

# Physiology of Spathe Re-greening in *Zantedeschia*

J. Chen<sup>1</sup>, K.A. Funnell<sup>1</sup>, D.J. Woolley<sup>1</sup>,  
D.H. Lewis<sup>2</sup>, J.R. Eason<sup>2</sup>



# Introduction

- *Zantedeschia* (calla lily)
  - ◆ NZ's second largest export flower
  - ◆ NZ produces the widest range of calla lily in the world
    - ◆ Various colours
    - ◆ Good flower forms
    - ◆ Diverse stem length



Z. 'Cameo'

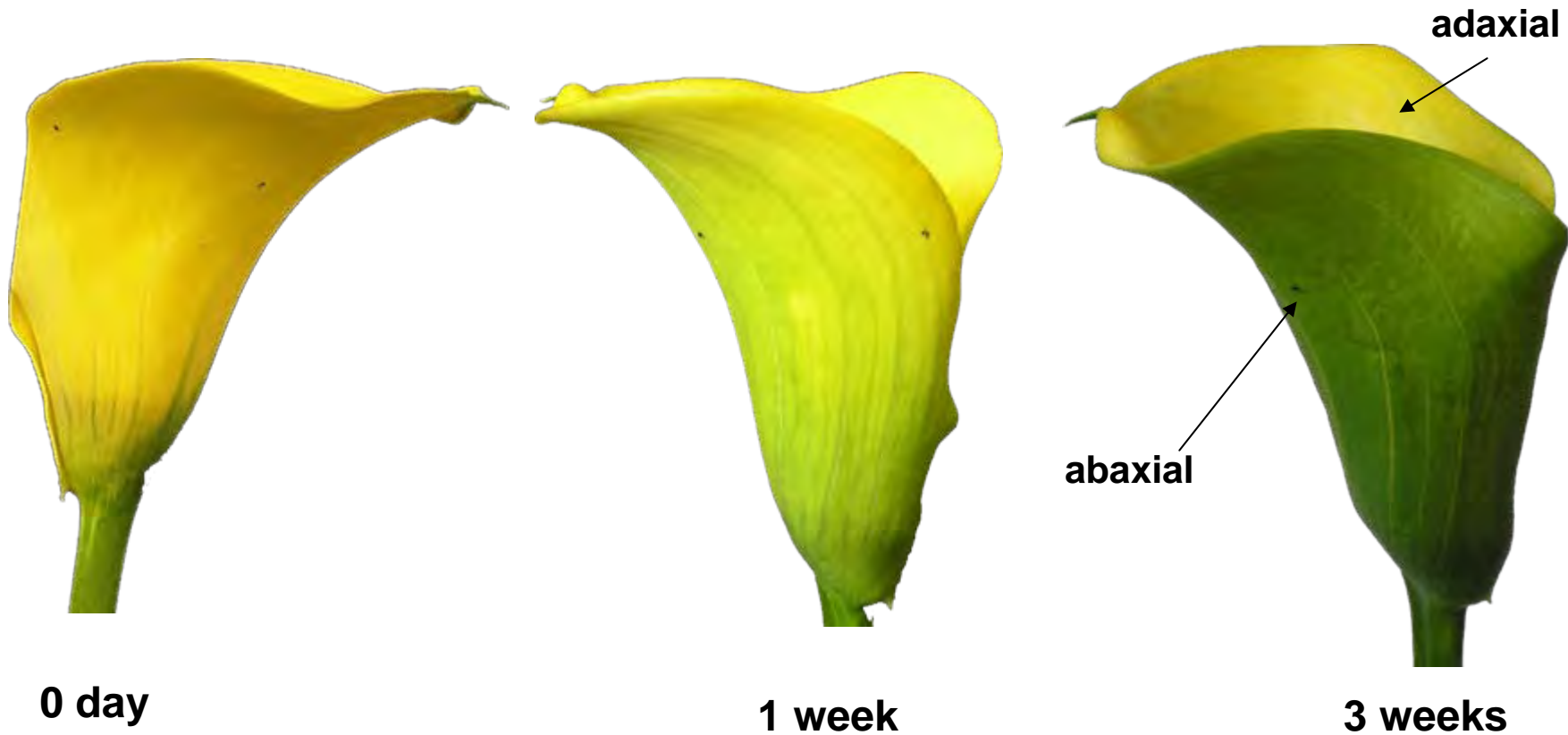


Z. 'Chianti'

# Introduction

- A post-harvest problem for some *Zantedeschia* (e.g. 'Best Gold')

Spathe Re-greening starts in 2-3 days after mature





# What is **re-greening**?

A reversal of Programmed Cell Death

- formation of chloroplast
- increase of chlorophylls
- live longer (months/years)

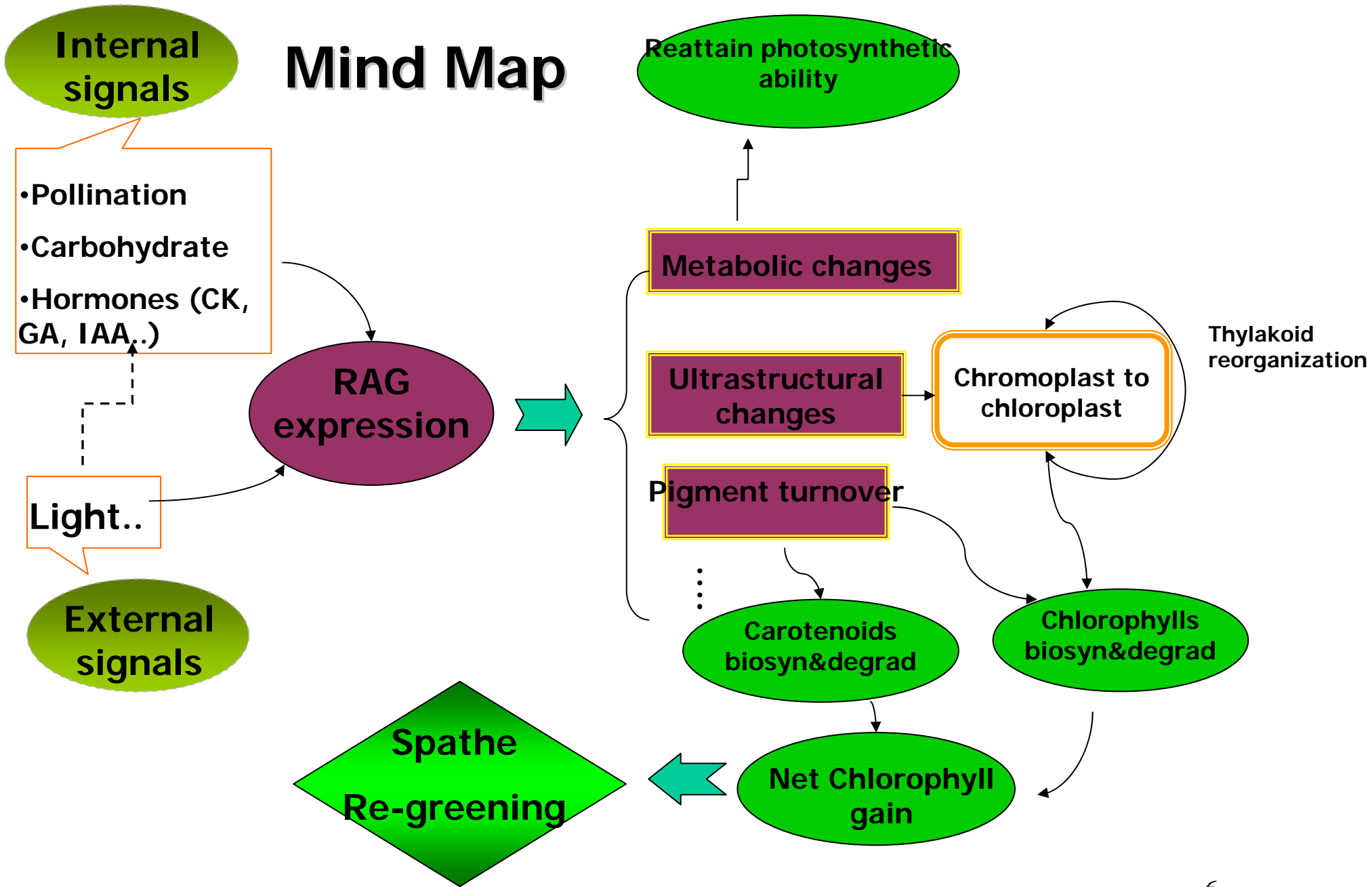
# What triggers **re-greening**?

- Senescent leaves: cytokinins (under low light)
- Orchid: pollination



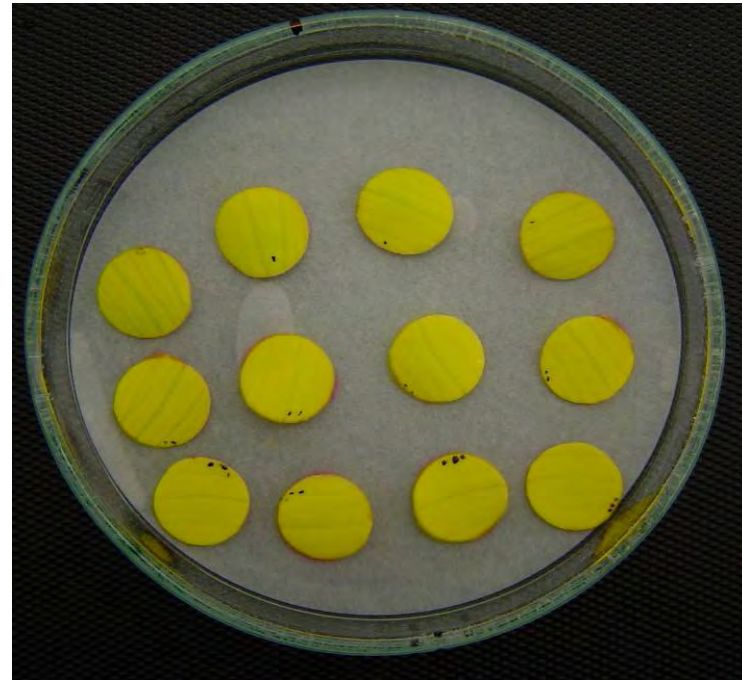
# Goals for PhD:

- Postpone re-greening to improve post-harvest quality of *Zantedeschia* for growers
- Understand the mechanism of spathe re-greening
  - Physiology level
  - Cellular level



# Materials

- Discs of Z. 'Best Gold'



# Methodology

- Colour measurement
  - Spectrophotometer:  $L^*$ ,  $a^*$  and  $b^*$  ( $a^*/b^*$ )



- Transmission Electron Microscope & Light Microscope
  - Cell ultrastructure (plastids)

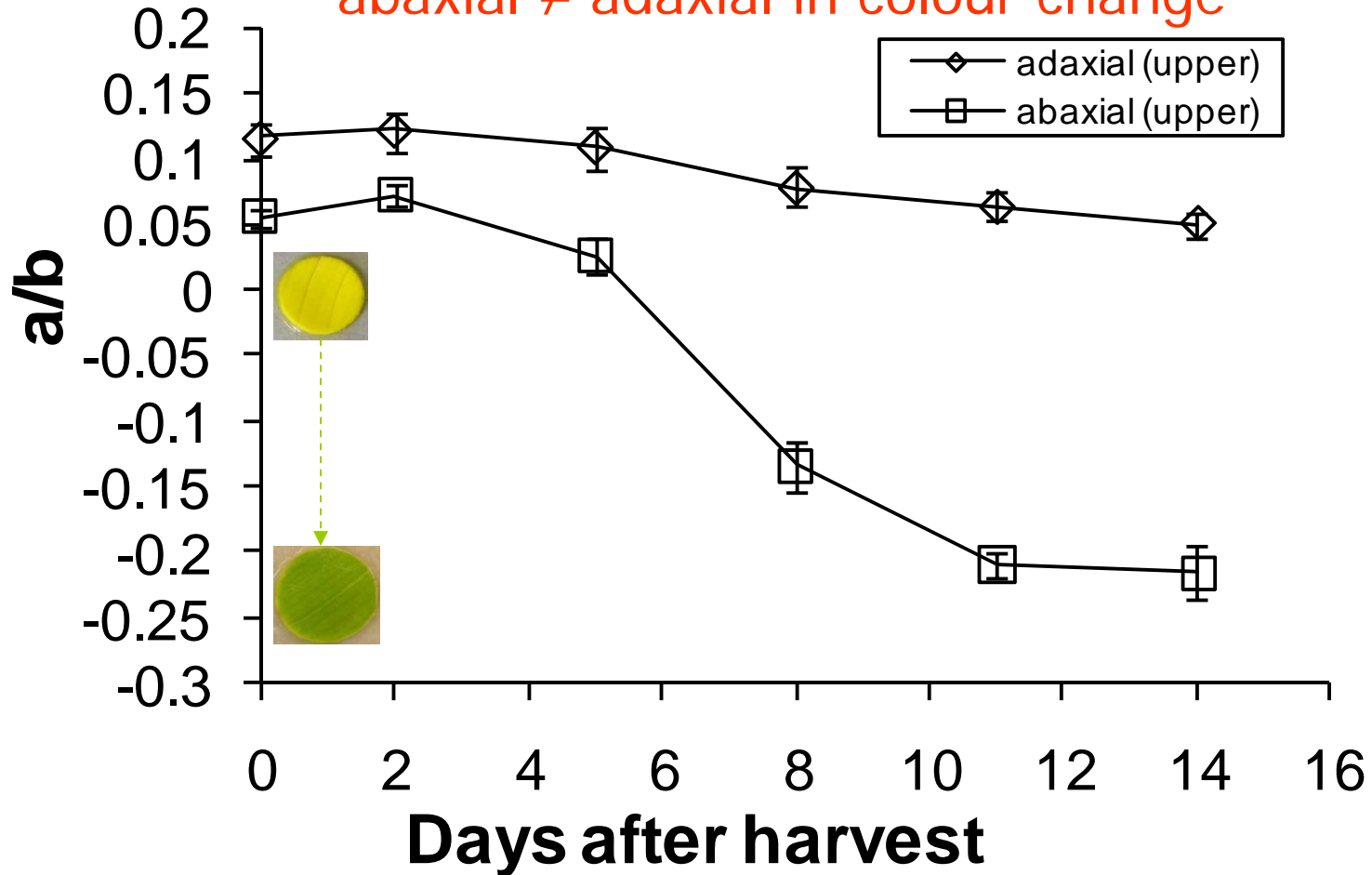
# Methodology

- Pigment analysis
  - Thin Layer Chromatography (TLC)
  - HPLC (Dionex DX500 chromatography system)
    - Carotenoids (e.g. lutein &  $\beta$ -carotene)
    - chlorophyll a, b

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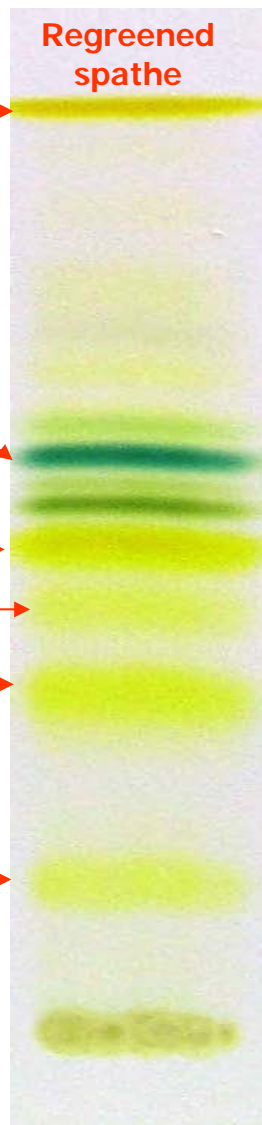
# Results: Colour

abaxial  $\neq$  adaxial in colour change

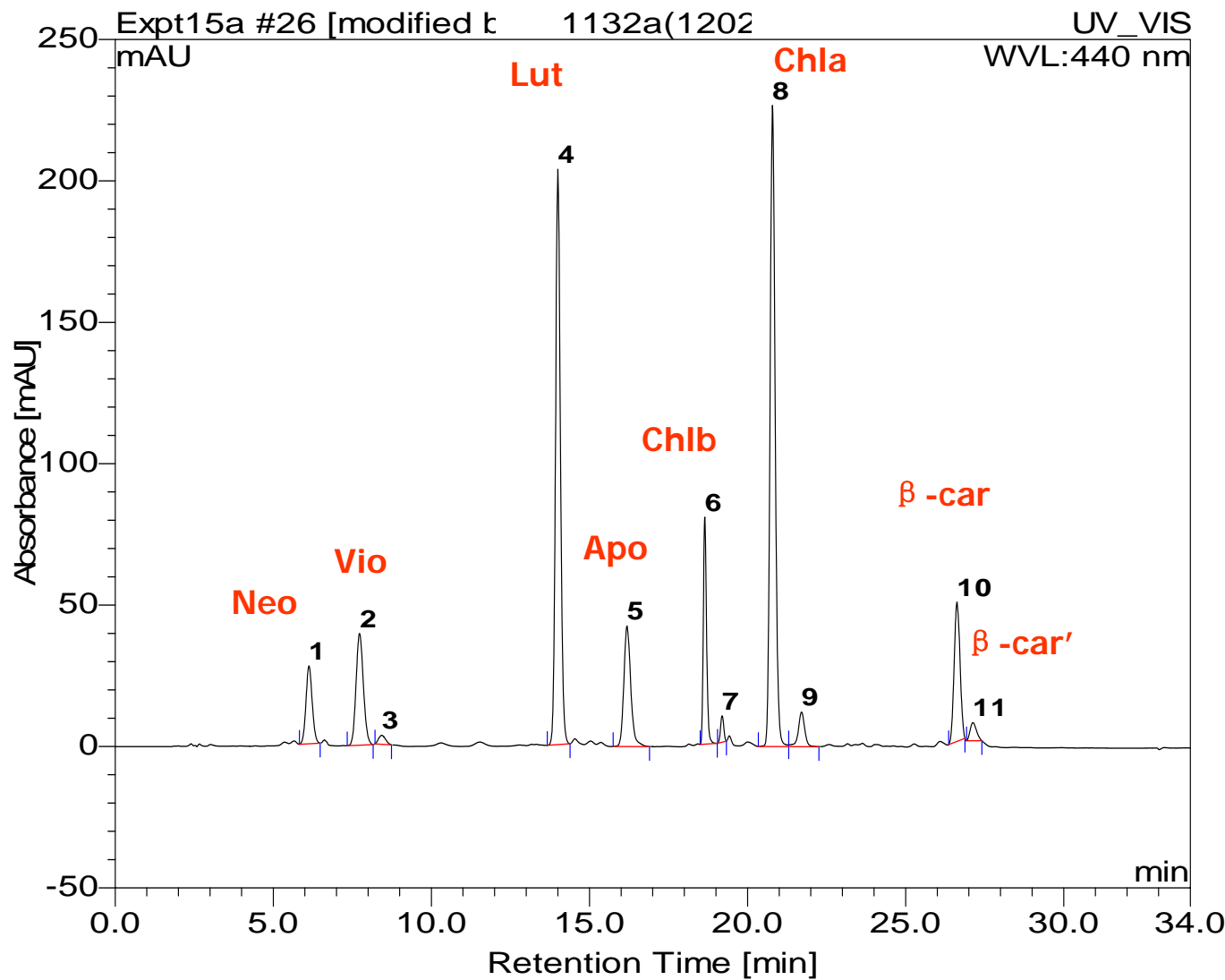


# Pigment analysis

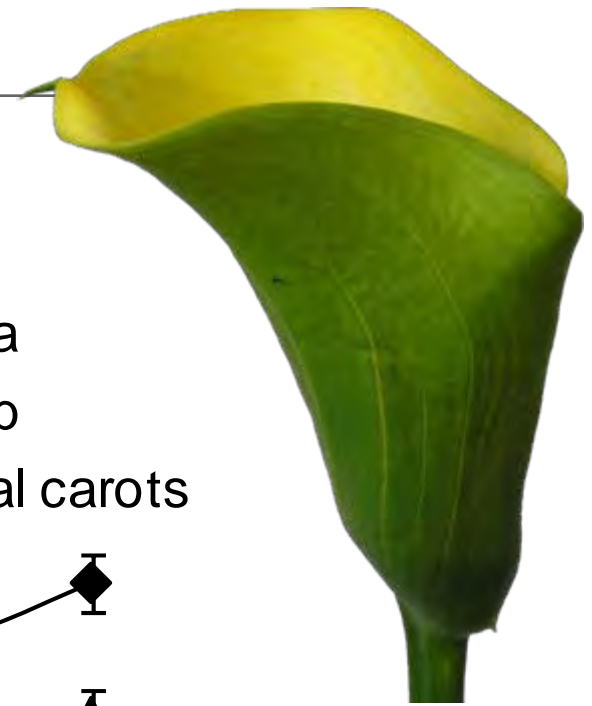
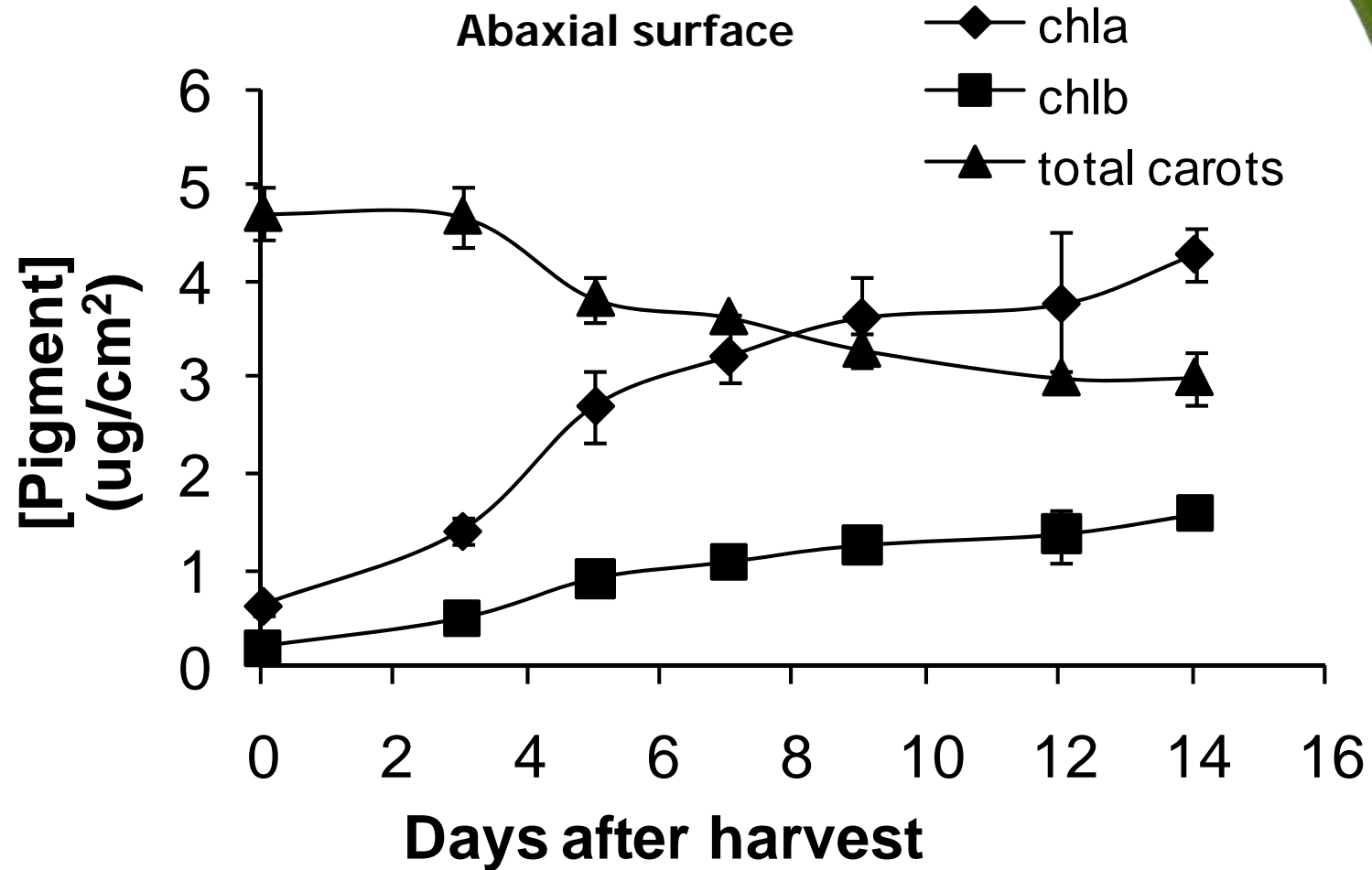
TLC



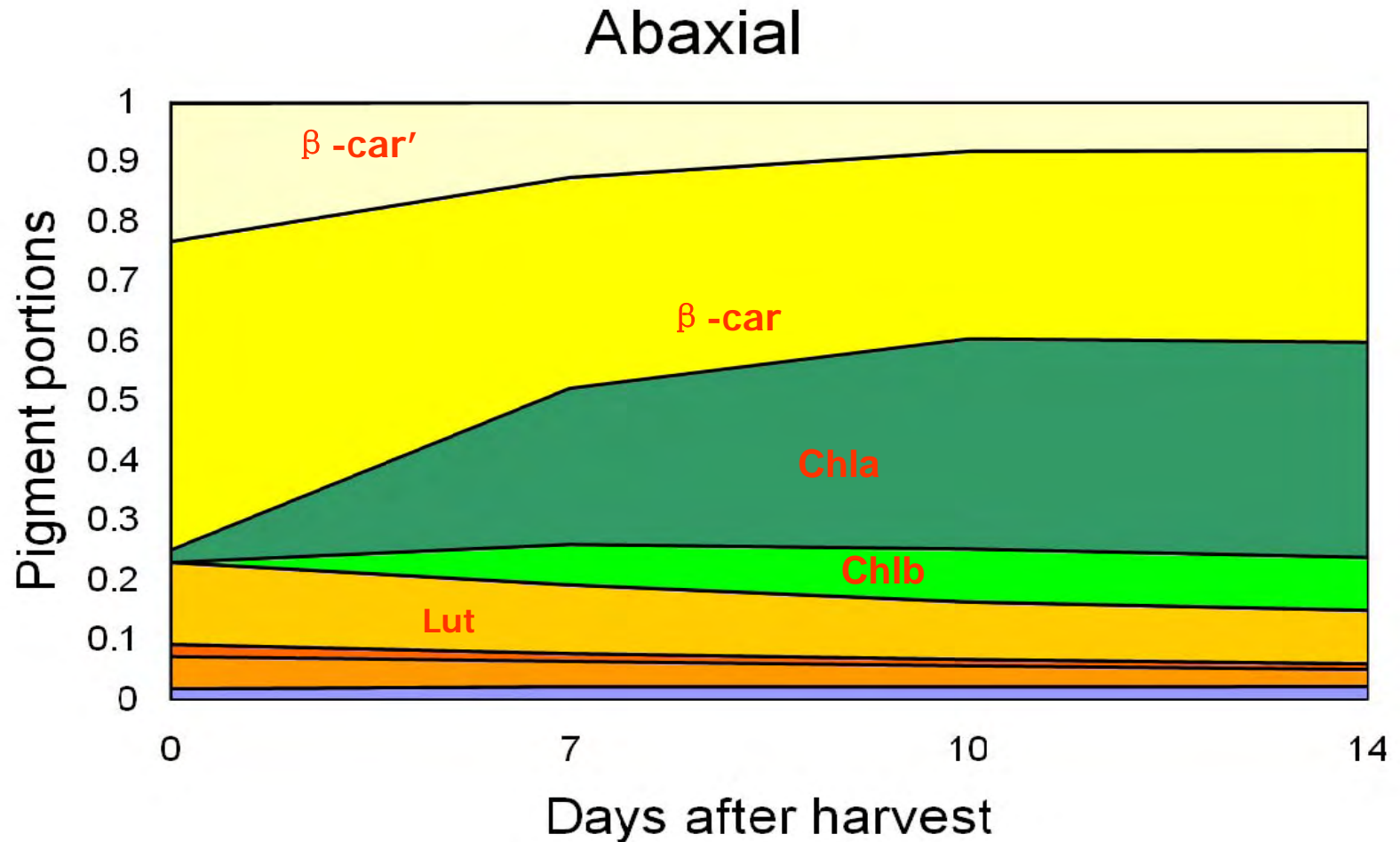
HPLC



# Results:

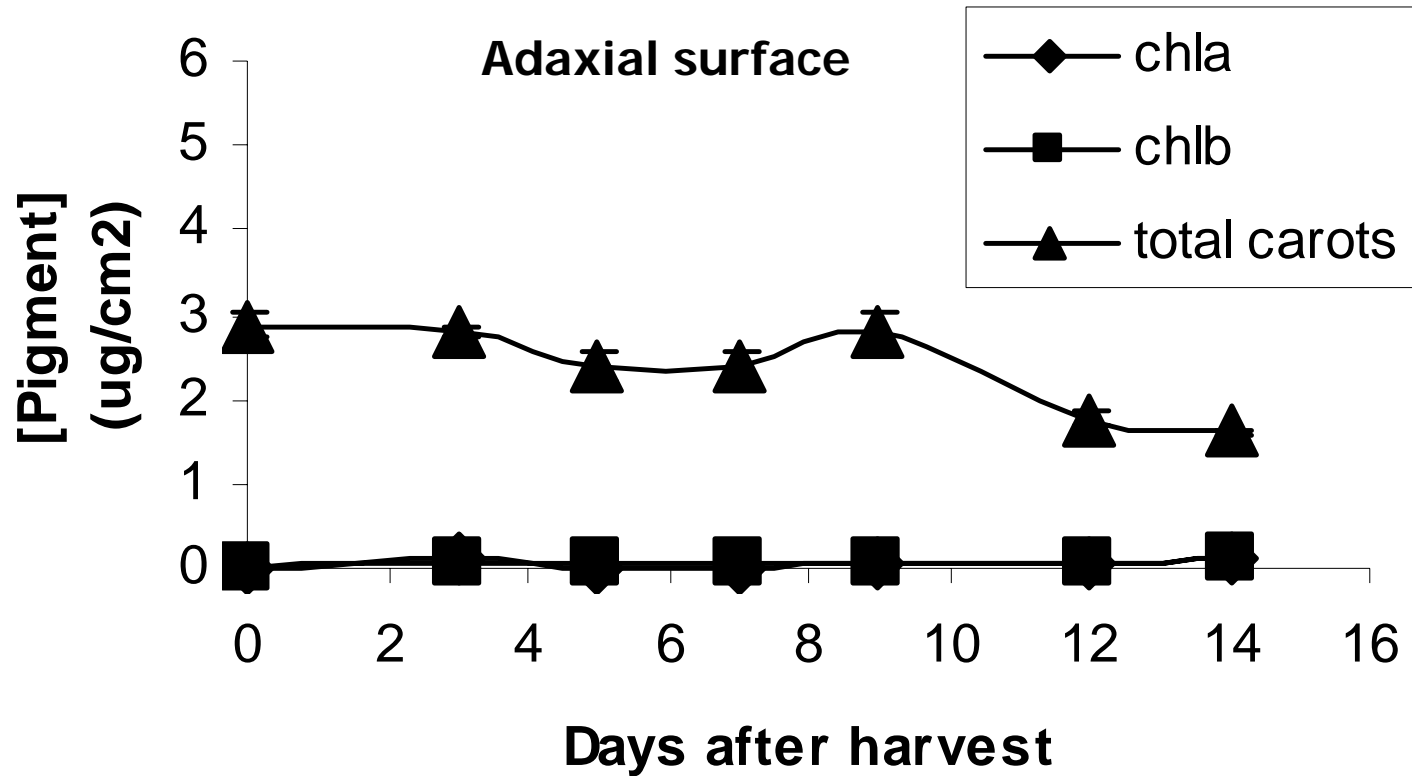


# Results — Changes in pigment proportion

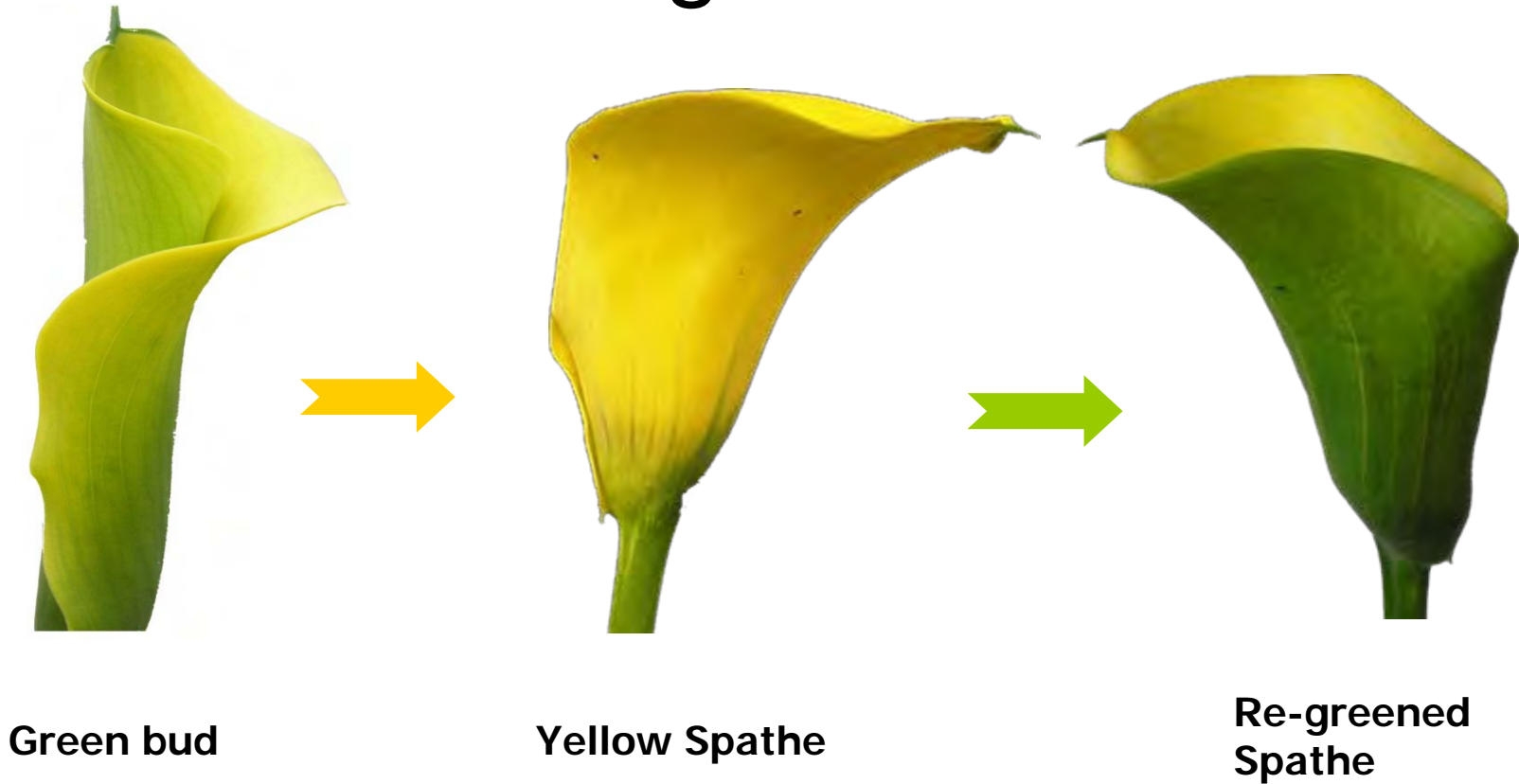


# Results:

abaxial  $\neq$  adaxial  
in [Chlorophylls] & [carotenoids]



# Cell Ultrastructure -using TEM

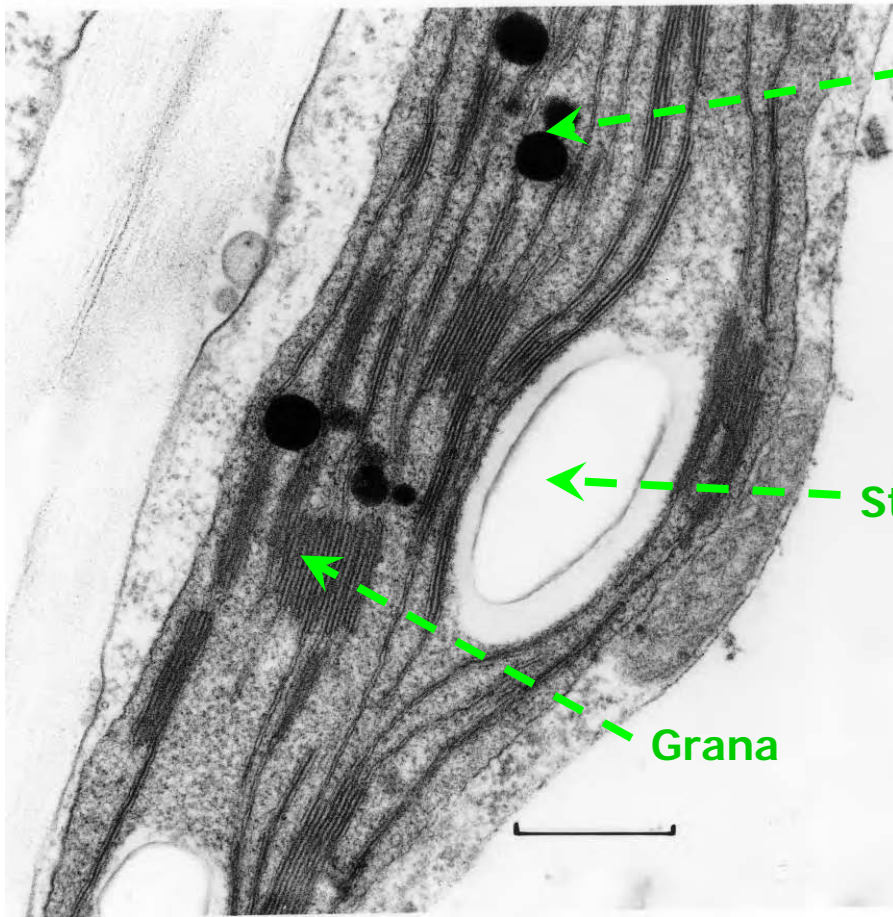


# Results: Plastid (green bud)



abaxial

adaxial

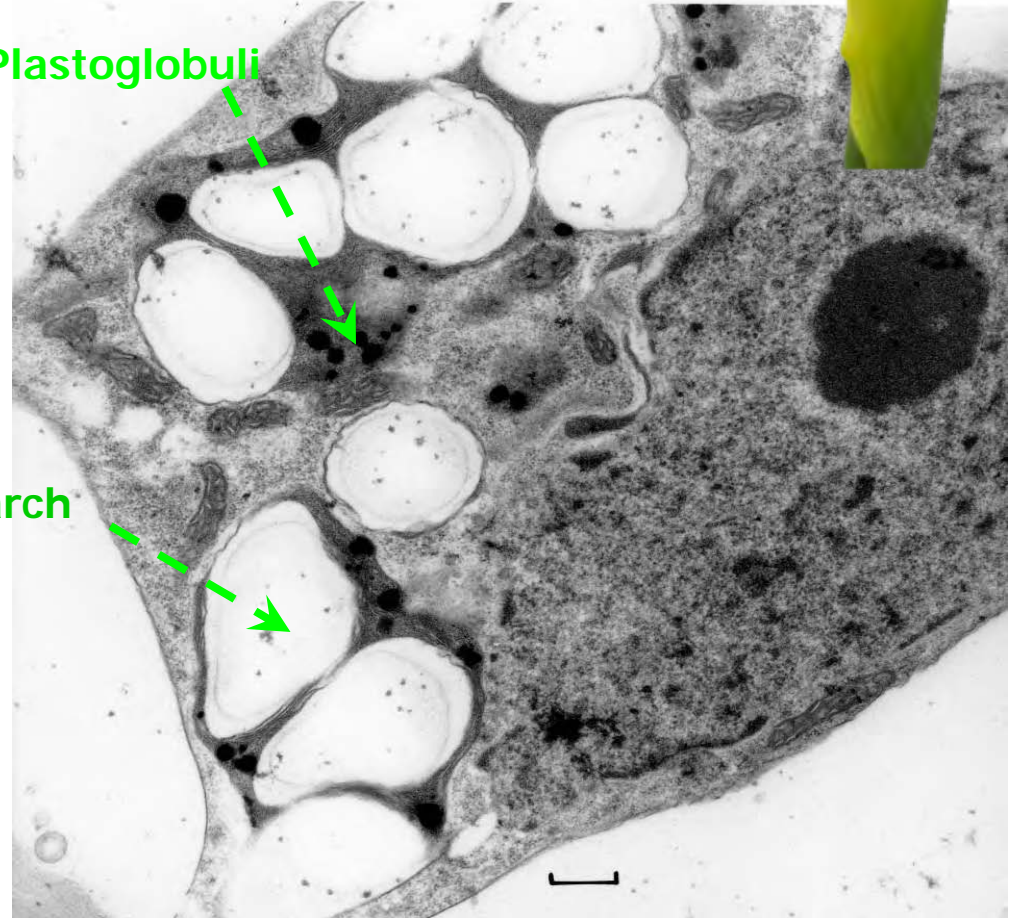


Plastoglobuli

Starch

Grana

(Chloroplast)



(Proplastid?)

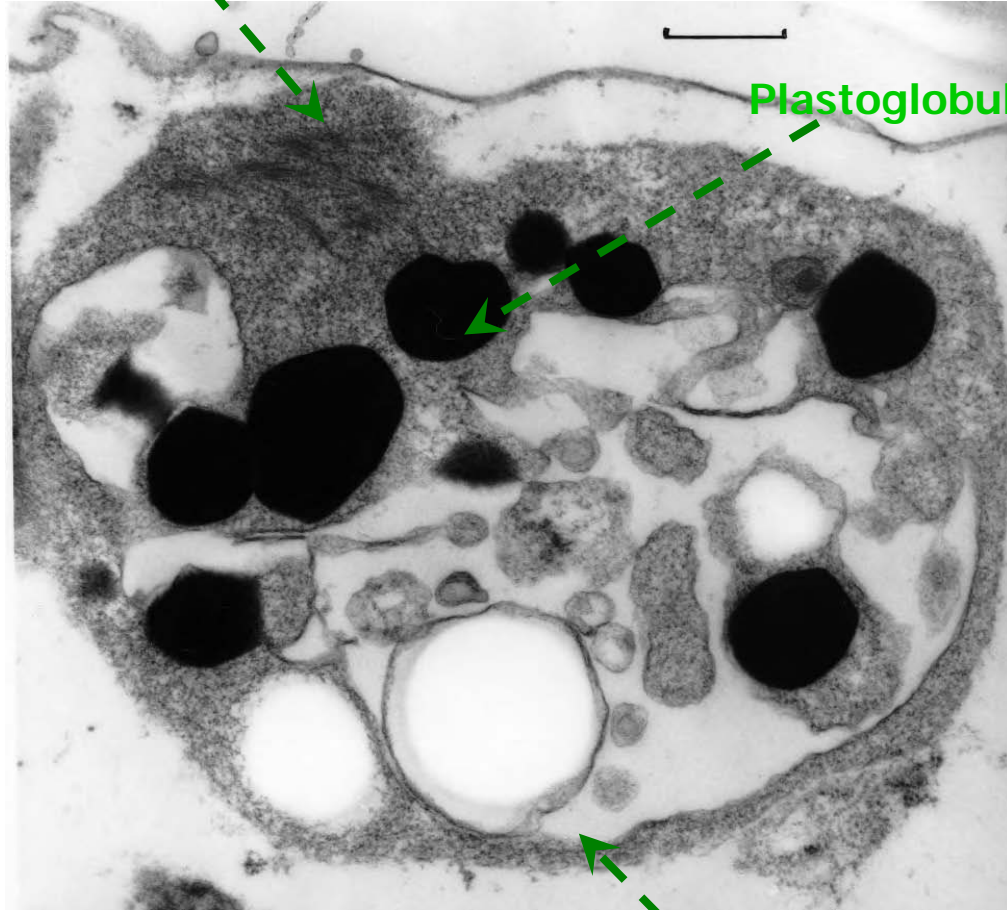
# Results: Plastid (yellow spathe)



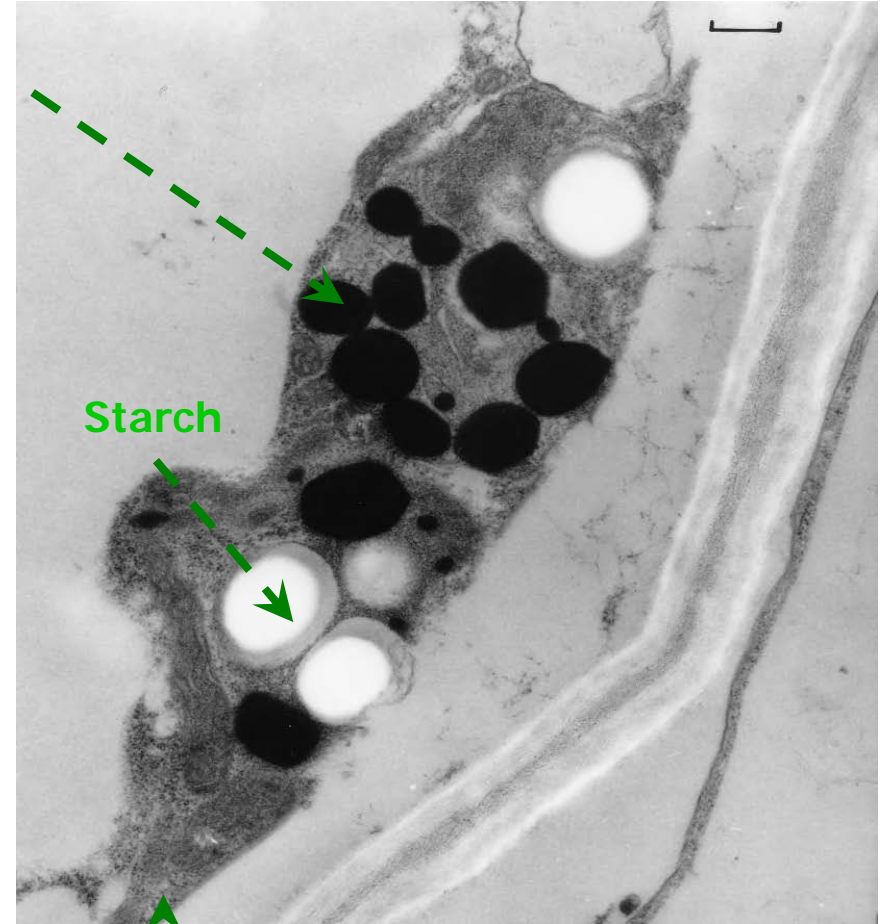
Thylakoid fragments

Abaxial

Adaxial



Plastoglobuli



Starch

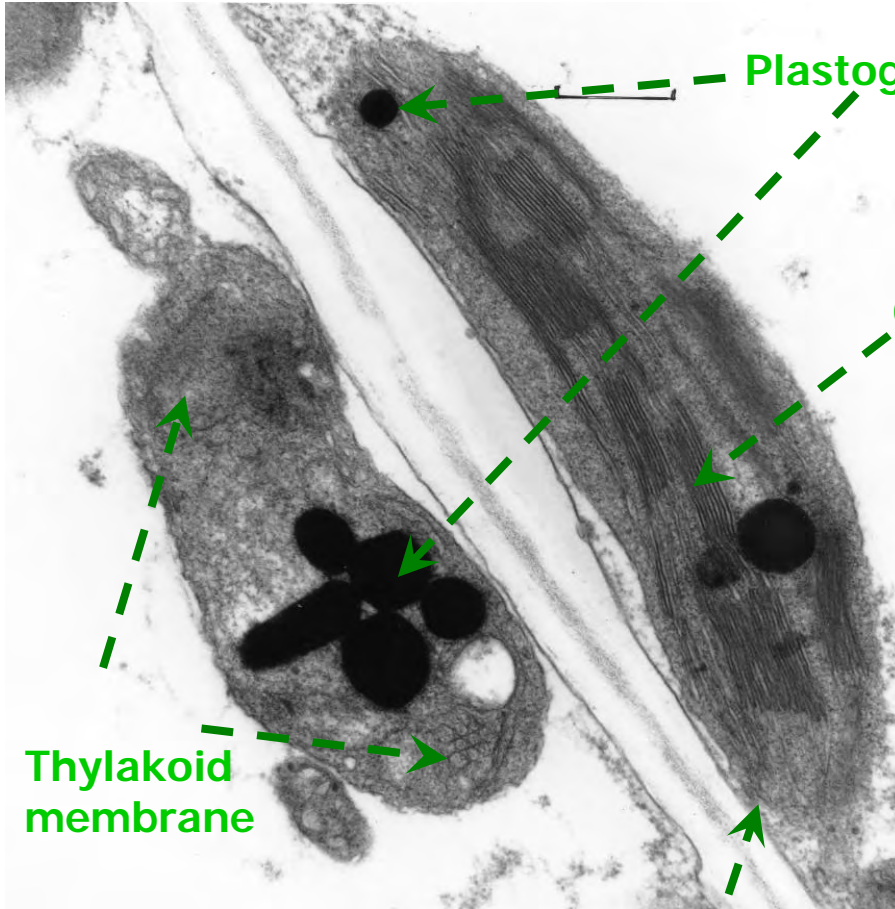
(Chromoplast)

# Results: Plastid (re-greened spathe)



Abaxial

Adaxial



Thylakoid  
membrane

Plastoglobuli

Grana

(Chloroplast)

(Chromoplast)

# Results: Plastid redifferentiation



Abaxial: chloroplast → chromoplast → chloroplast

Adaxial: Prolastid? → chromoplast → chromoplast



# Conclusion

- Abaxial and adaxial surfaces differ in their patterns of re-greening
- Re-greening of Z. 'Best Gold'
  - Chla, Chlb, and total Carotenoids
  - Plastid re-differentiation: chloroplast – chromoplast - chloroplast



# Has the goal been achieved?

- Post-harvest treatments to delay re-greening have been developed
- In discussion for commercial pilot trials

# Acknowledgement

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Thank you

