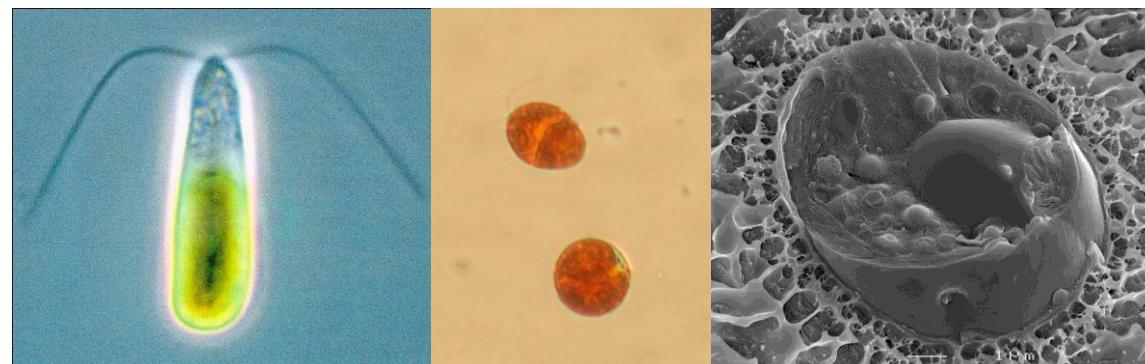
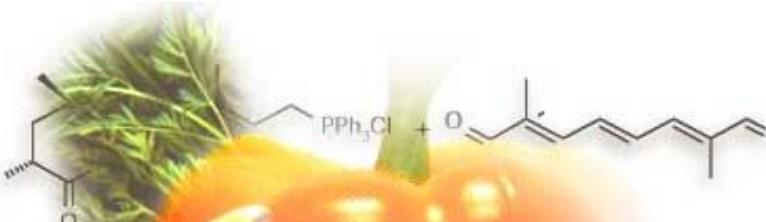


Carotenoid accumulation in *Dunaliella salina*



Packo Lamers

Carotenoids



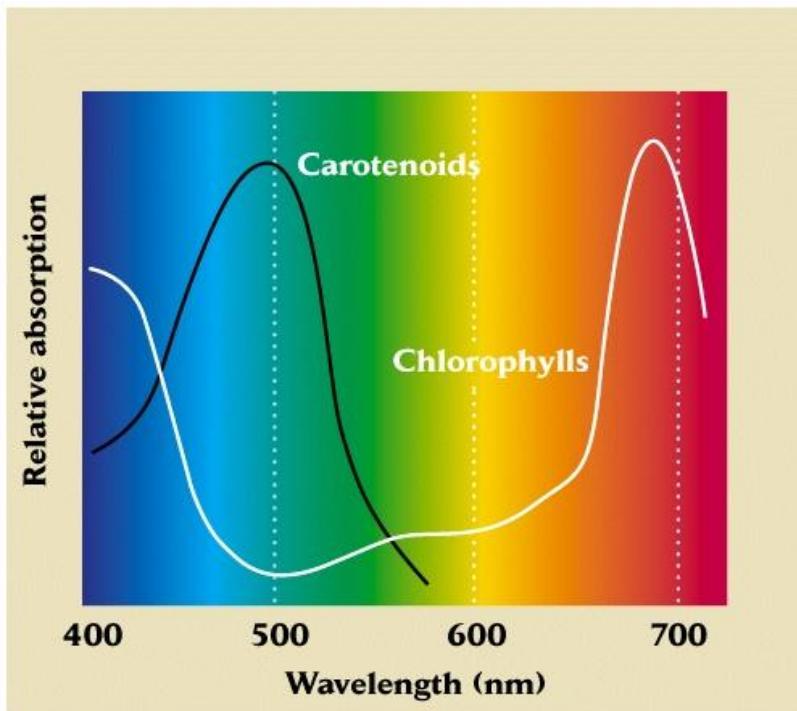
CAROTENOIDS ARE PIGMENTS



Antioxidant activity



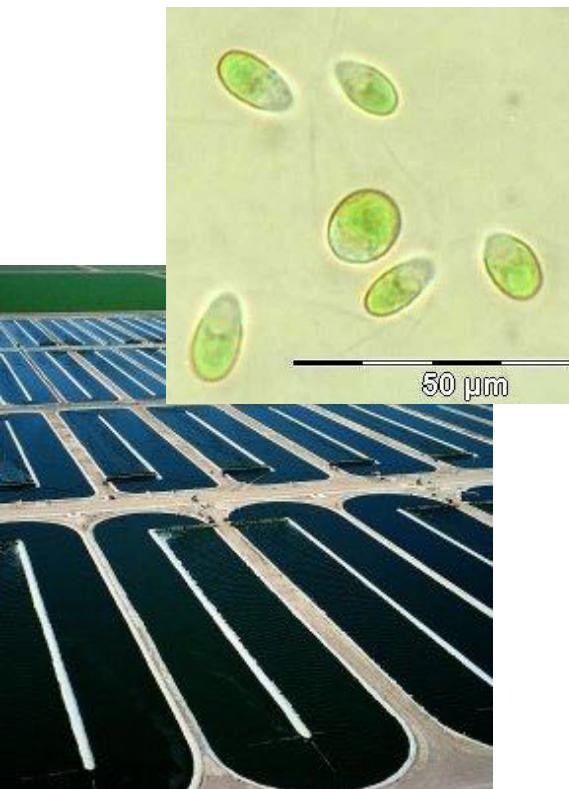
Provitamin A



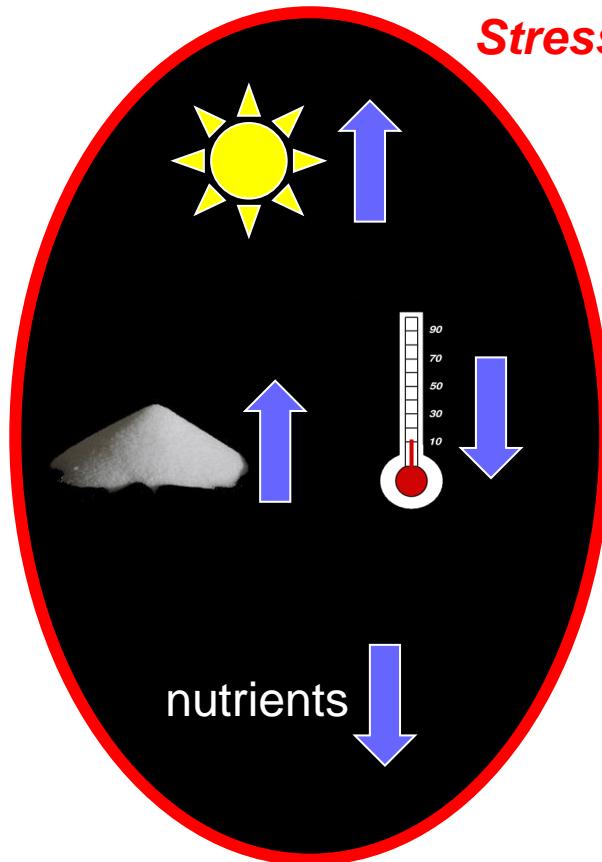
Applications in food, feed and cosmetics

Dunaliella salina

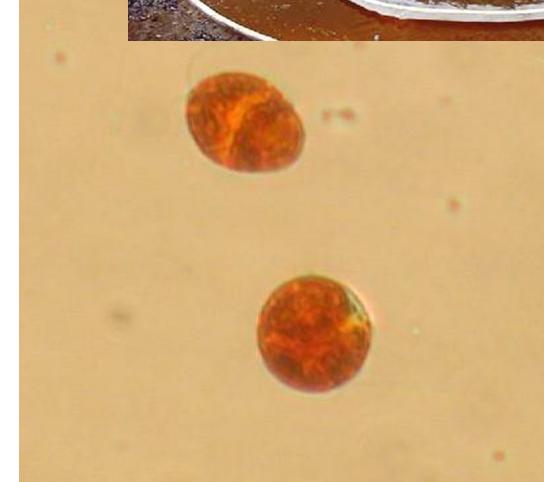
Normal growth



Stress!!



Carotenoid production





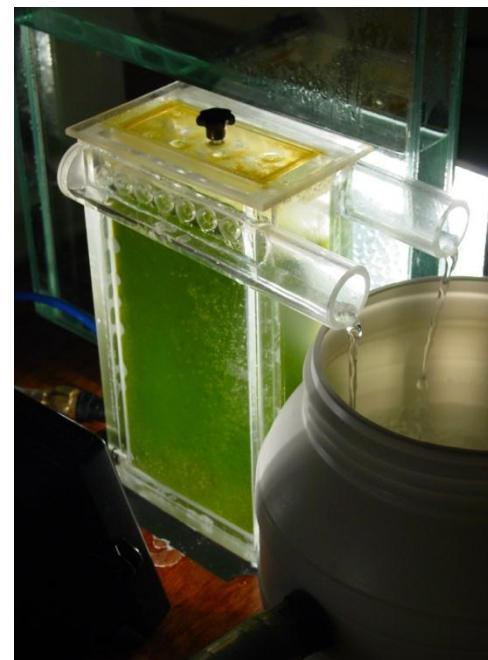
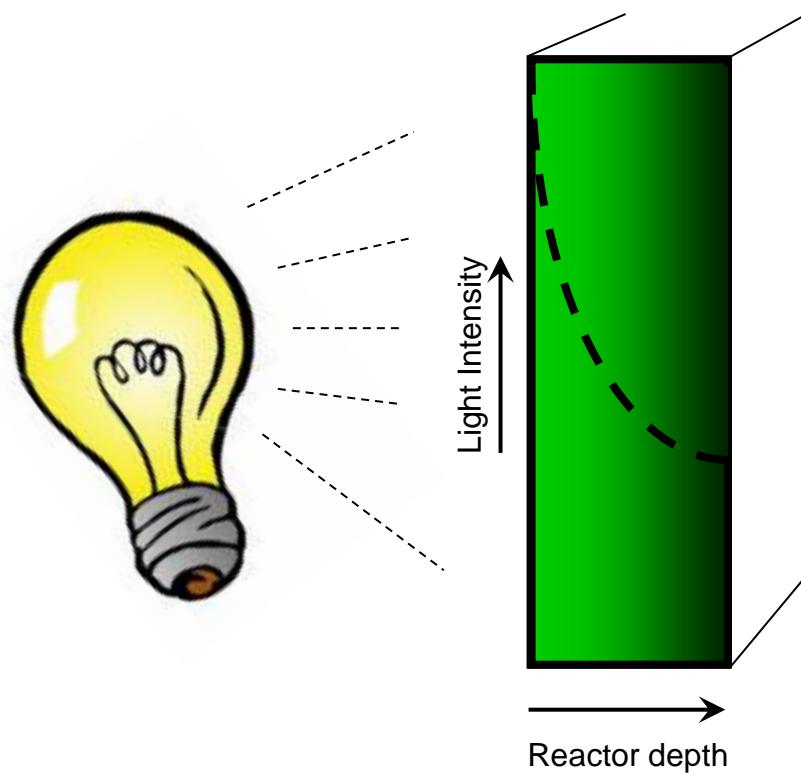
Mechanisms involved in carotenogenesis?

Research questions

- Similar effects on stress response by light intensity and nitrogen starvation?
- Relation between fatty acid and carotenoid metabolism?

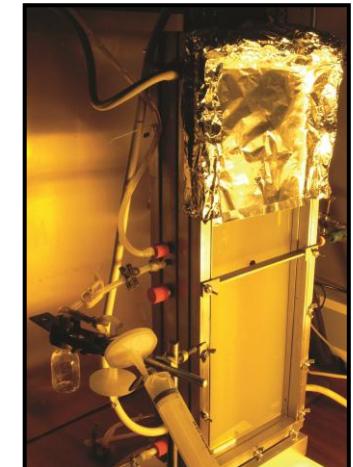
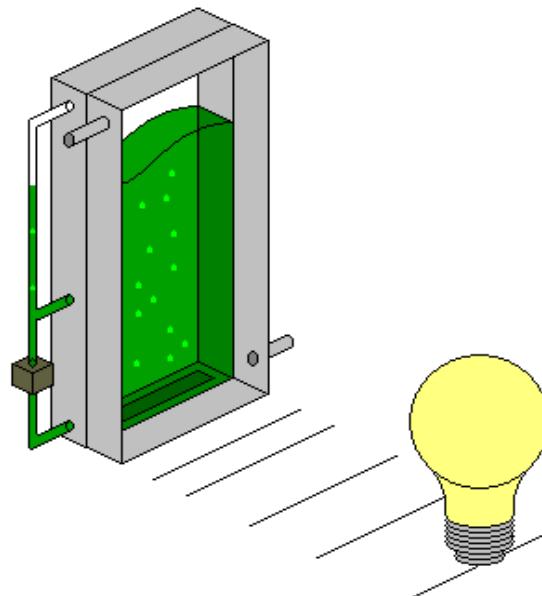
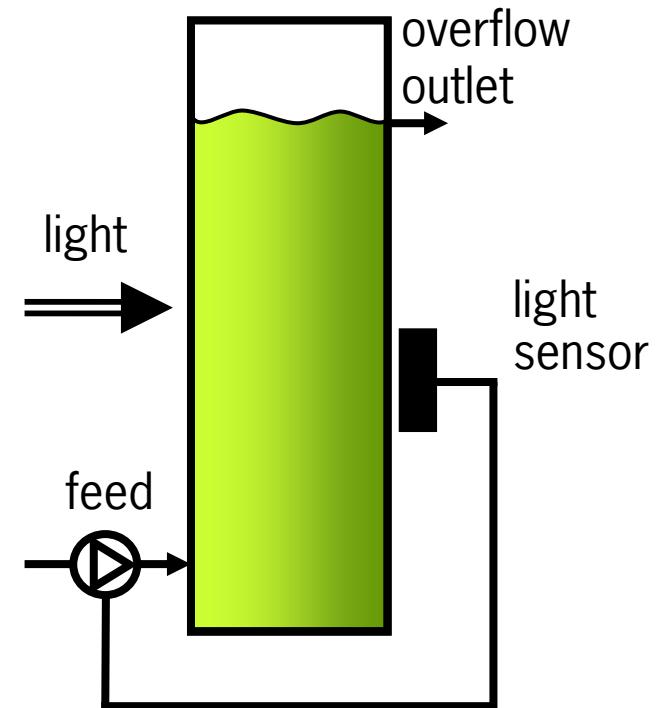
Stress assessment

- Batch experiments: various environmental conditions
- Light intensity is most important determinant of carotenoid production

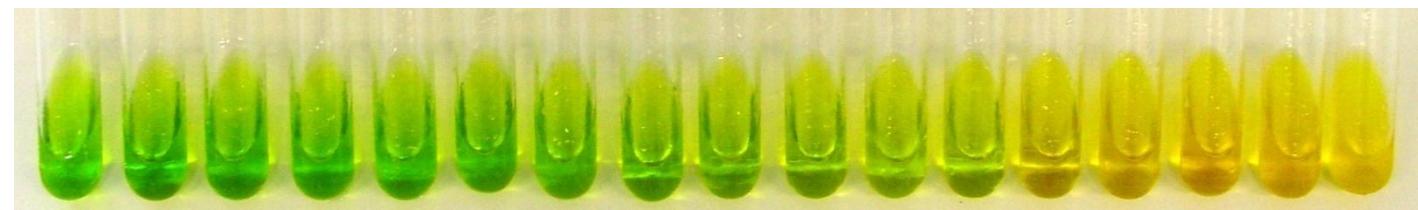
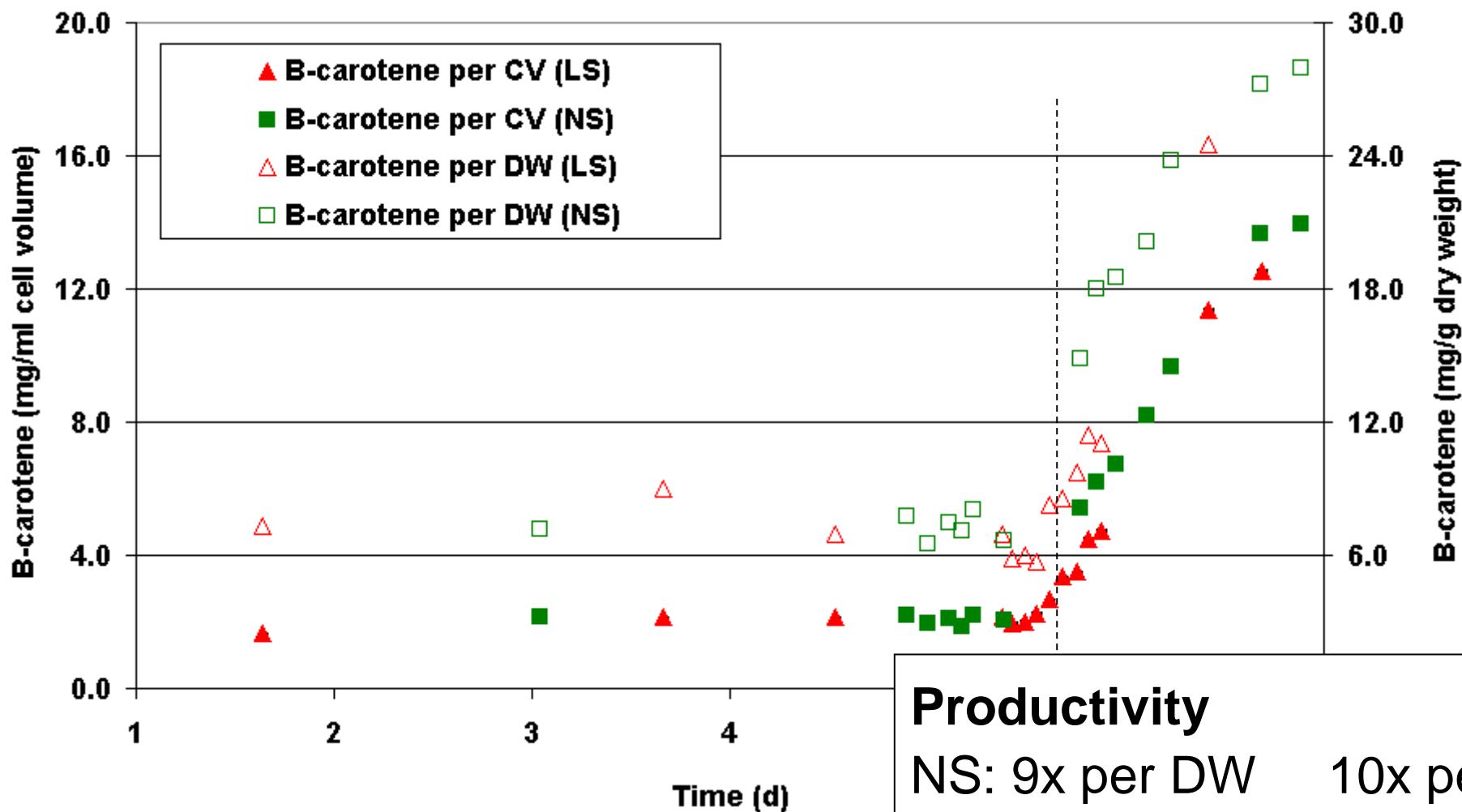


Turbidostat

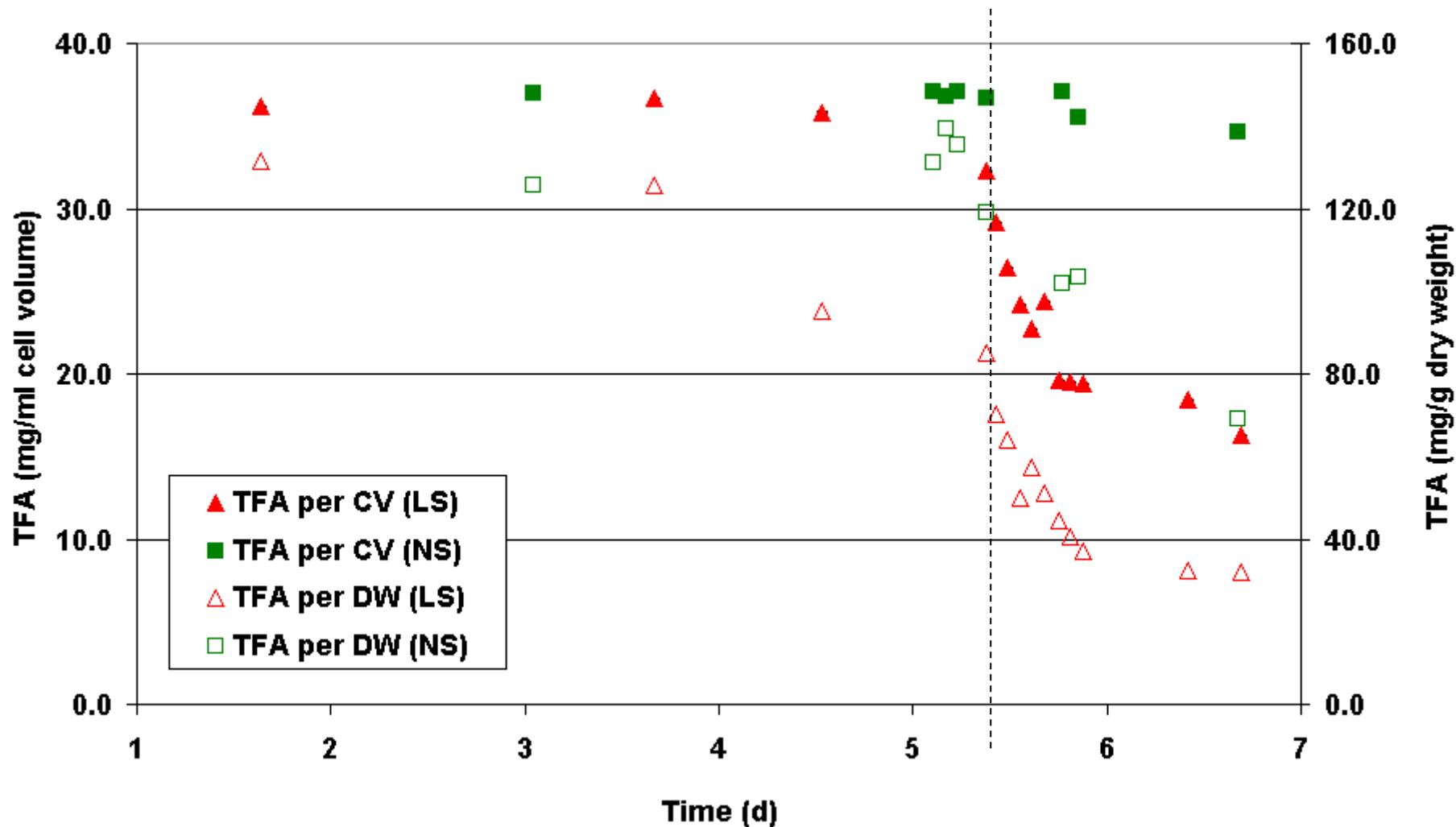
- Turbidostat
- Defined and stable light regime
- Stepwise increase of light
 - $200 \rightarrow 1400 \mu\text{mol/m}^2\text{s}$
- Nitrogen run-out



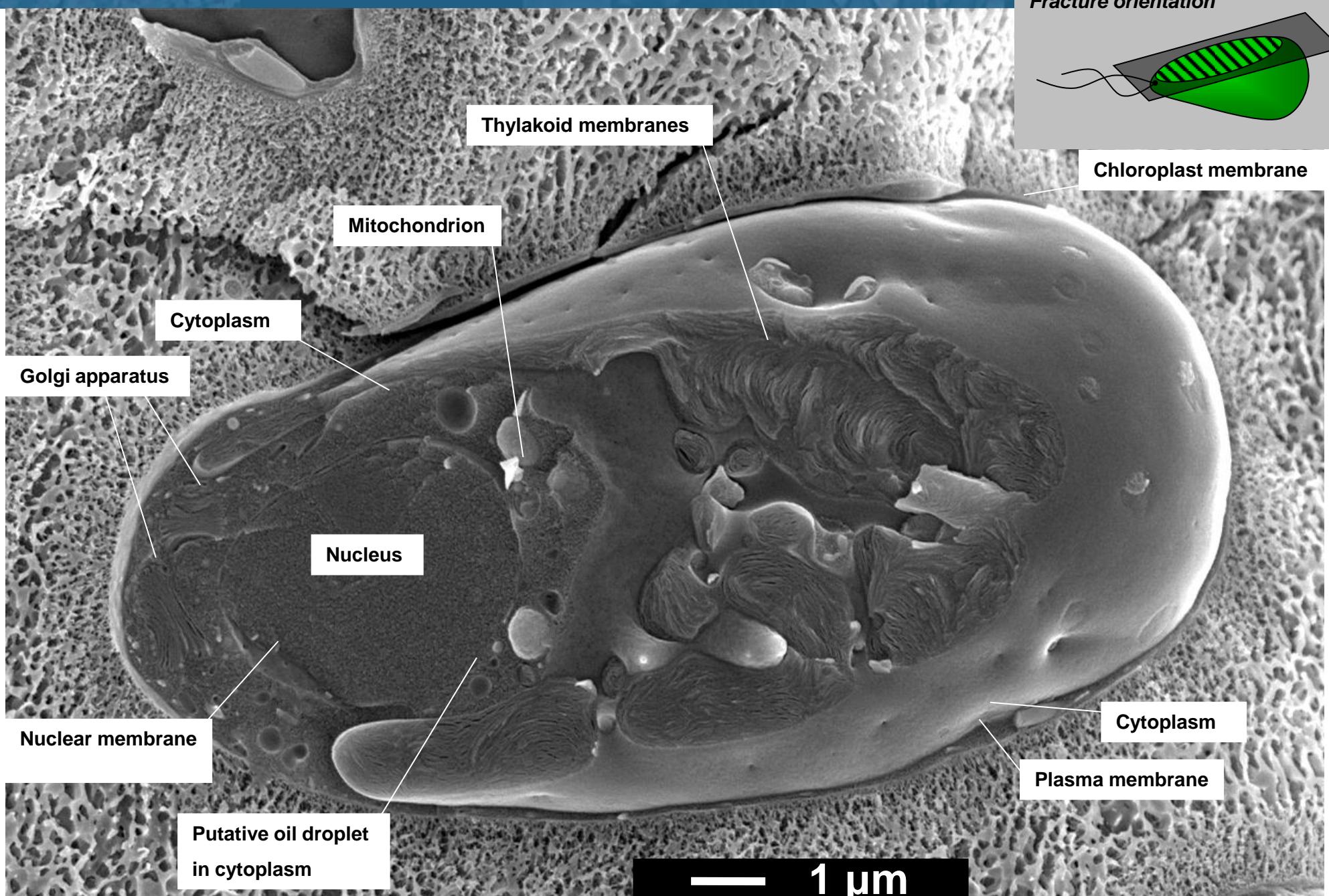
β -carotene



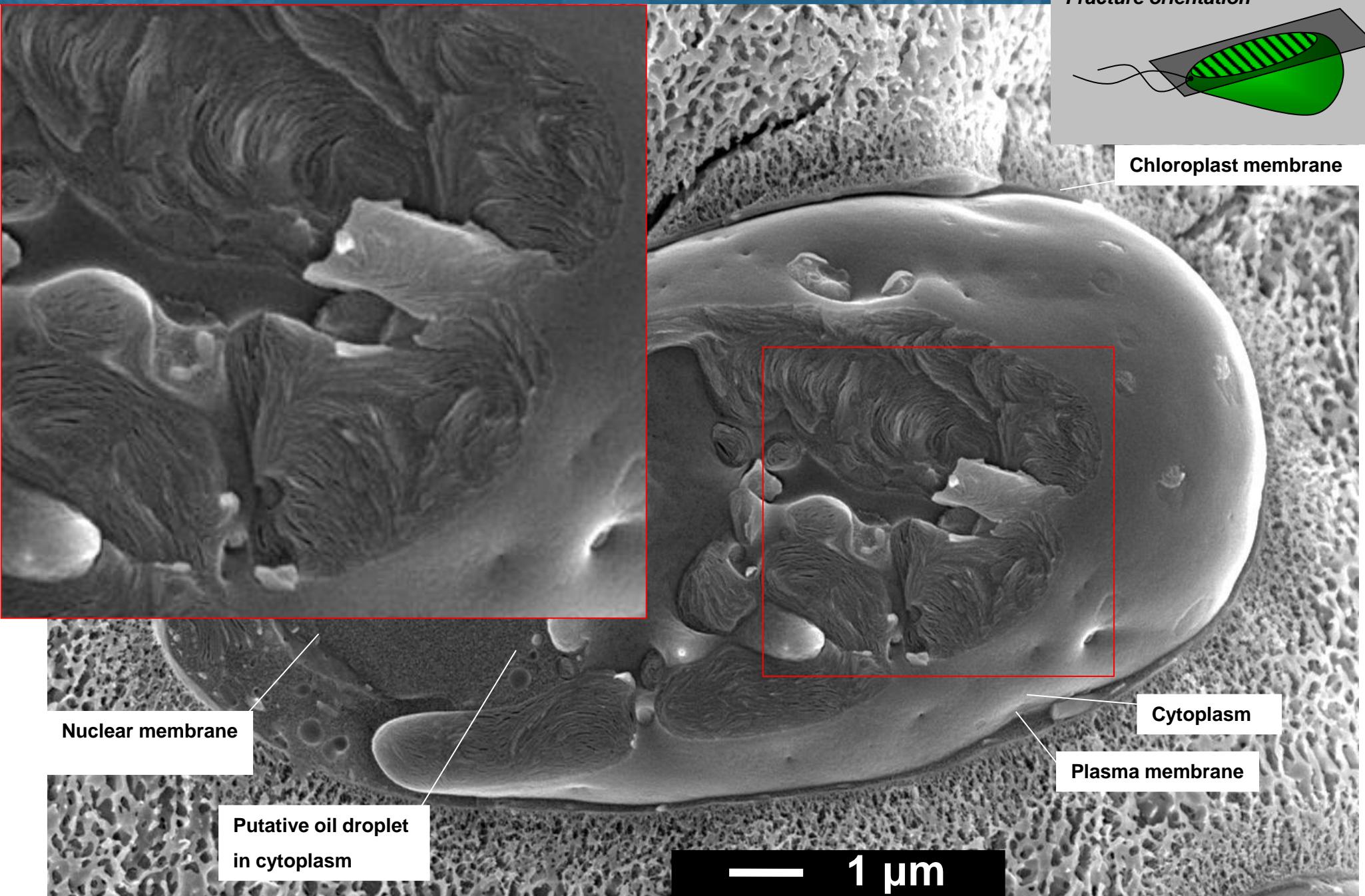
Total fatty acids



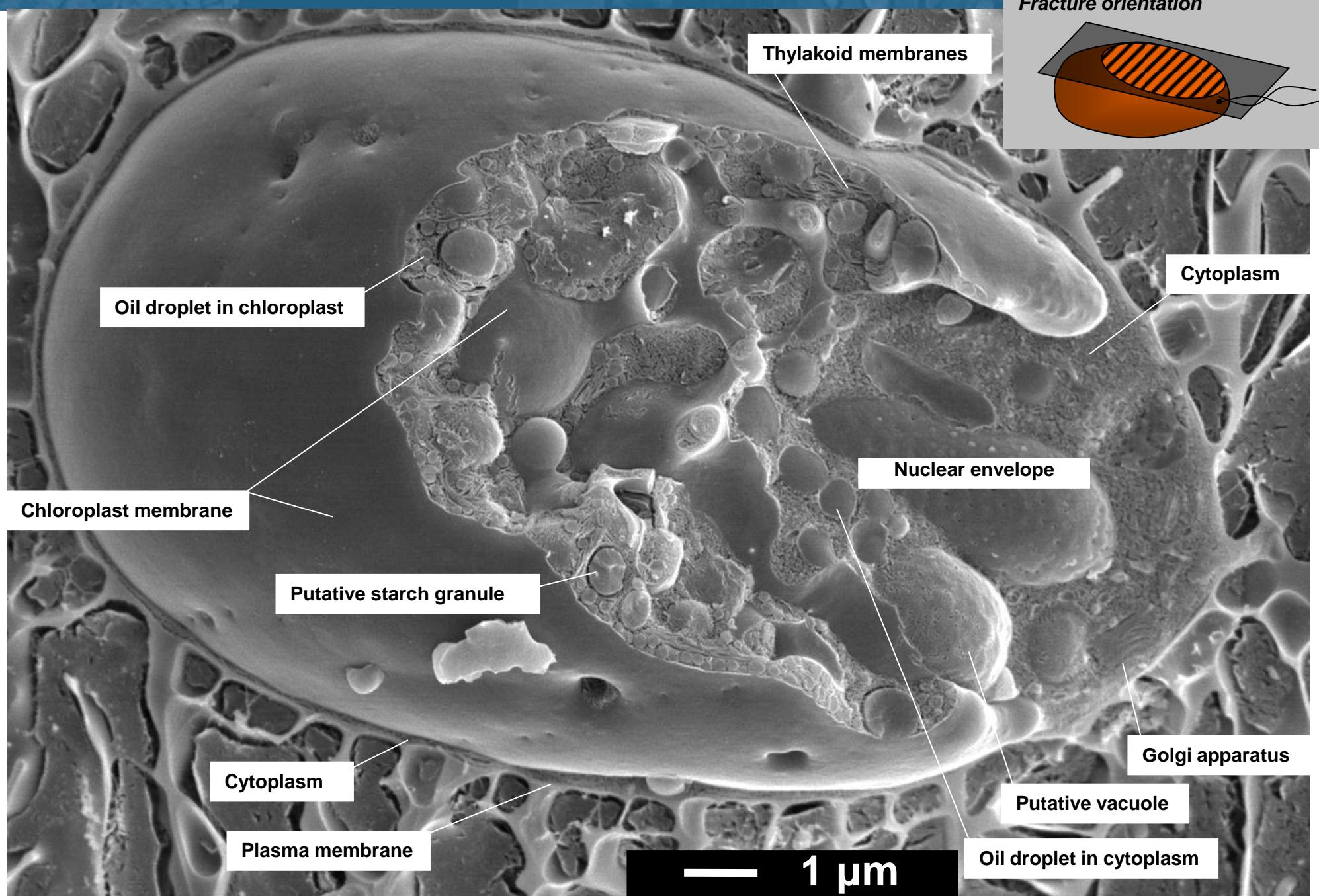
Non-stressed *Dunaliella salina*



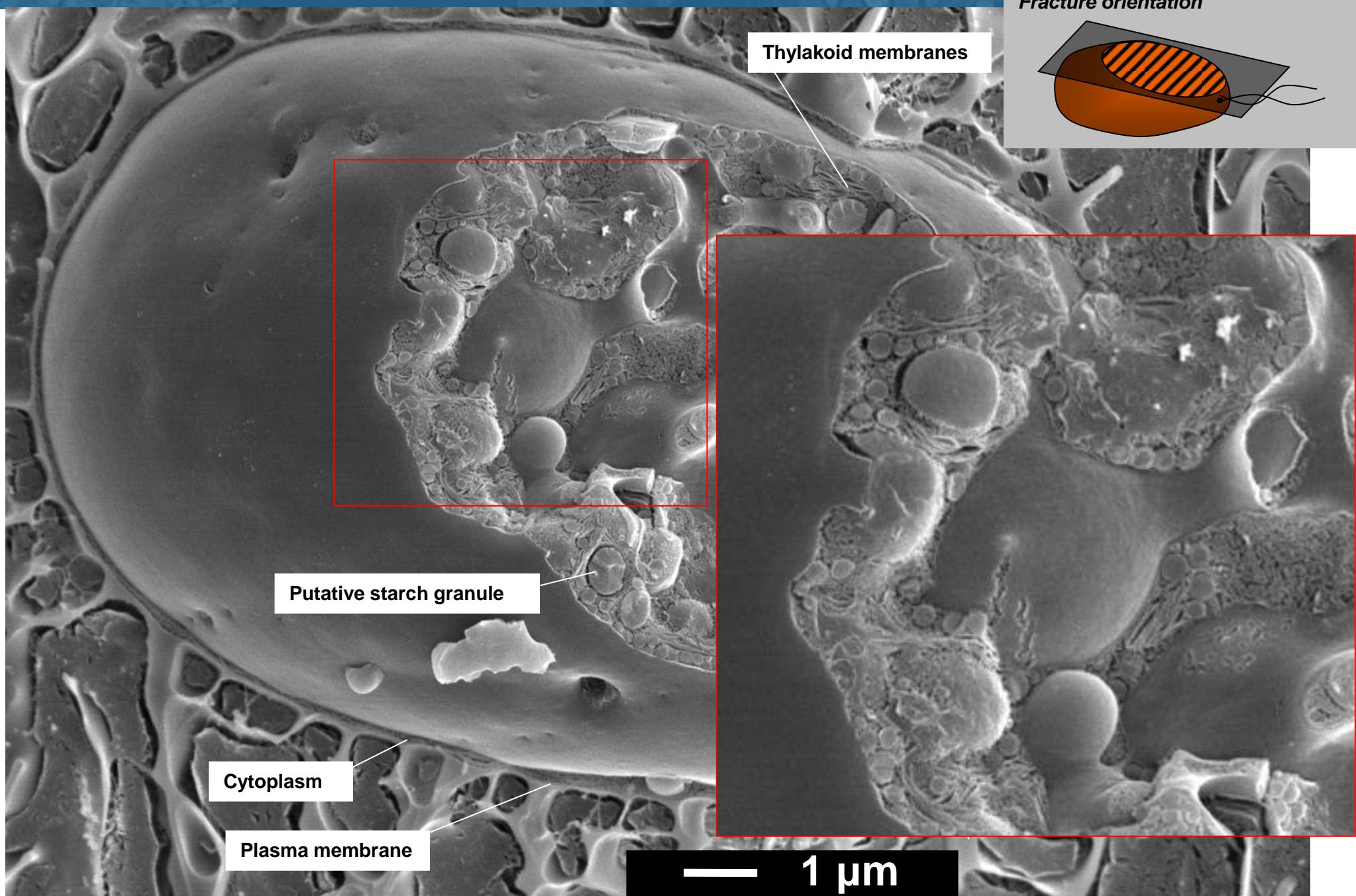
Non-stressed *Dunaliella salina*



Stressed *Dunaliella salina*



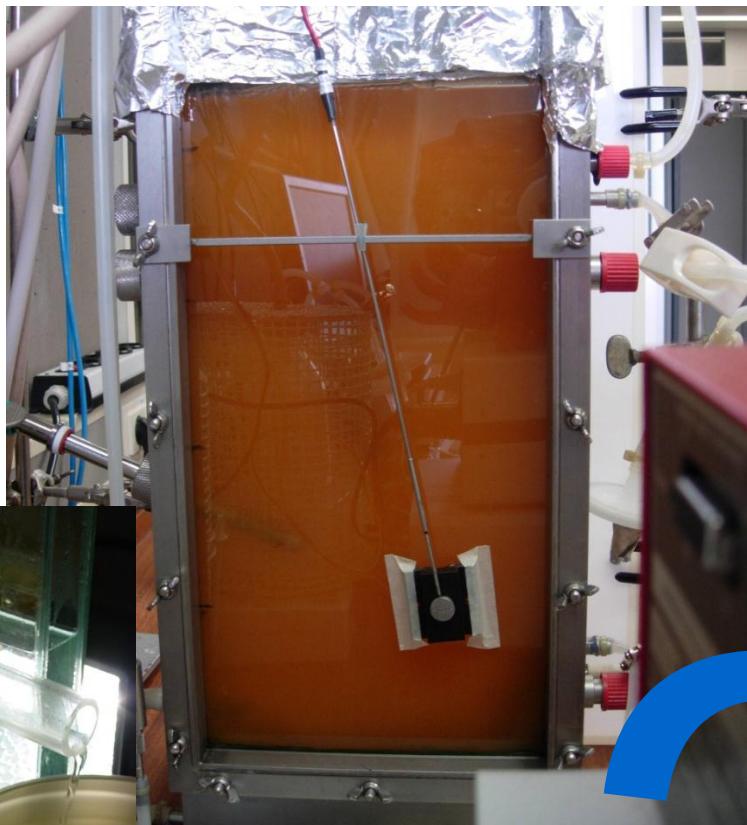
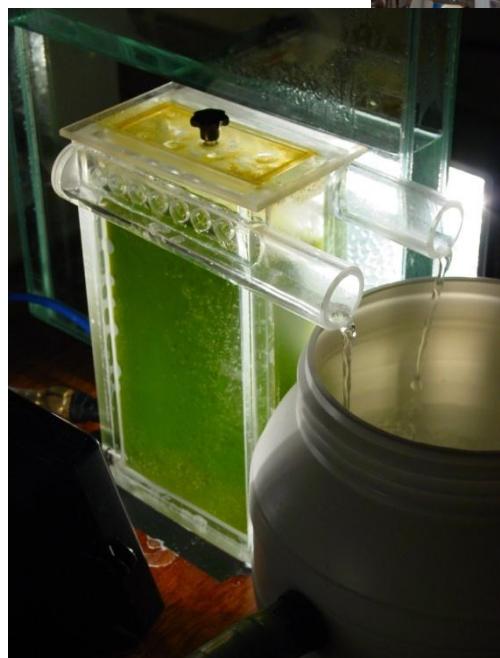
Stressed *Dunaliella salina*



Conclusions

- High light stress and nitrogen starvation cause similar responses
- Total fatty acid and carotenoid metabolism are not correlated

Questions/discussion



www.algae.wur.nl

Carlien van de Laak

Petrouchka Kaasenbrood

Jeroen Lorier

Marcel Janssen

Ric de Vos

Raoul Bino

René Wijffels

Katja Grolle

Fred van den End

Geert Stoopen

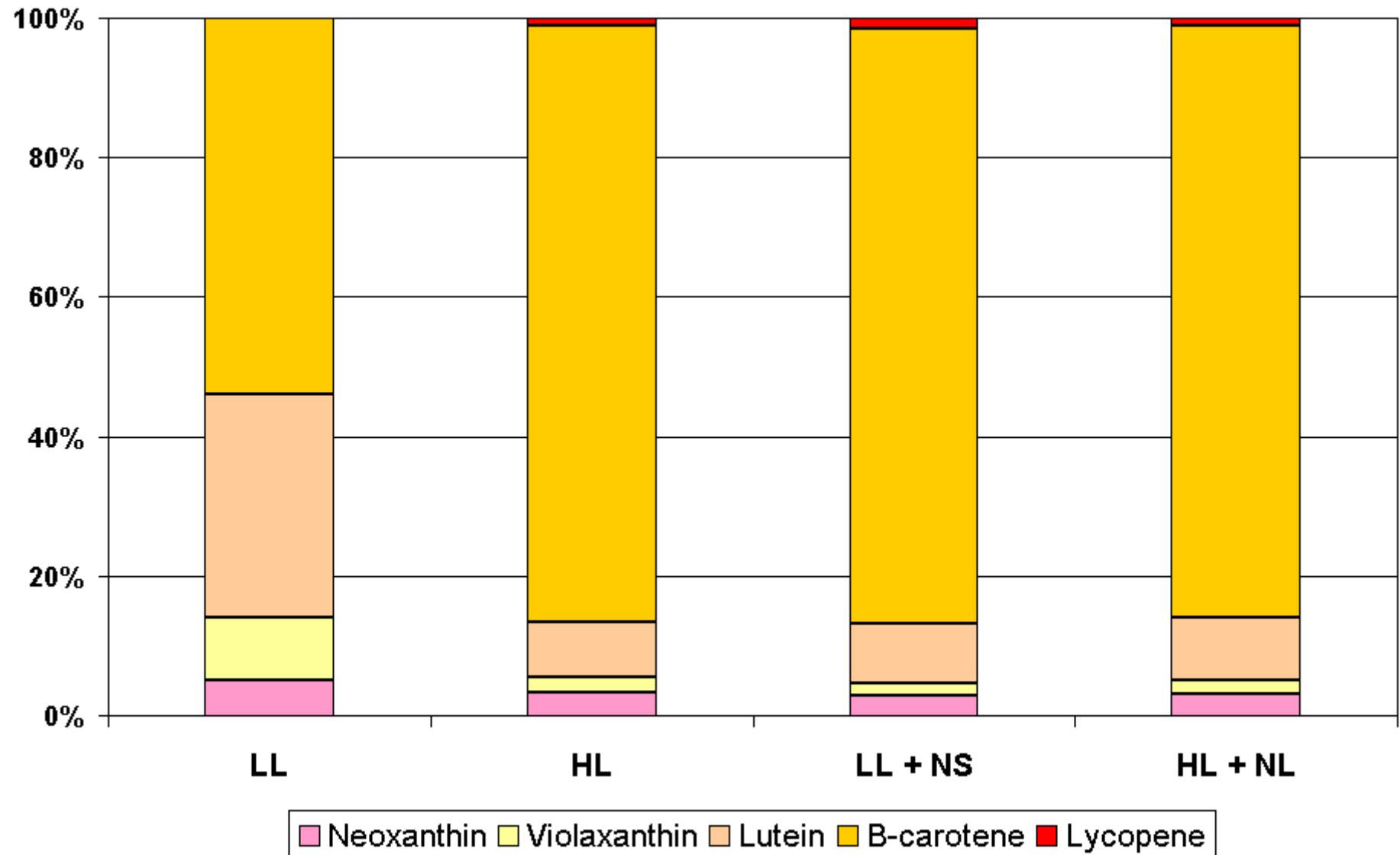
Francel Verstappen

Harry Jonker

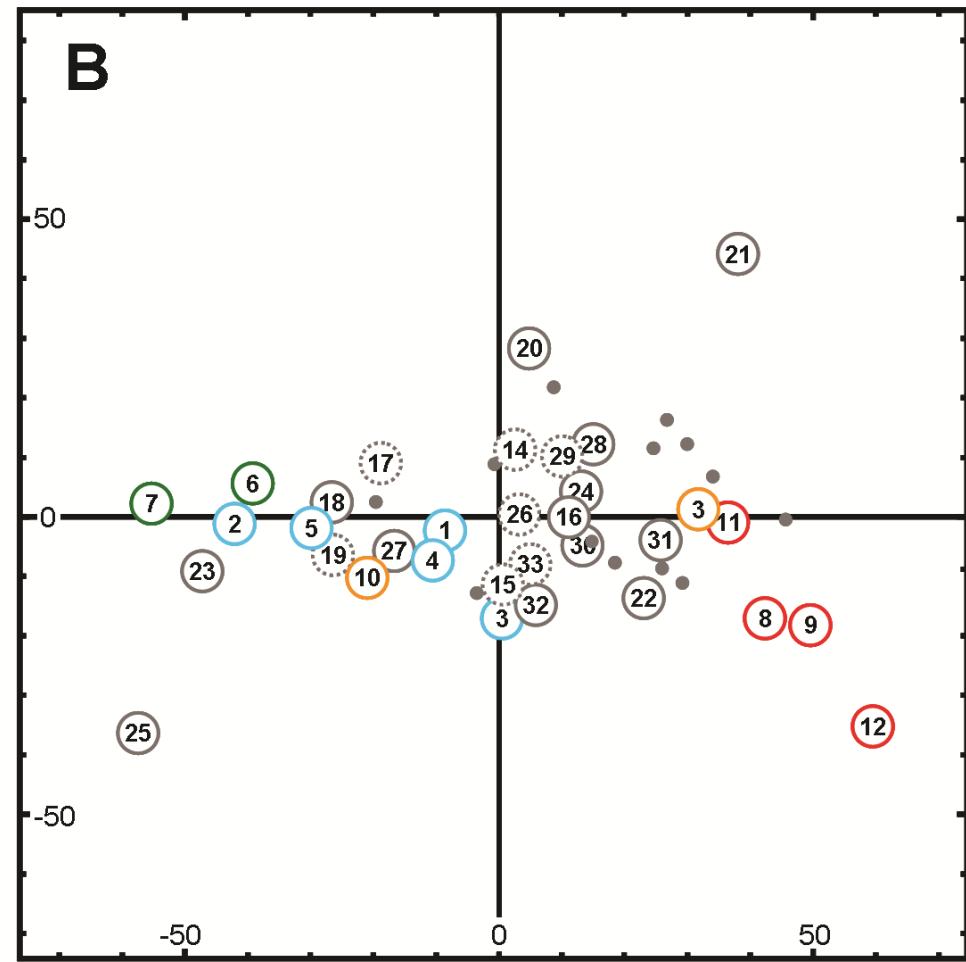
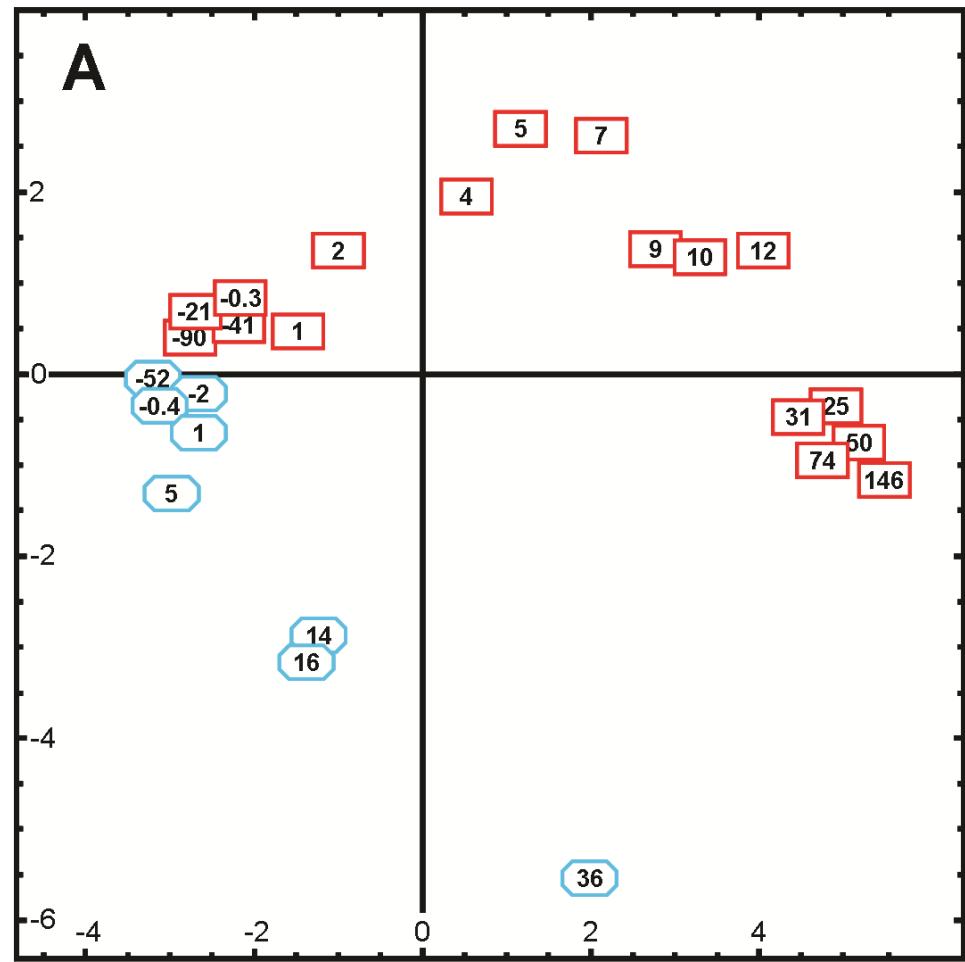
Hans Helsper

Adriaan van Aelst

Carotenoid composition in batch



(a)polar metabolites



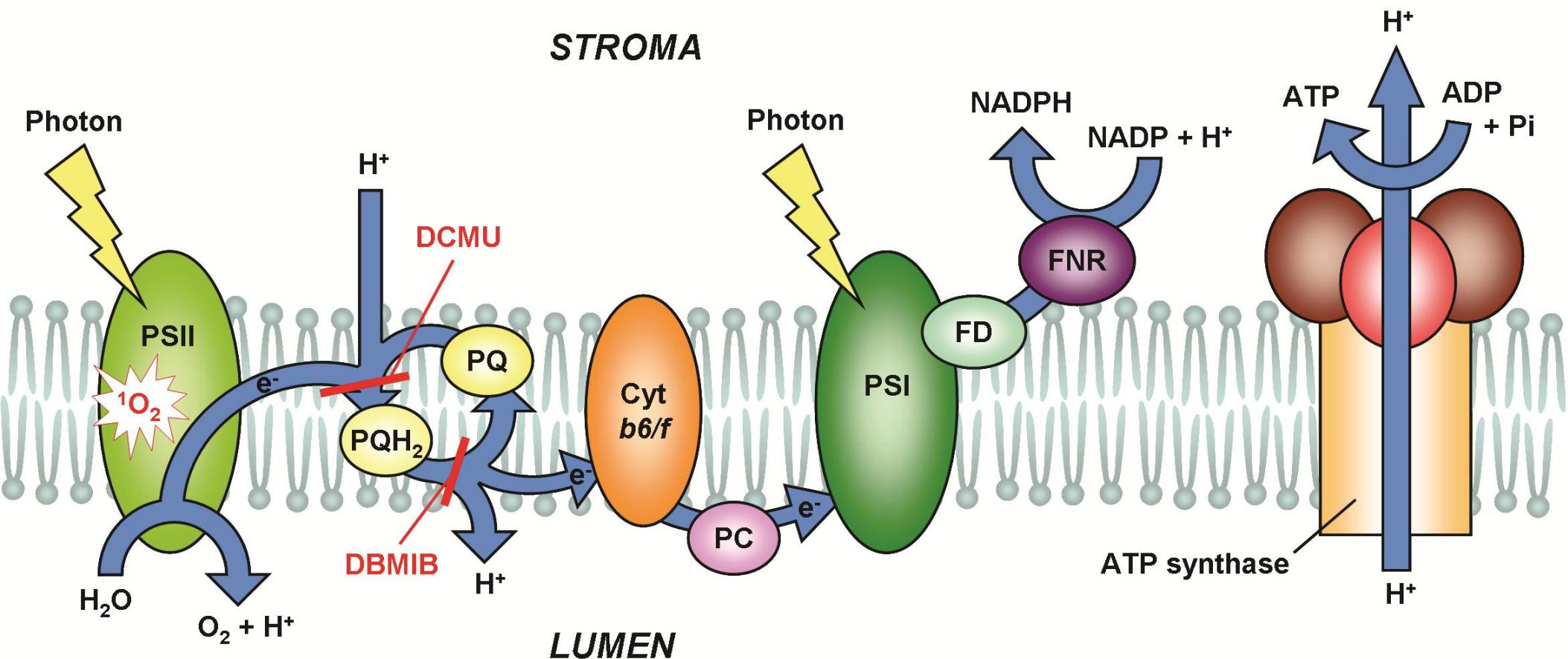
Stress sensing hypothesis

One mechanism to detect:

Imbalance between supply and demand of energy



Stress signal & sensor



Plastoquinone pool redox regulation for:
LHCII complex synthesis (*D. salina* & *D. tertiolecta*)
Astaxanthin production (*H. pluvialis*)

Inhibitors

	LL		HL		NS (LL)	
	<i>growth</i>	β -carotene	<i>growth</i>	β -carotene	<i>growth</i>	β -carotene
No inhibitors	100 %	1.7	100 %	6.9	100 %	10.6
+ DCMU	86 %	1.9	65 %	4.6	48 %	5.2
+ DBMIB	69 %	1.9	-	-	66 %	10.0

