Transcriptomic responses of *Emiliania huxleyi* to Ocean Acidification

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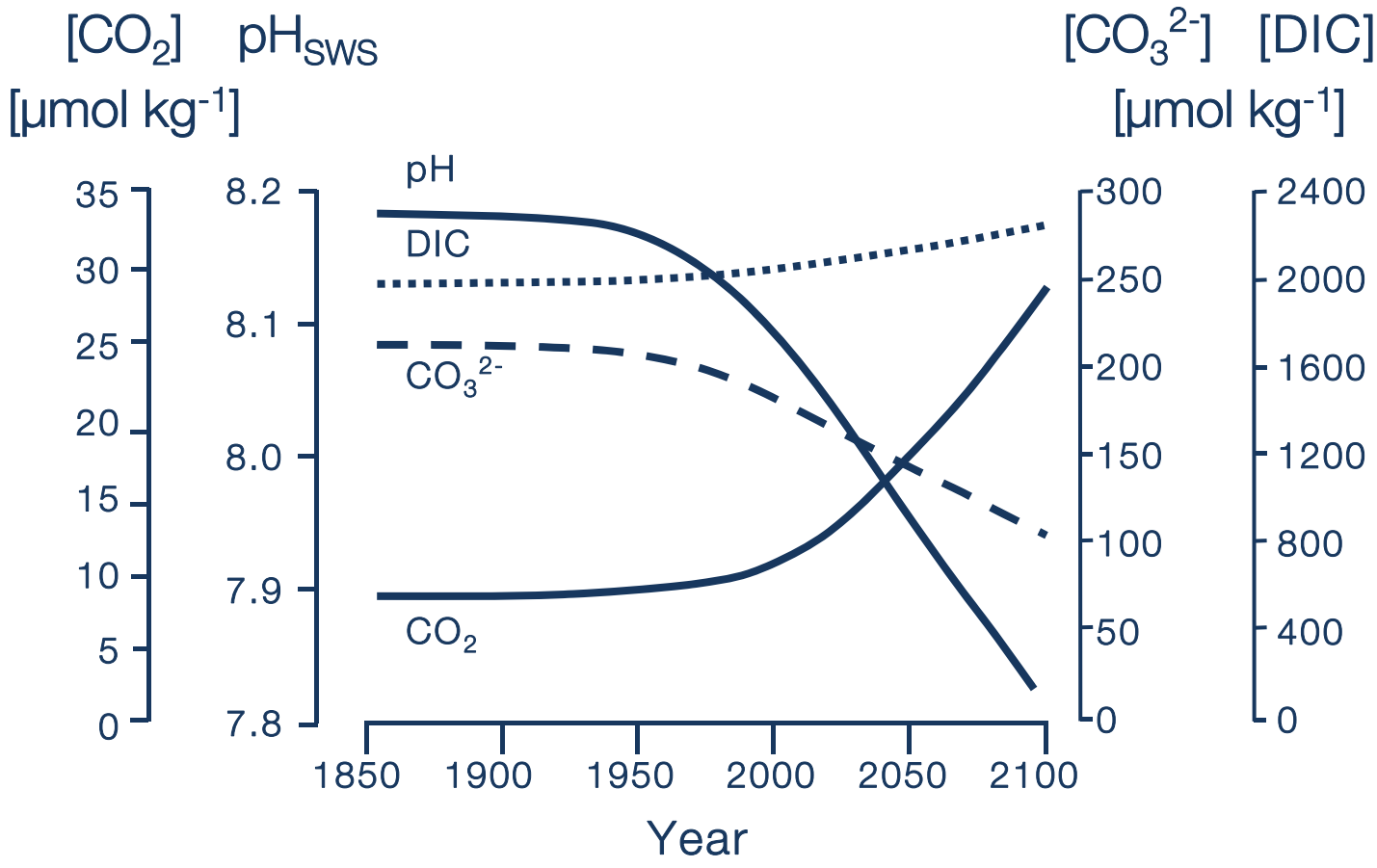
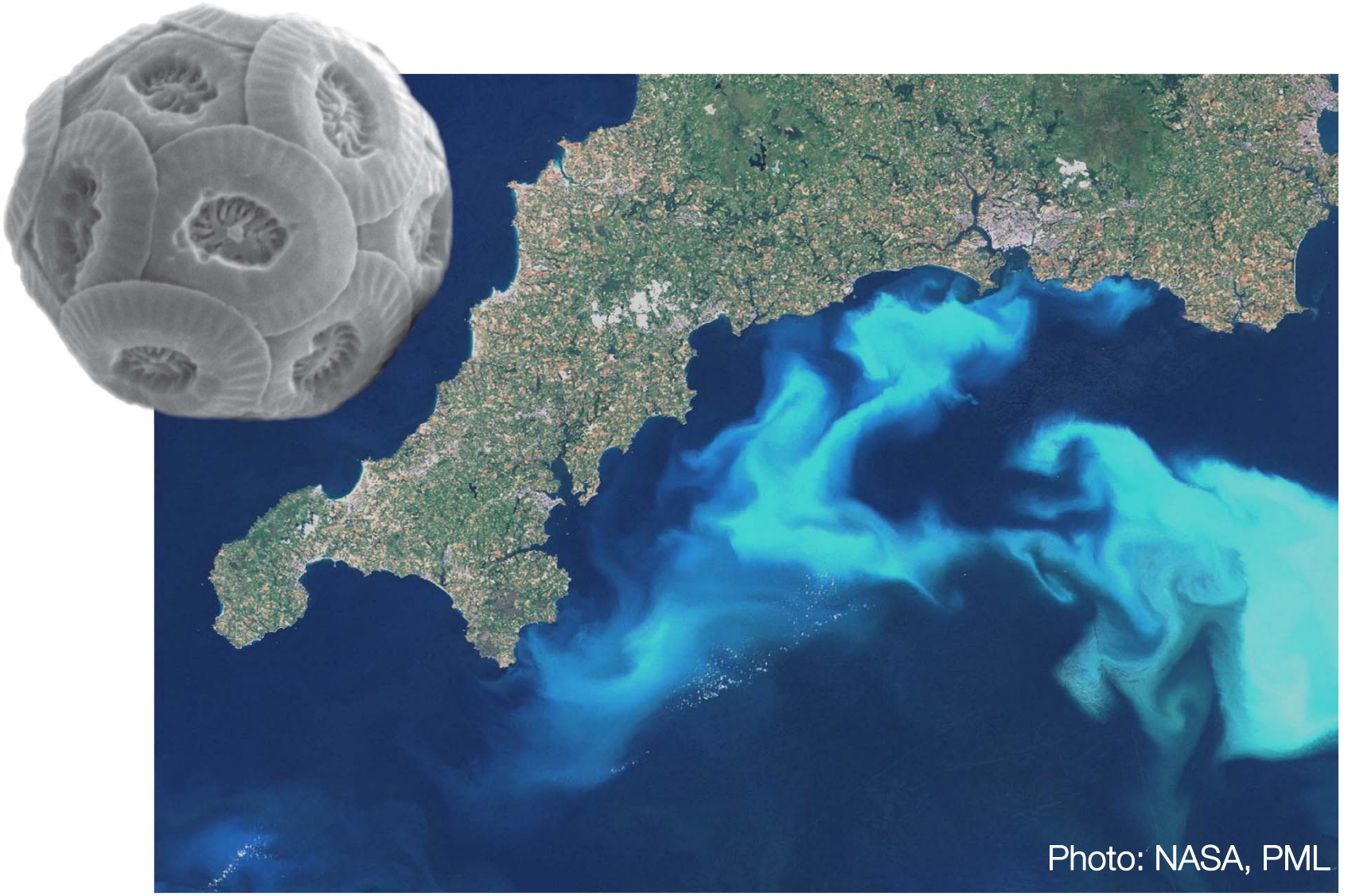
Ocean Acidifcation



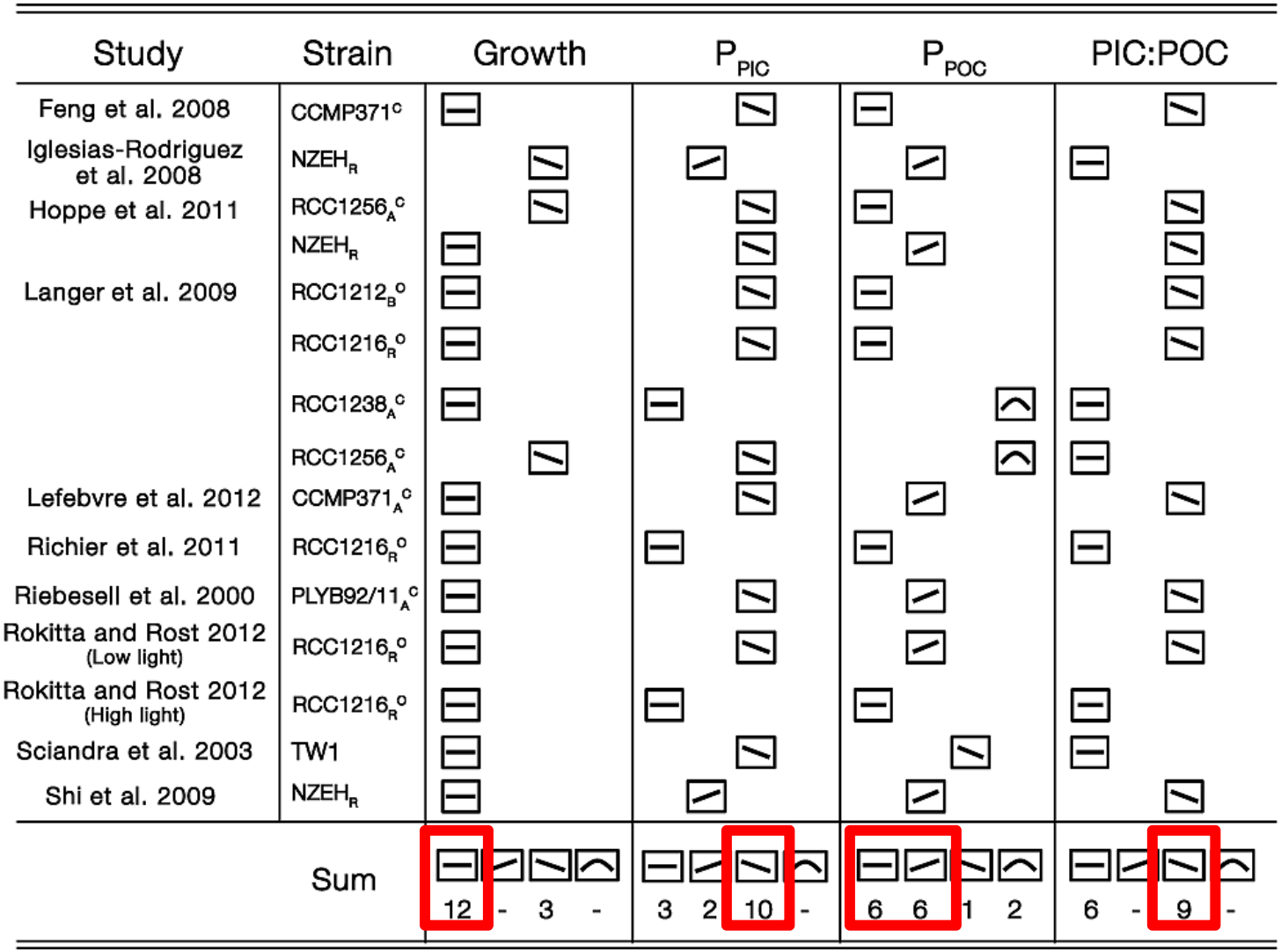
After Wolf-Gladrow et al. (1999)

Coccolithophores



Biological carbon pumps

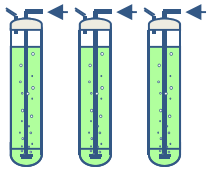
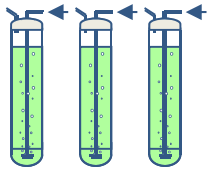
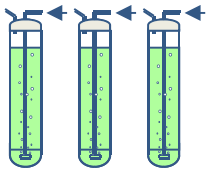
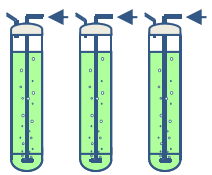
OA-responses in *E. huxleyi*



Modified from Hoppe et al. (2011)

Energization?

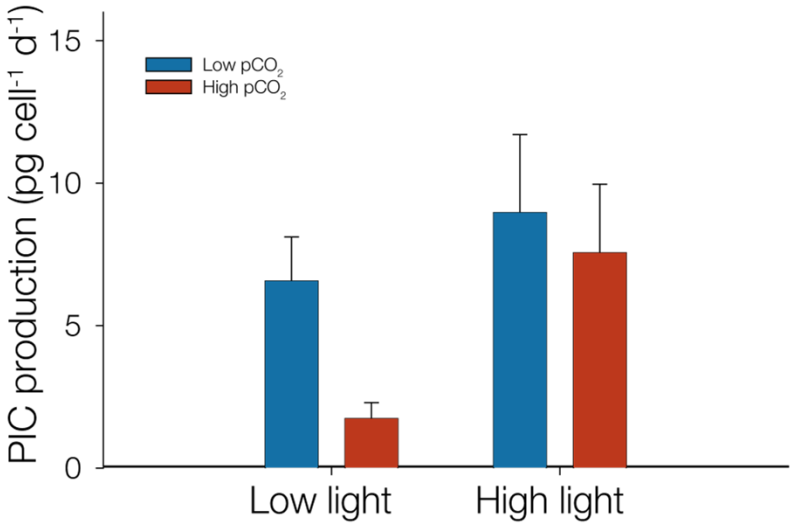
The matrix approach

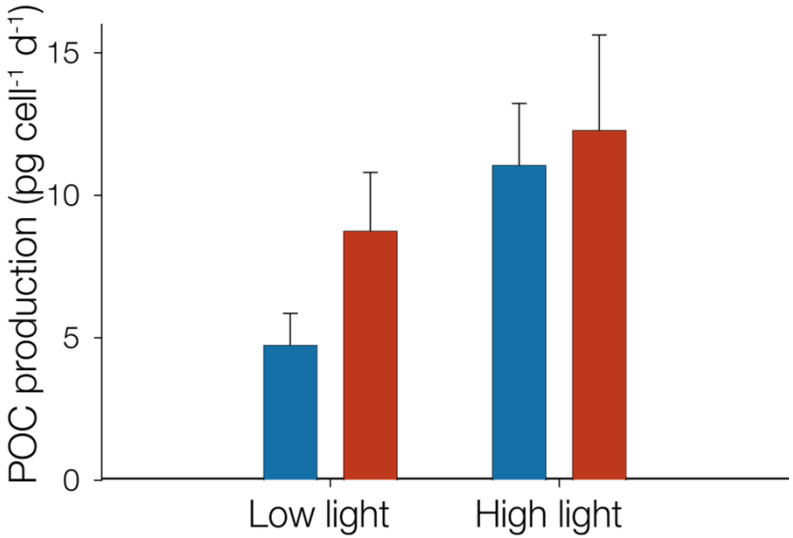
Light vs. pCO_2	380 µatm	1000 µatm
50 µmol photons m^{-2} s^{-1}		
300 µmol photons m^{-2} s^{-1}		

- Acclimation data (µ, POC, PIC)
- Physiology (C_i acquisition, light reactions)
- Transcriptomics (gene expression)

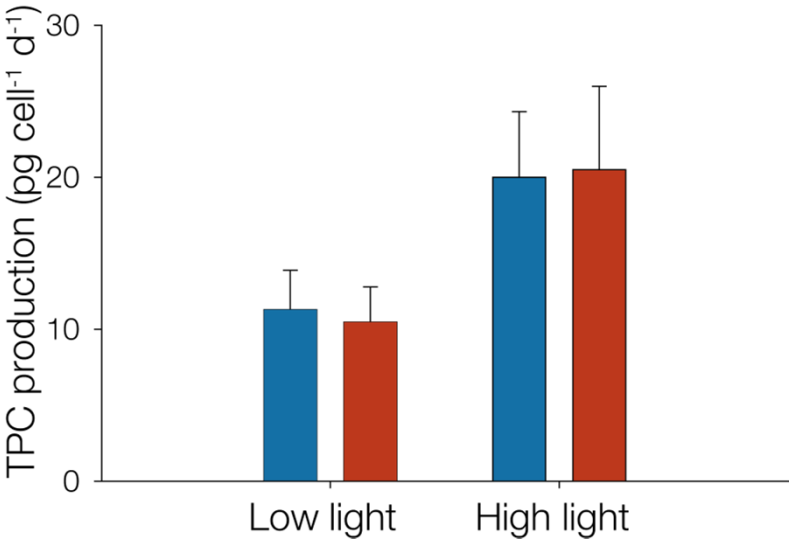
Phenomenology

Rokitta & Rost (2012)



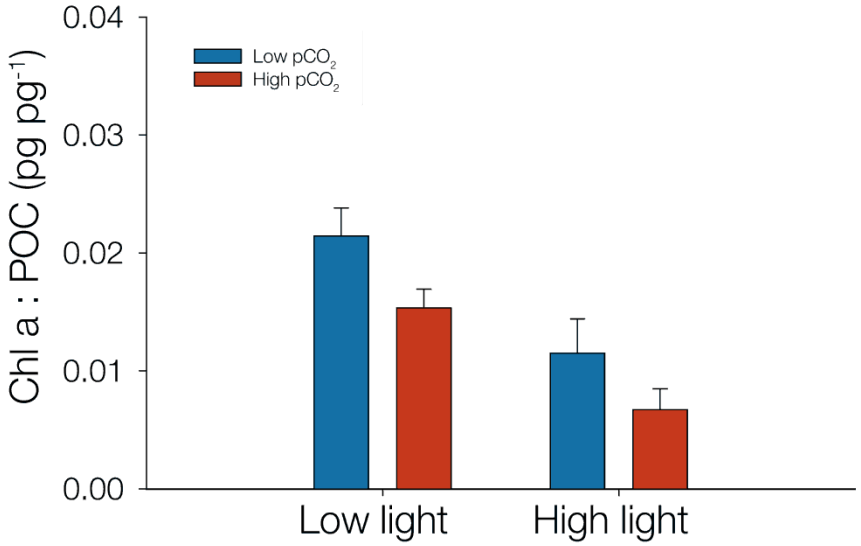


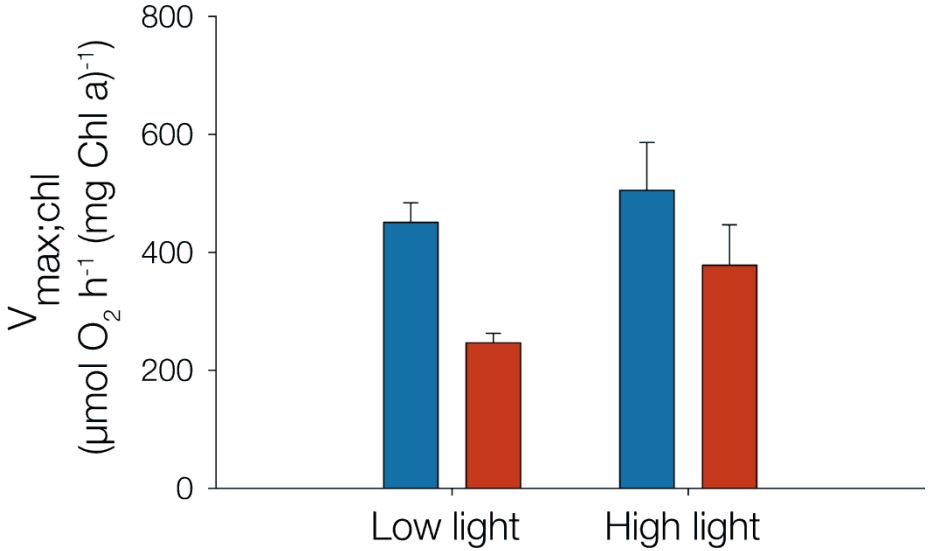
- PIC production drops (especially under low light!)
- POC production is boosted (especially under low light!)
- TPC production is insensitive



Physiology

Rokitta & Rost (2012)



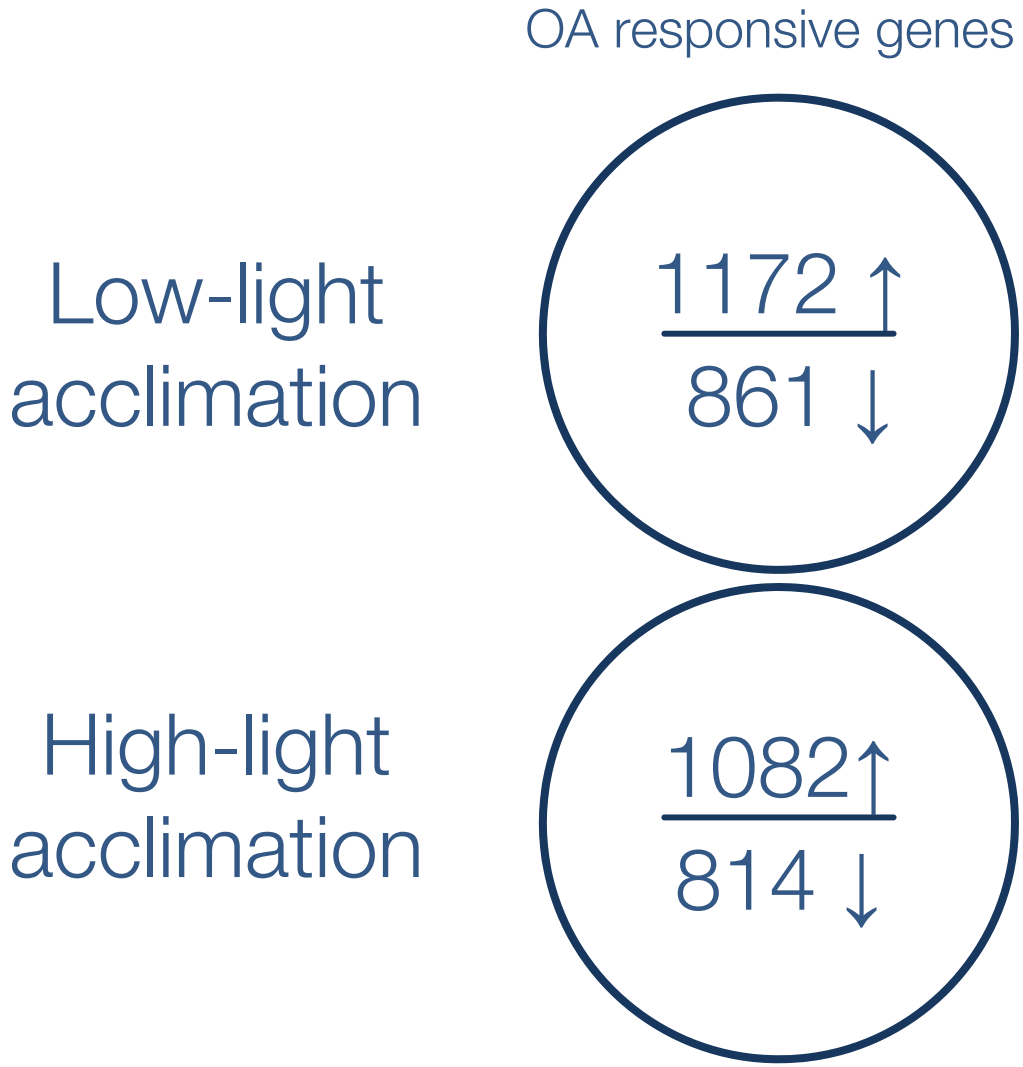


- More POC despite less pigmentation and O_2 evolution

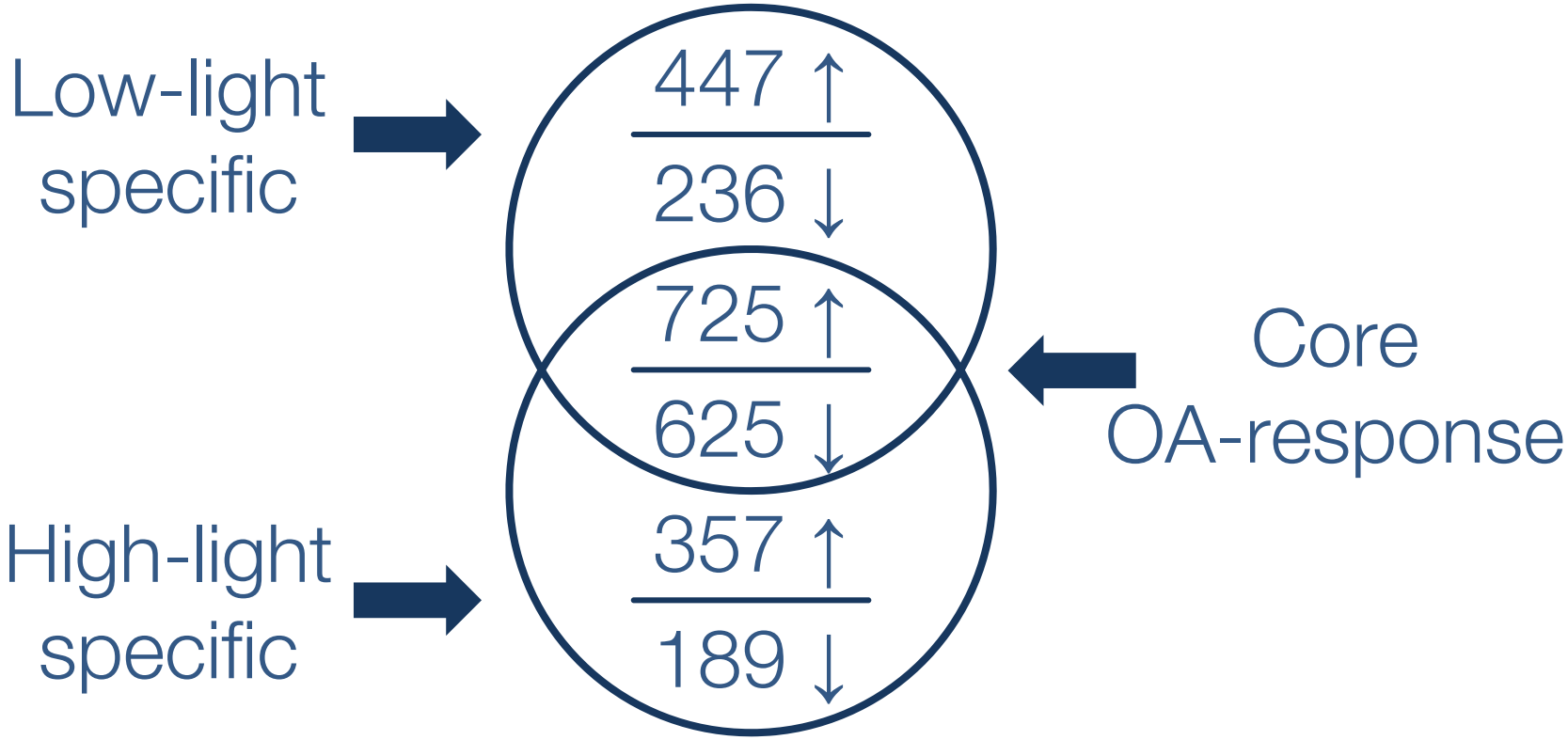
→ Improved energy efficiency under OA

Gene expression?

Transcriptomics



Transcriptomics



Transcriptomics

Carbon metabolism

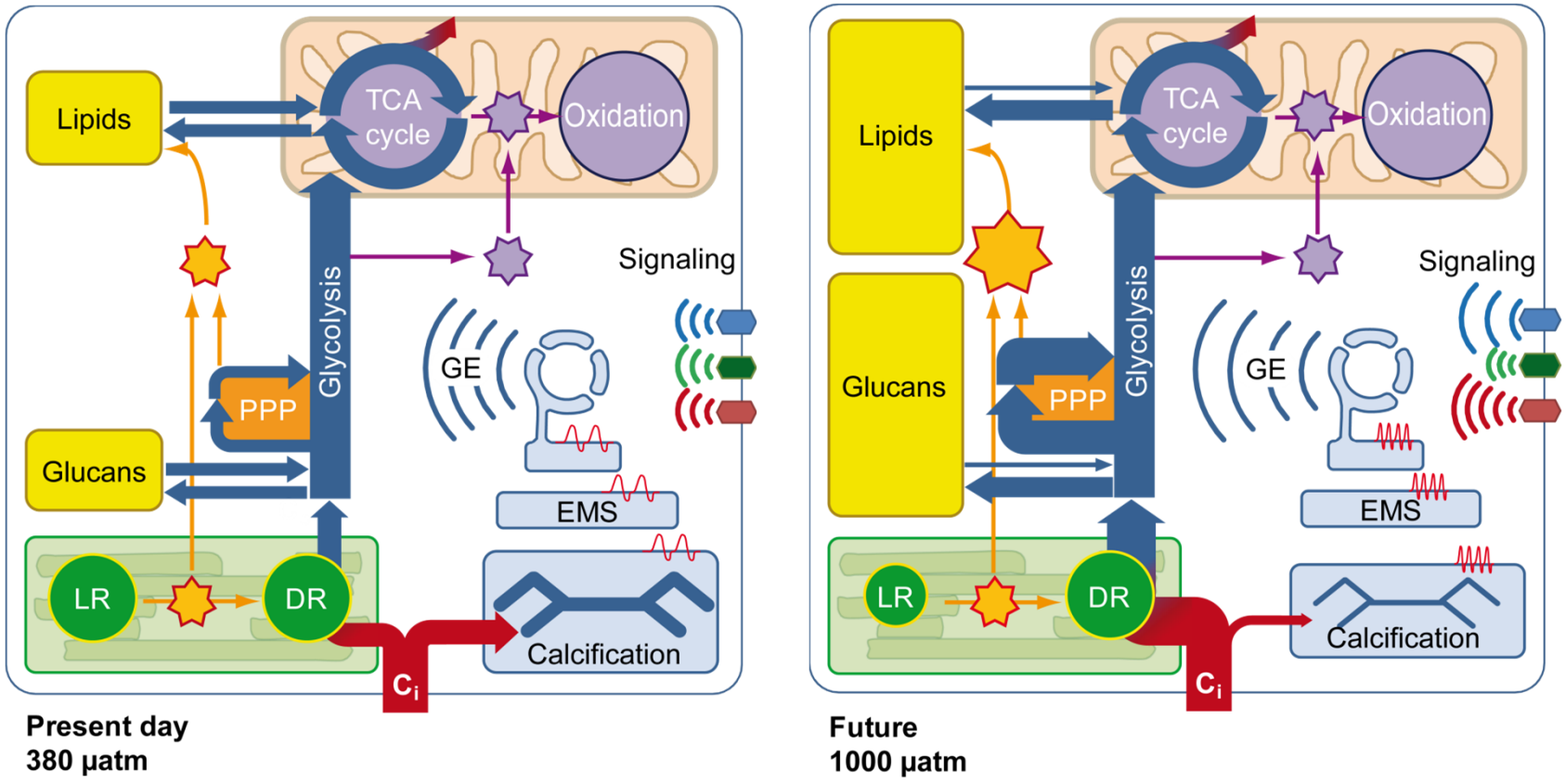
Light physiology

Signalling

Ion fluxes

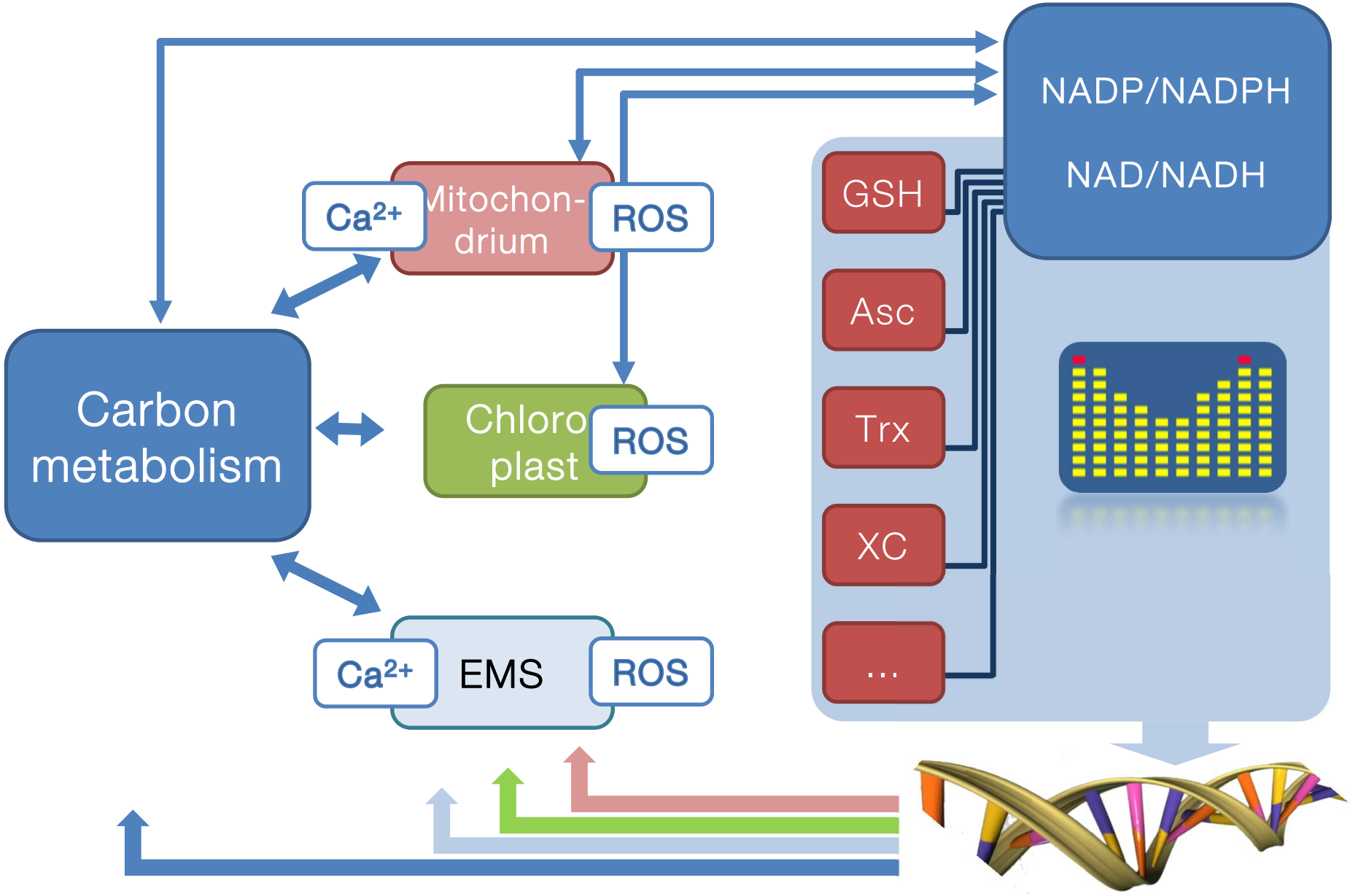
Pentose phosphate pathway ↑ Glycolysis ↓ Fatty Acid & Glucan anabolism↑	Regulation of C fluxes ↑	Organellar shuttling ↑
Energy dissipation ↑	Energy dissipation ↑	
Lipid and IP_3 signaling ↑		
Membrane potentials ↑		

OA re-wires carbon fluxes



NADPH NADH

OA affects the redox hub



Conclusions

- OA causes a shunting of carbon from calcification towards biomass production
- OA-Responses are modulated by energy availability and typically attenuated by high light
- OA affects cellular signaling and the redox hub and thereby re-wires carbon flux networks