valine biosynthesis	9.56E-03
9	pantothenate biosynthesis	1.12E-02
10	superpathway of isoleucine and valine biosynthesis	1.24E-02
11	monoterpene biosynthesis	2.23E-02
12	tyrosine degradation	3.56E-02

AS (4 d darkness -> 5 min UV-A light -> 40 min darkness)		
Number	Pathway name	p value
1	quercetin glucoside biosynthesis (Arabidopsis)	7.74E-04
2	spermine biosynthesis	1.50E-03
3	abscisic acid glucose ester biosynthesis	3.94E-03
4	geranyldiphosphate biosynthesis	3.94E-03
5	trans,trans-farnesyl diphosphate biosynthesis	3.94E-03
6	phenylalanine biosynthesis II	5.37E-03
7	chlorophyll a degradation	1.09E-02
8	phaseic acid biosynthesis	1.09E-02
9	carotenoid biosynthesis	1.36E-02
10	superpathway of polyamine biosynthesis	1.71E-02
11	kaempferol glucoside biosynthesis (Arabidopsis)	3.05E-02
12	polyisoprenoid biosynthesis	3.49E-02
13	stachyose biosynthesis	3.49E-02
14	spermidine biosynthesis	3.49E-02
15	flavonoid biosynthesis	3.59E-02
16	ajugose biosynthesis (galactinol-dependent)	4.41E-02
17	phenylpropanoid biosynthesis	4.45E-02
18	gibberellin inactivation	4.52E-02

BL (4 d darkness -> 4 h continuous blue light)		
Number	Pathway name	p value
1	photosynthesis, light reaction	1.28E-17
2	photosynthesis	5.61E-13
3	chlorophyllide a biosynthesis	2.50E-05

4	carotenoid biosynthesis	2.91E-04
5	kaempferol glucoside biosynthesis (Arabidopsis)	5.82E-03
6	salicylic acid biosynthesis	1.38E-02
7	vitamin E biosynthesis	1.38E-02
8	phylloquinone biosynthesis	1.42E-02
9	leucine degradation	2.02E-02
10	Calvin cycle	2.08E-02
11	geranyldiphosphate biosynthesis	2.38E-02
12	trans,trans-farnesyl diphosphate biosynthesis	2.38E-02
13	suberin biosynthesis	4.30E-02
14	free phenylpropanoid acid biosynthesis	4.65E-02
15	phenylpropanoid biosynthesis, initial reactions	4.65E-02
16	non-oxidative branch of the pentose phosphate pathway	4.70E-02

BS (4 d darkness -> 45 min continuous blue light)

Number	Pathway name	p value
1	valine biosynthesis	5.95E-03
2	gibberellin biosynthesis II (early C-3 hydroxylation)	7.21E-03
3	superpathway of isoleucine and valine biosynthesis	7.30E-03
4	spermine biosynthesis	1.06E-02
5	stachyose biosynthesis	1.46E-02
6	spermidine biosynthesis	1.46E-02
7	gibberellin biosynthesis I (non C-3, non C-13 hydroxylation)	1.91E-02
8	superpathway of gibberellin biosynthesis	2.42E-02
9	gibberellin biosynthesis III (early C-13 hydroxylation)	2.42E-02
10	superpathway of leucine, valine, and isoleucine biosynthesis	2.43E-02
11	homogalacturonan biosynthesis	2.72E-02
12	ajugose biosynthesis (galactinol-dependent)	2.79E-02
13	leucine degradation	4.88E-02
14	superpathway of polyamine biosynthesis	4.88E-02

FL (4 d darkness -> 4 h continuous far-red light)

Number	Pathway name	p value
1	photosynthesis, light reaction	1.20E-16
2	photosynthesis	1.63E-12
3	carotenoid biosynthesis	3.47E-06
4	chlorophyllide a biosynthesis	6.02E-05
5	kaempferol glucoside biosynthesis (Arabidopsis)	1.03E-02
6	glycine degradation	1.28E-02
7	Calvin cycle	1.76E-02
8	phylloquinone biosynthesis	1.81E-02
9	salicylic acid biosynthesis	1.87E-02
10	leucine degradation	3.12E-02
11	geranyldiphosphate biosynthesis	3.34E-02
12	lysine degradation II	3.34E-02

13	trans,trans-farnesyl diphosphate biosynthesis	3.34E-02
14	photorespiration	3.83E-02

FS (4 d darkness -> 45 min continuous far-red light)

Number	Pathway name	p value
1	gibberellin biosynthesis II (early C-3 hydroxylation)	3.64E-03
2	gibberellin biosynthesis I (non C-3, non C-13 hydroxylation)	9.83E-03
3	gibberellin biosynthesis III (early C-13 hydroxylation)	1.25E-02
4	superpathway of gibberellin biosynthesis	1.25E-02
5	valine biosynthesis	2.97E-02
6	superpathway of isoleucine and valine biosynthesis	3.38E-02
7	chlorophyll cycle	3.91E-02
8	anthocyanin biosynthesis (pelargonidin 3-O-glucoside, cyanidin 3-O-glucoside)	3.91E-02
9	xanthophyll cycle	3.91E-02
10	flavonoid biosynthesis	4.27E-02

PL (4 d darkness -> 1 min red light -> 4 h darkness)

Number	Pathway name	p value
1	photosynthesis, light reaction	2.22E-32
2	photosynthesis	1.08E-23
3	chlorophyllide a biosynthesis	2.29E-05
4	methionine degradation	4.12E-02

PS (4 d darkness -> 1 min red light -> 45 min darkness)

Number	Pathway name	p value
1	spermine biosynthesis	5.40E-03
2	spermidine biosynthesis	7.46E-03
3	superpathway of polyamine biosynthesis	2.57E-02
4	valine biosynthesis	2.97E-02
5	superpathway of isoleucine and valine biosynthesis	3.38E-02
6	anthocyanin biosynthesis (pelargonidin 3-O-glucoside, cyanidin 3-O-glucoside)	3.91E-02
7	chlorophyll cycle	3.91E-02
8	xanthophyll cycle	3.91E-02
9	flavonoid biosynthesis	4.27E-02

RL (4 d darkness -> 4 h continuous red light)

Number	Pathway name	p value
1	photosynthesis, light reaction	2.51E-21
2	photosynthesis	5.51E-18
3	chlorophyllide a biosynthesis	1.46E-06
4	Calvin cycle	2.40E-03
5	leucine degradation	7.10E-03
6	salicylic acid biosynthesis	2.60E-02

7	superpathway of aspartate and asparagine biosynthesis	4.51E-02
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RS (4 d darkness -> 45 min continuous red light)

Number	Pathway name	p value
1	quercetin glucoside biosynthesis (Arabidopsis)	3.43E-03
2	abscisic acid glucose ester biosynthesis	9.27E-03
3	valine biosynthesis	2.80E-02
4	superpathway of isoleucine and valine biosynthesis	3.20E-02
5	kaempferol glucoside biosynthesis (Arabidopsis)	3.61E-02
6	anthocyanin biosynthesis (pelargonidin 3-O-glucoside, cyanidin 3-O-glucoside)	3.79E-02
7	xanthophyll cycle	3.79E-02
8	chlorophyll cycle	3.79E-02
9	flavonoid biosynthesis	4.04E-02

UL (4 d darkness -> 5 min UV-A/B light -> 4 h darkness)

Number	Pathway name	p value
1	photosynthesis, light reaction	2.02E-17
2	photosynthesis	1.61E-12
3	leucine degradation	3.44E-03
4	superpathway of isoleucine and valine biosynthesis	9.30E-03
5	glucosinolate biosynthesis from phenylalanine	1.10E-02
6	glucosinolate biosynthesis from tryptophan	1.10E-02
7	chlorophyllide a biosynthesis	1.41E-02
8	valine degradation	1.41E-02
9	branched-chain α -keto acid dehydrogenase complex	1.95E-02
10	phenylpropanoid biosynthesis, initial reactions	1.95E-02
11	lactose degradation	2.03E-02
12	valine biosynthesis	2.55E-02
13	glutamate degradation I	3.17E-02
14	chlorophyll cycle	3.17E-02
15	superpathway of leucine, valine, and isoleucine biosynthesis	3.85E-02
16	quercetin glucoside biosynthesis (Arabidopsis)	4.23E-02
17	salicylic acid biosynthesis	4.23E-02
18	carotenoid biosynthesis	4.65E-02

US (4 d darkness -> 5 min UV-A/B light -> 40 min darkness)

Number	Pathway name	p value
1	quercetin glucoside biosynthesis (Arabidopsis)	5.54E-05
2	cytokinins 7-N-glucoside biosynthesis	1.14E-04
3	cytokinins 9-N-glucoside biosynthesis	1.14E-04
4	cytokinins-O-glucoside biosynthesis	1.14E-04
5	kaempferol glucoside biosynthesis (Arabidopsis)	1.83E-04
6	phenylalanine biosynthesis II	2.30E-03
7	spermine biosynthesis	3.54E-03

8	stachyose biosynthesis	5.92E-03
9	gibberellin inactivation	9.07E-03
10	abscisic acid glucose ester biosynthesis	9.07E-03
11	chlorophyll a degradation	1.93E-02
12	phenylalanine biosynthesis I	1.93E-02
13	carotenoid biosynthesis	3.00E-02
14	superpathway of polyamine biosynthesis	3.73E-02
15	tyrosine biosynthesis I	4.45E-02
16	tyrosine biosynthesis II	4.45E-02

WL (4 d darkness -> 4 h continuous white light)

Number	Pathway name	p value
1	photosynthesis, light reaction	4.76E-18
2	photosynthesis	1.67E-14
3	chlorophyllide a biosynthesis	2.57E-05
4	kaempferol glucoside biosynthesis (Arabidopsis)	6.19E-03
5	phylloquinone biosynthesis	7.63E-03
6	Calvin cycle	9.05E-03
7	geranyldiphosphate biosynthesis	9.64E-03
8	trans,trans-farnesyl diphosphate biosynthesis	9.64E-03
9	non-oxidative branch of the pentose phosphate pathway	1.78E-02
10	carotenoid biosynthesis	1.78E-02
11	free phenylpropanoid acid biosynthesis	2.60E-02
12	leucine degradation	2.77E-02
13	ribose degradation	3.15E-02
14	polyisoprenoid biosynthesis	3.15E-02
15	plastoquinone-9 biosynthesis	3.88E-02
16	chlorophyll cycle	3.88E-02
17	xanthophyll cycle	3.88E-02
18	glutamate degradation I	3.88E-02

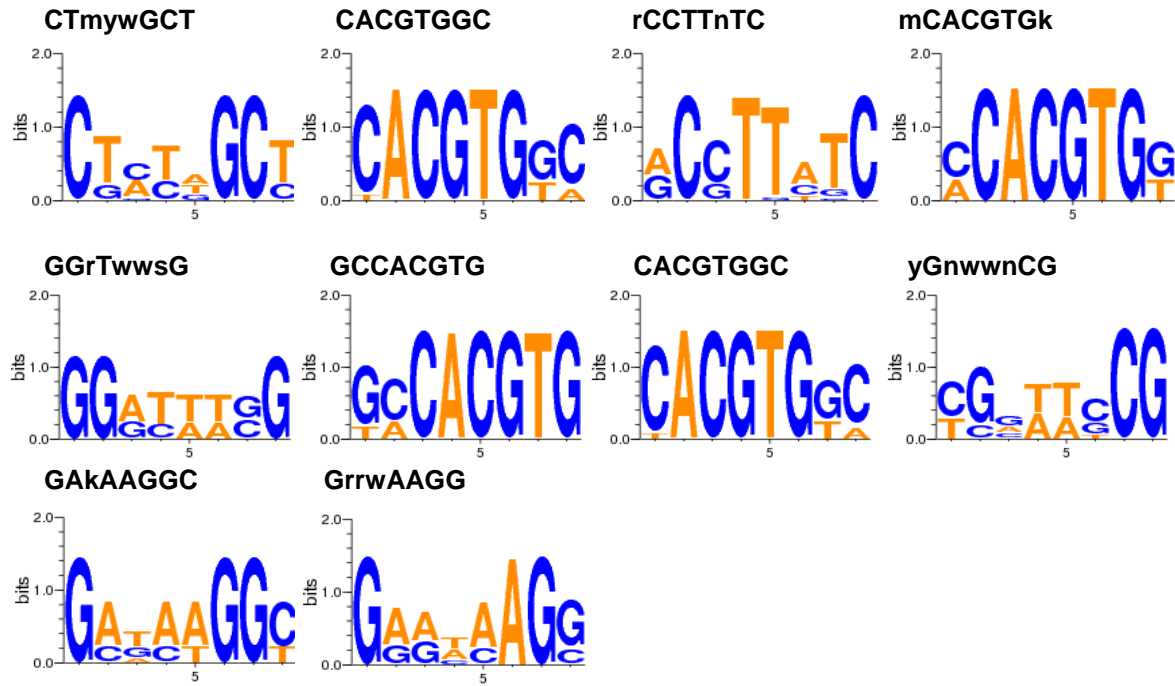
WS (4 d darkness -> 45 min continuous white light)

Number	Pathway name	p value
1	gibberellin biosynthesis II (early C-3 hydroxylation)	5.80E-03
2	spermine biosynthesis	8.57E-03
3	spermidine biosynthesis	1.18E-02
4	stachyose biosynthesis	1.18E-02
5	gibberellin biosynthesis I (non C-3, non C-13 hydroxylation)	1.55E-02
6	superpathway of gibberellin biosynthesis	1.96E-02
7	gibberellin biosynthesis III (early C-13 hydroxylation)	1.96E-02
8	ajugose biosynthesis (galactinol-dependent)	2.50E-02
9	ethylene biosynthesis from methionine	2.79E-02
10	superpathway of polyamine biosynthesis	3.99E-02
11	valine biosynthesis	4.58E-02
12	chlorophyll cycle	4.93E-02

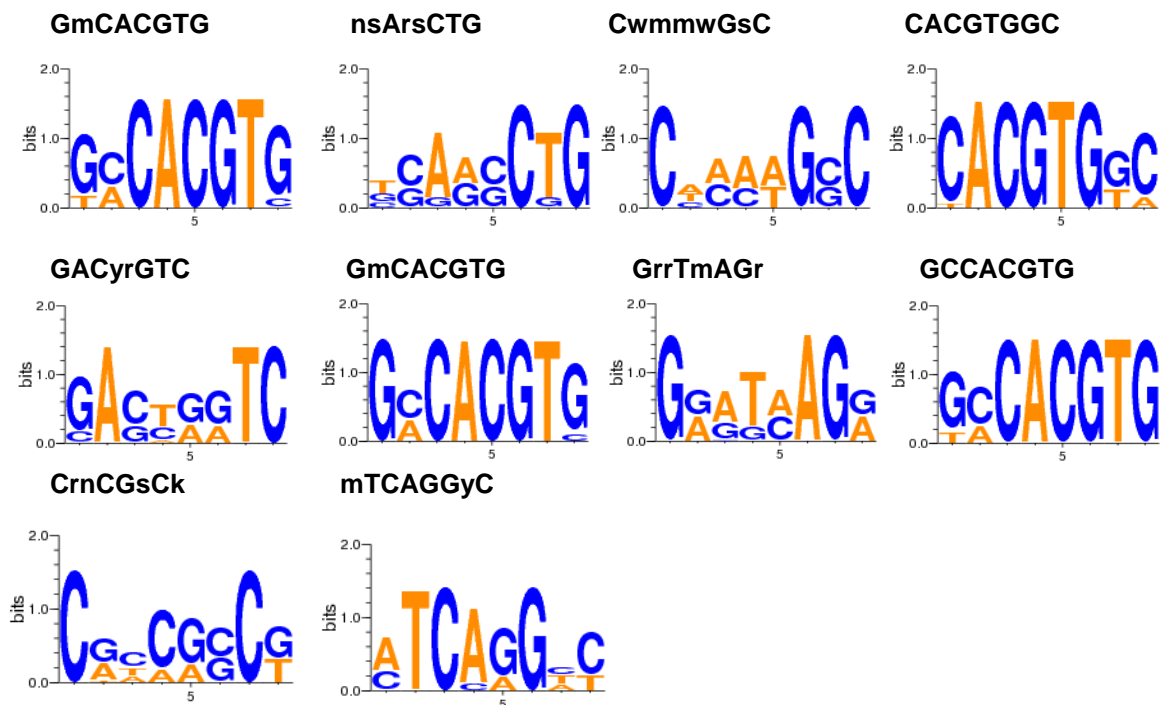
13	xanthophyll cycle		4.93E-02
14	anthocyanin (pelargonidin 3-O-glucoside, cyanidin 3-O-glucoside)	biosynthesis	4.93E-02

Figure S1. Over-represented motifs identified from co-expressed genes in highly altered pathways.

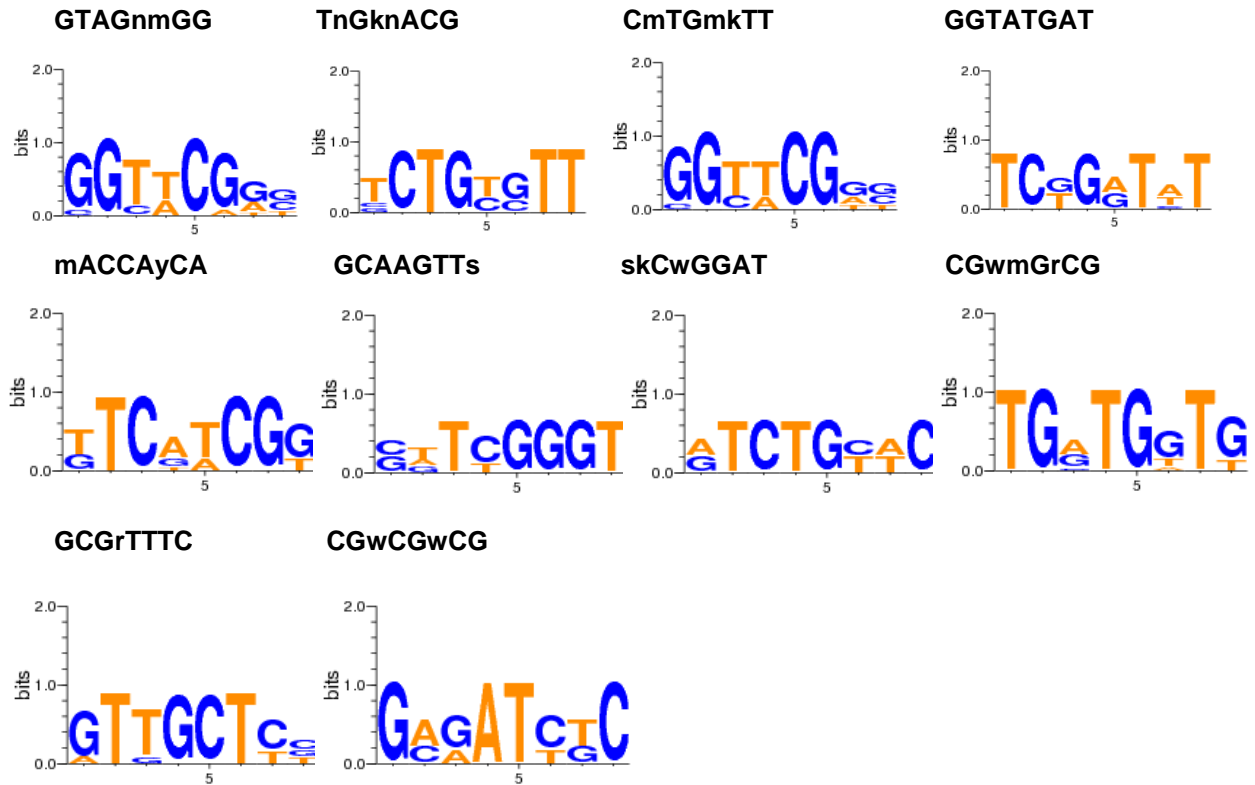
A, Photosynthesis, light reaction (under AL: 4 d darkness -> 5 min UV-A light -> 4 h darkness)



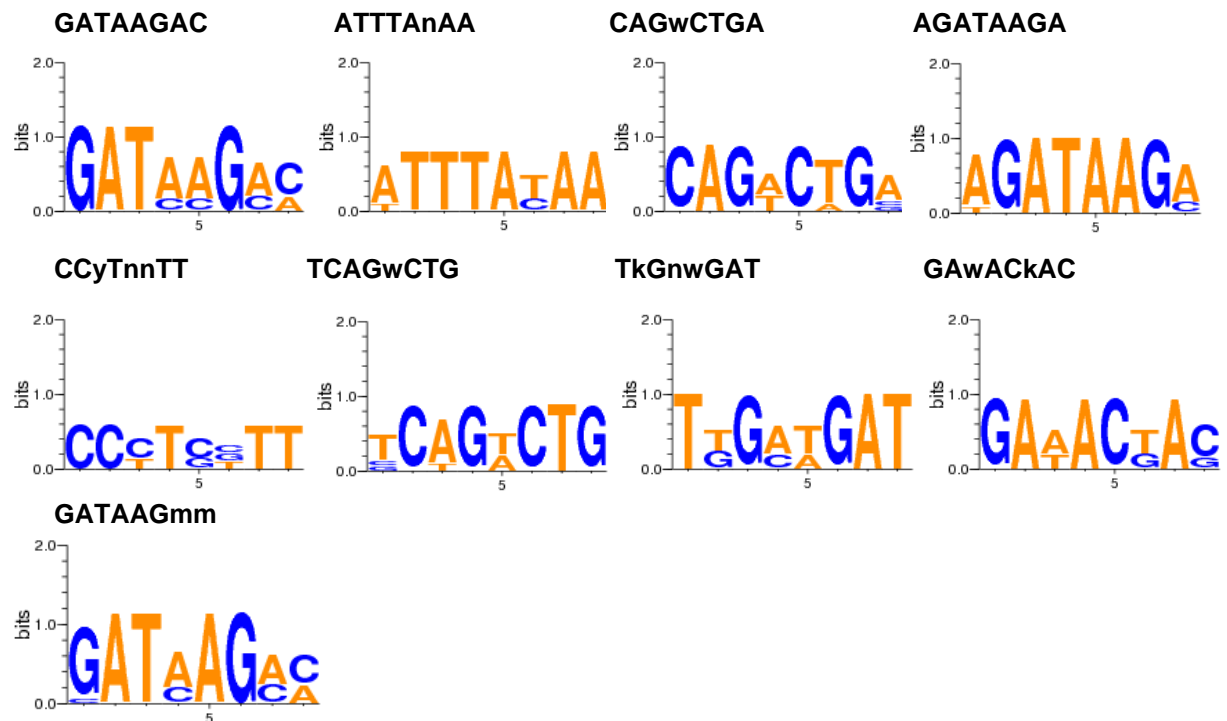
B, Photosynthesis (under AL: 4 d darkness -> 5 min UV-A light -> 4 h darkness)



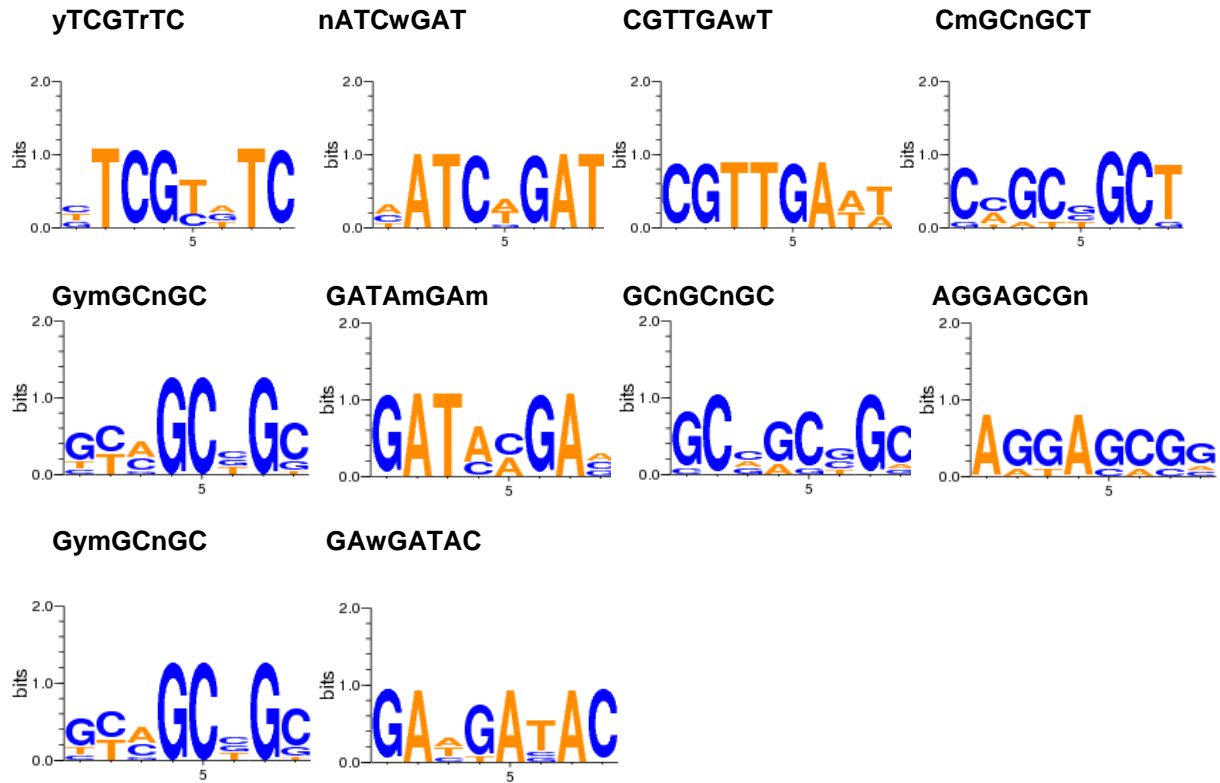
C, Chlorophyllide A Biosynthesis (under AL: 4 d darkness -> 5 min UV-A light -> 4 h darkness)



D, Leucine Degradation (under AL: 4 d darkness -> 5 min UV-A light -> 4 h darkness)



E, Valine Biosynthesis (under BS: 4 d darkness -> 45 min continuous blue light short term)



F, Spermine Biosynthesis (under BS: 4 d darkness -> 45 min continuous blue light short term)

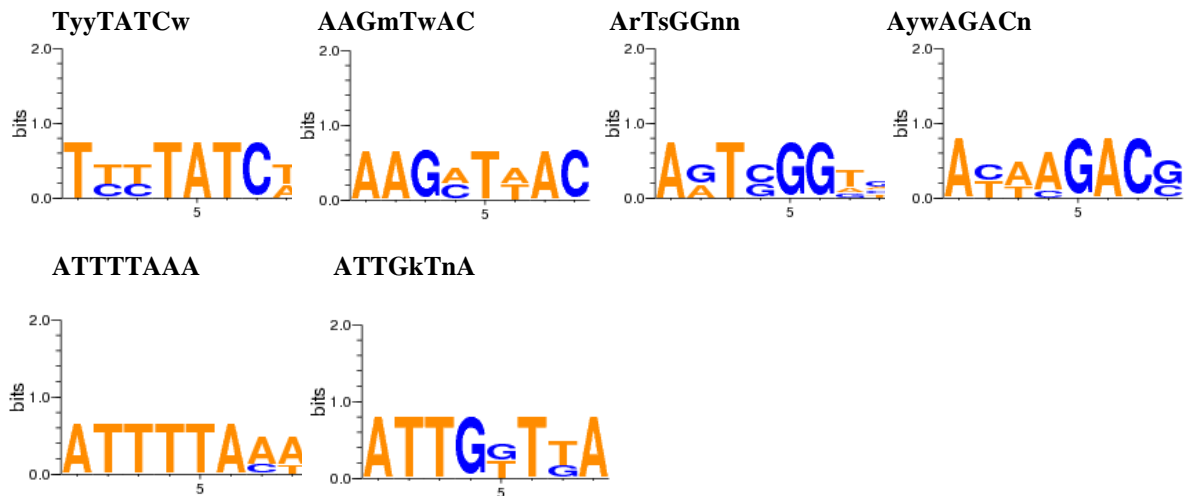


Figure S2. Enriched GO terms of biological process category in light treatments. Numbers on the color bar indicate the significance of the enrichment (p value)

