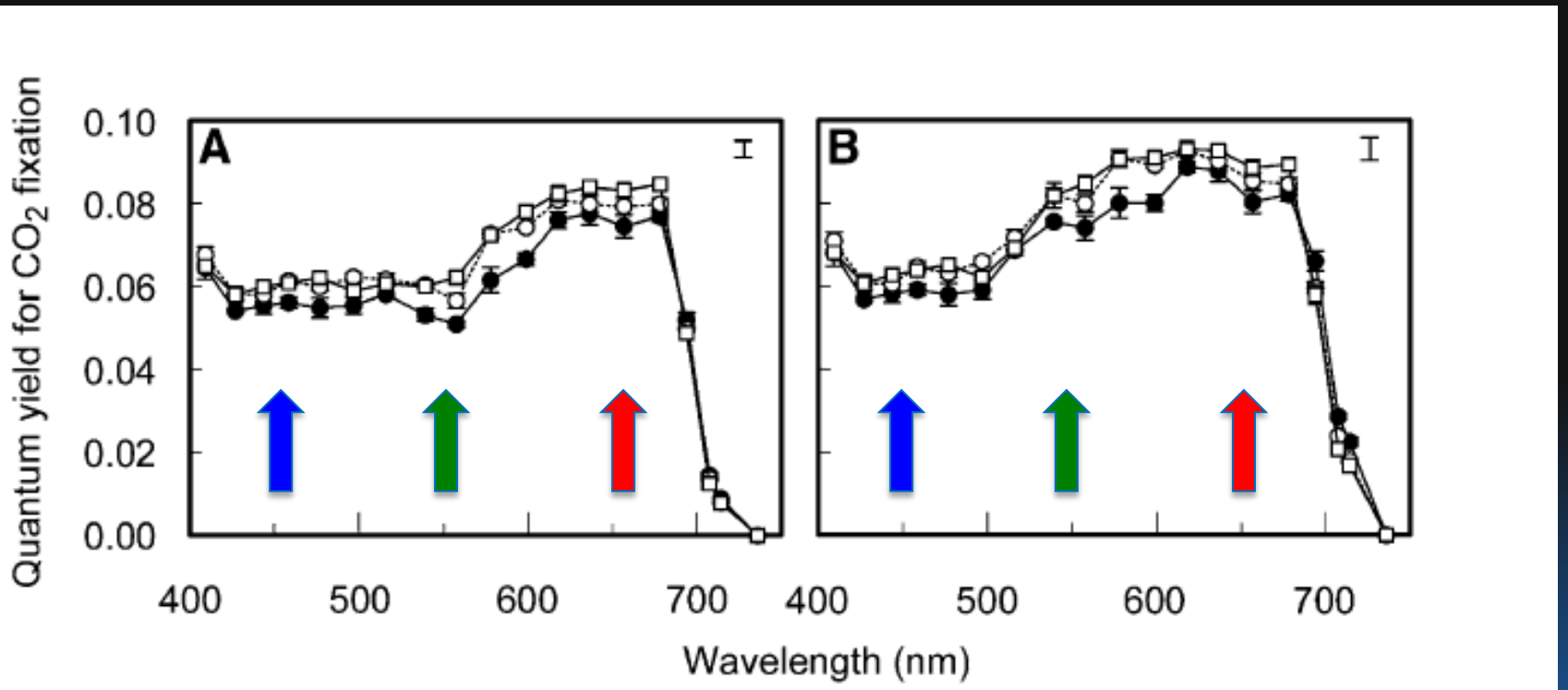
Action Spectrum and Beyond

Tessa Pocock Ph.D.

LESA
Lighting Enabled Systems & Applications

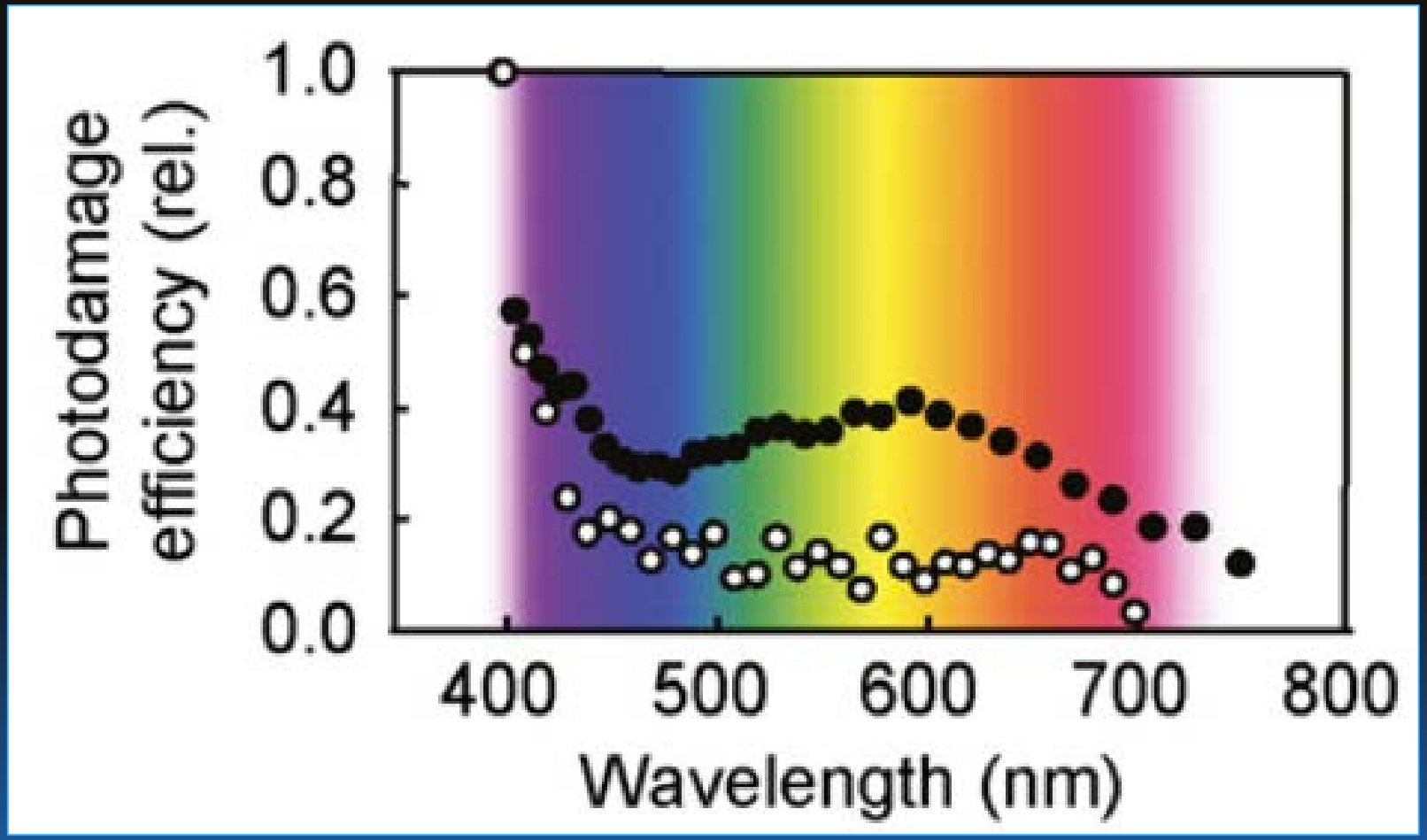
Pocock 2011 Heliospectra AB.

Action spectrum - Photosynthesis



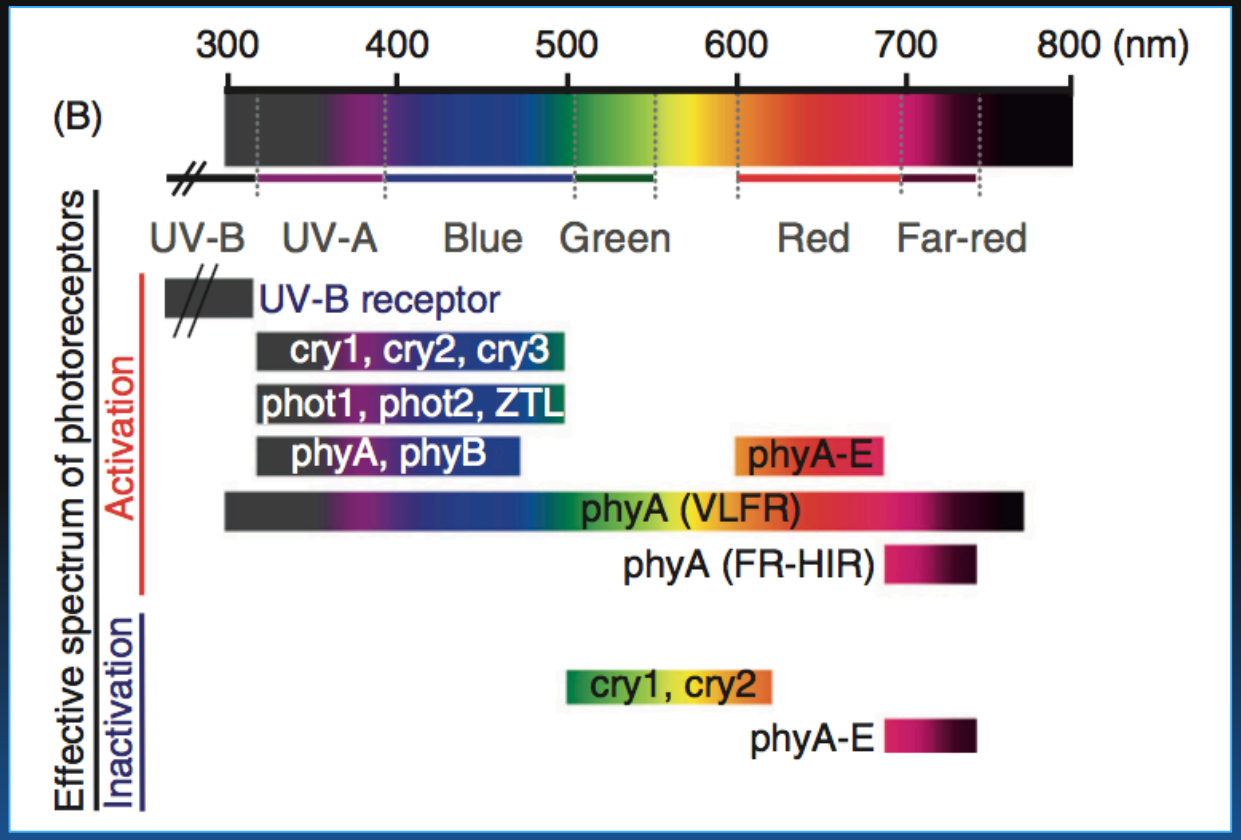
Hogewoning et al. 2012

Action Spectrum: PSII Photodamage



Takahashi et al. 2010

Photoreceptor Control



(Kami et al. 2010)

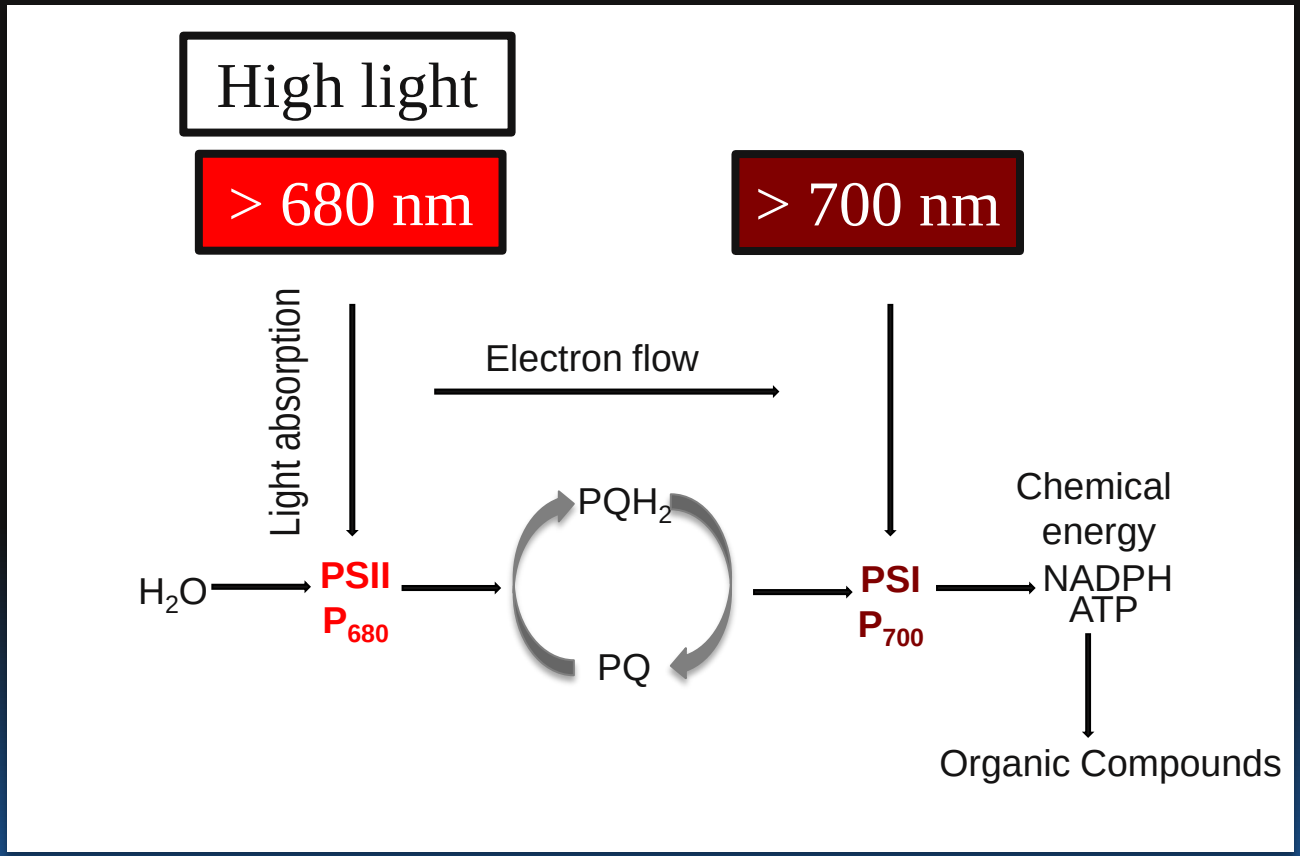
Developmental

- Flowering
- Photoperiodism
- Circadian rhythm
- Height
- Leaf expansion
- Branching
- Stomatal opening

- Pigments
- Immunity
- Defense

(Pocock 2016)

Photosynthetic control – Chloroplast as signal



(Pocock 2015)

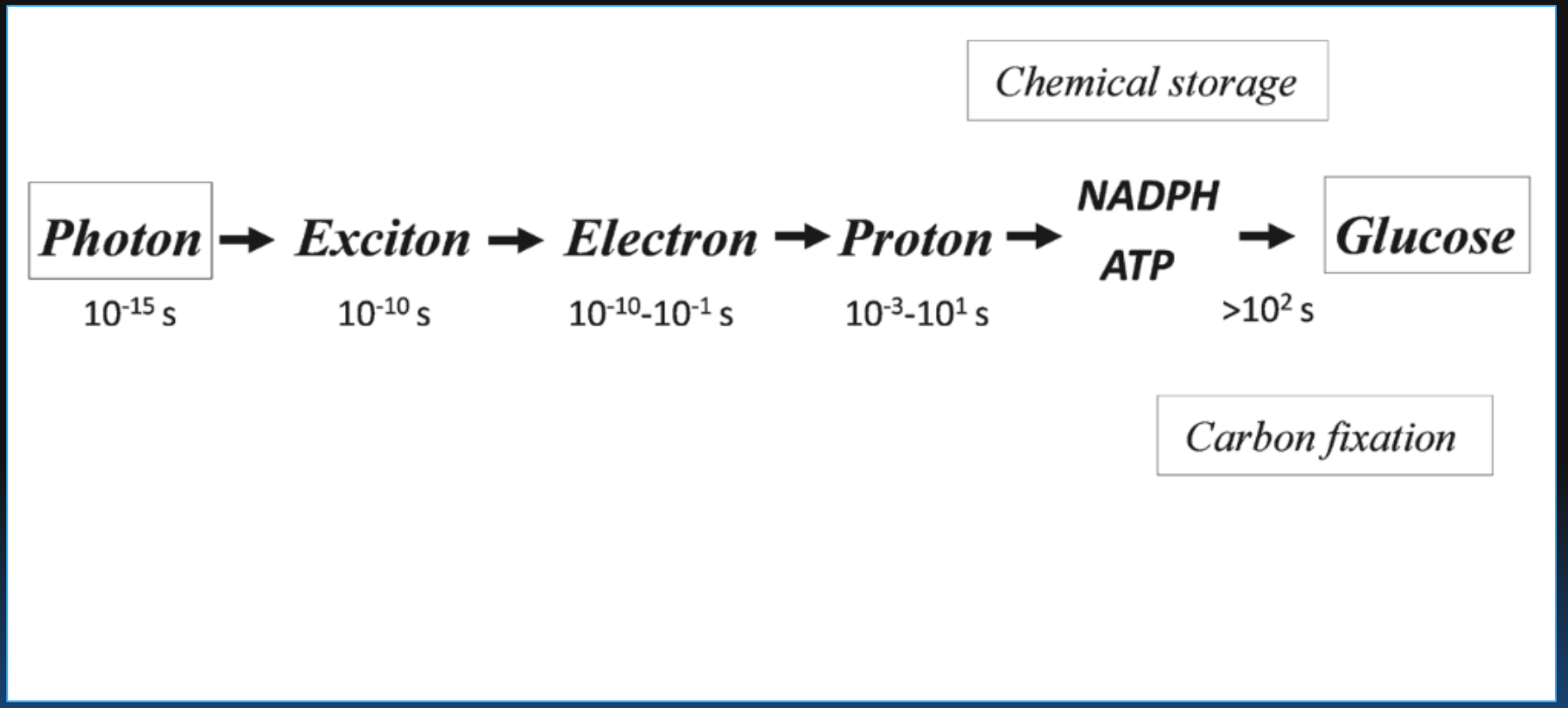
Operational

- Light capture
- PSN efficiency
- CO_2 assimilation
- Stomatal opening

- Pigments
- Protection
- Defense

- Height

Photochemical time constants: More control

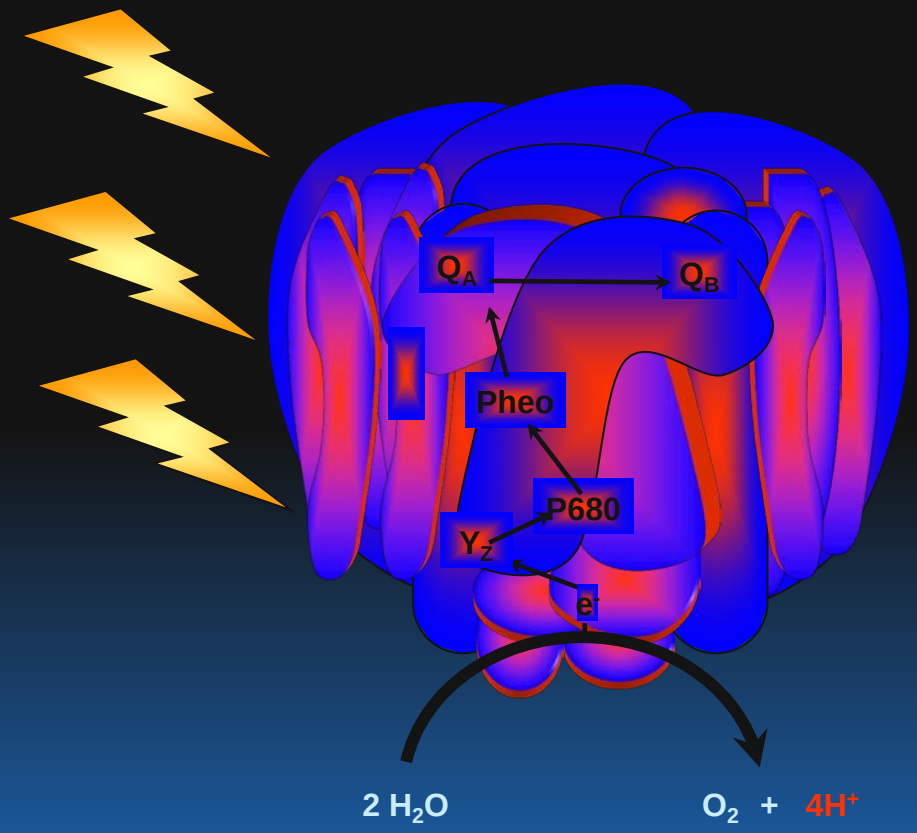


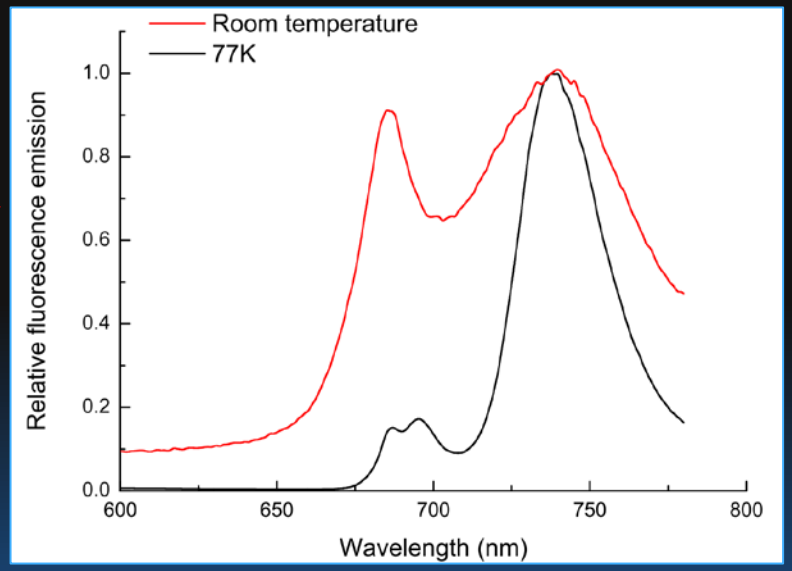
Ruban 2015

PSN control through Pulse Width Modulation of LEDs

Chlorophyll fluorescence - 1-3% absorbed light

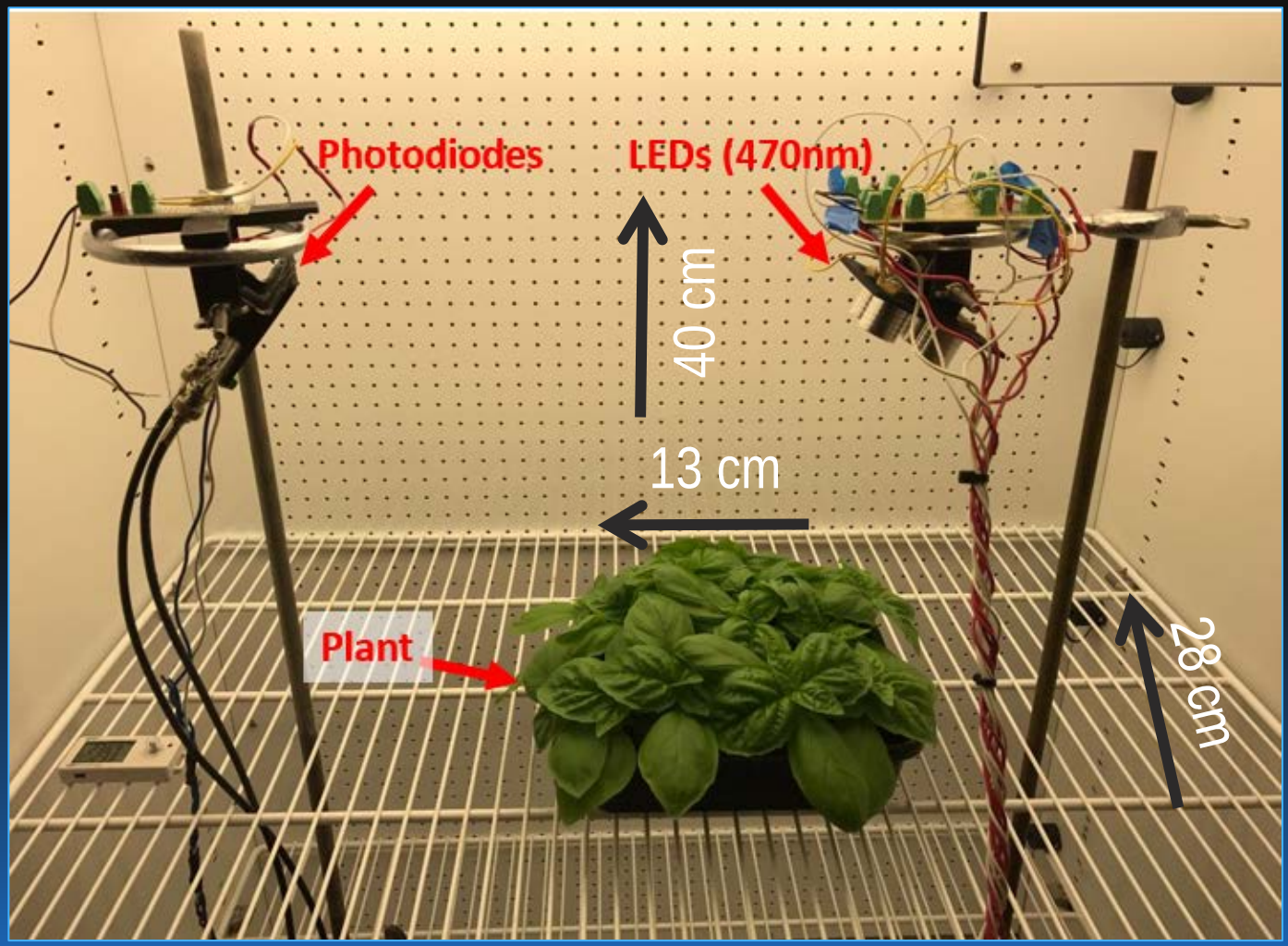
Can increase to 15% under stress



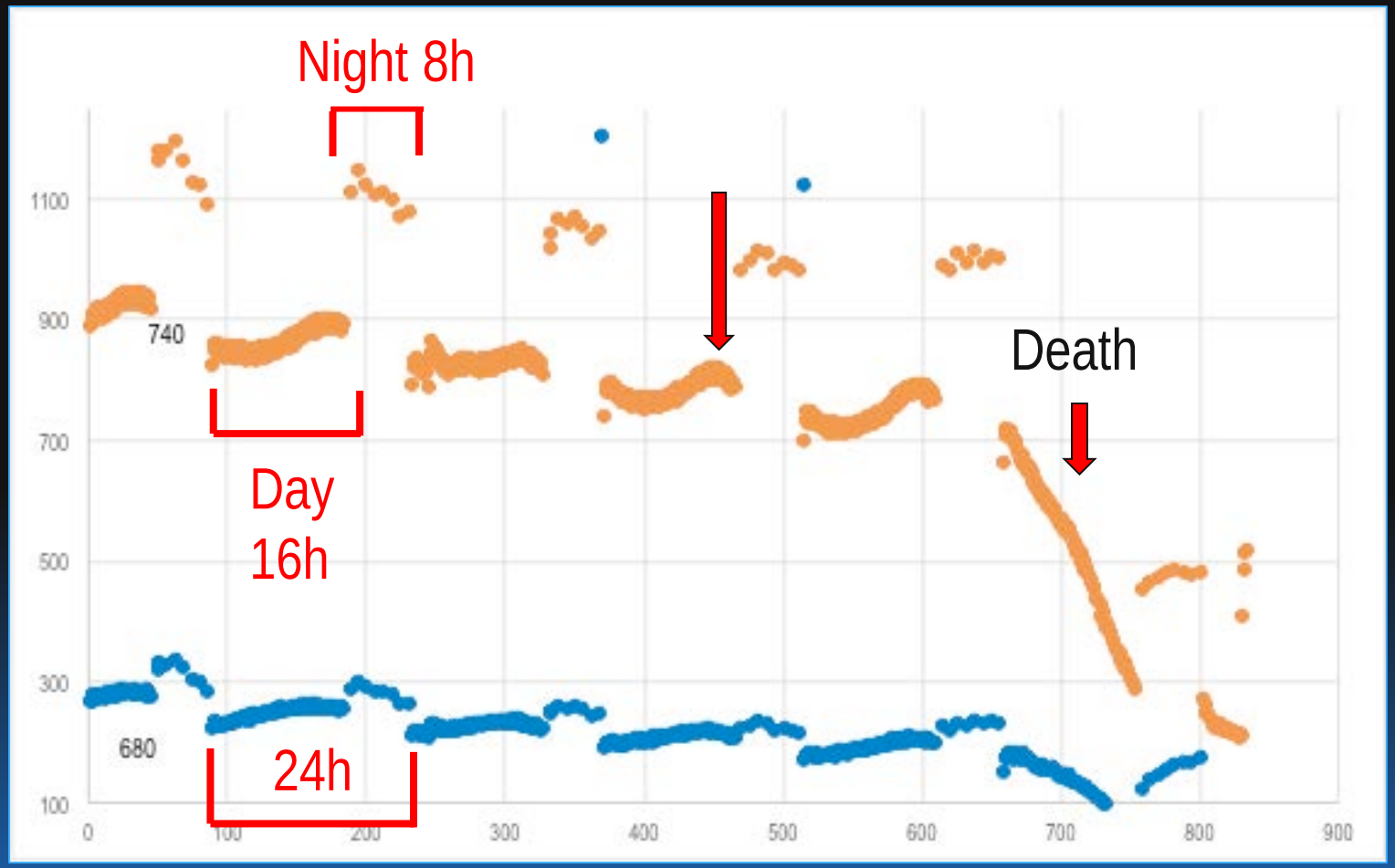


http://plantsinaction.science.uq.edu.au

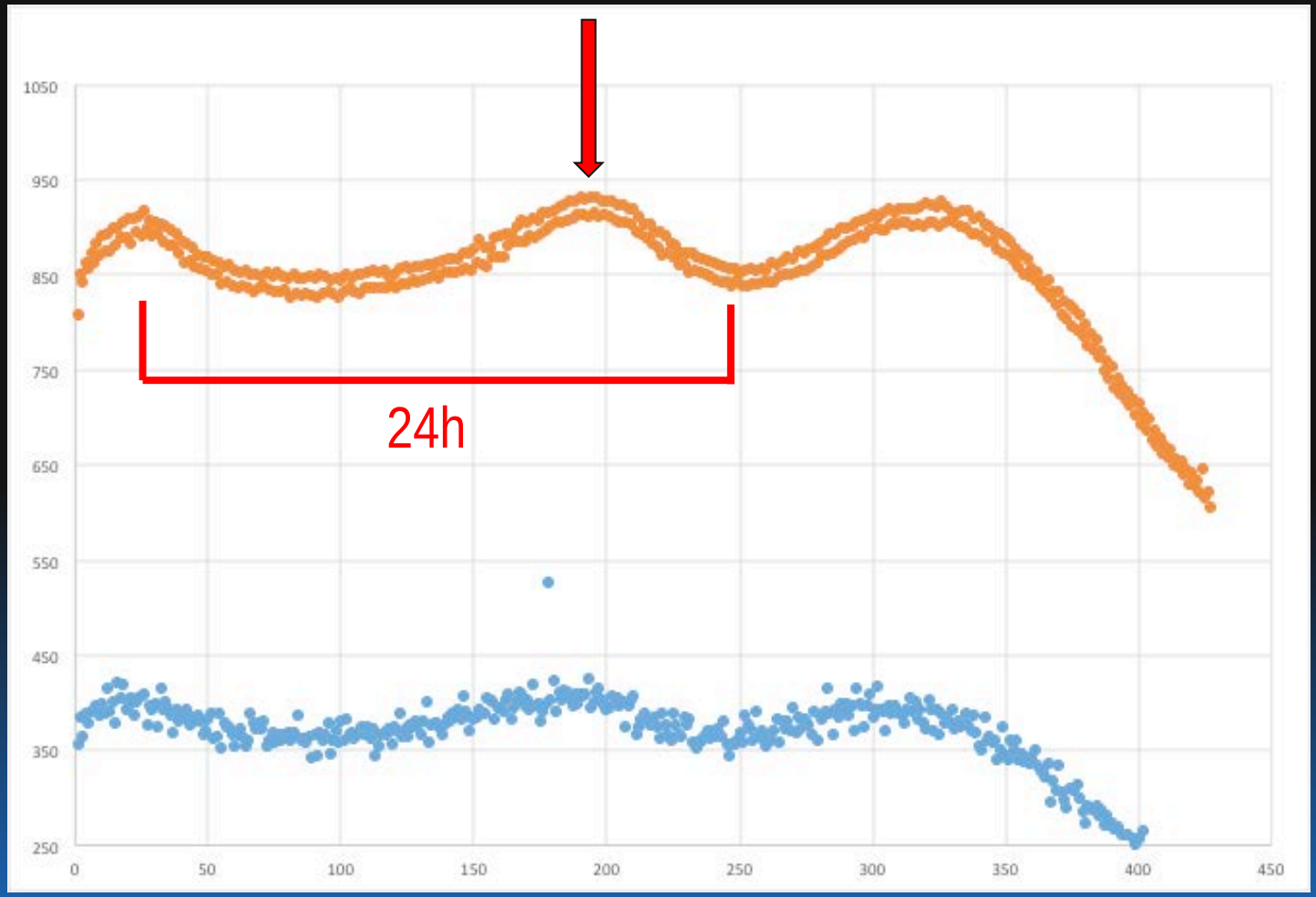
LESA Plant Sensing Project



Seven Days of Sensing: Lettuce

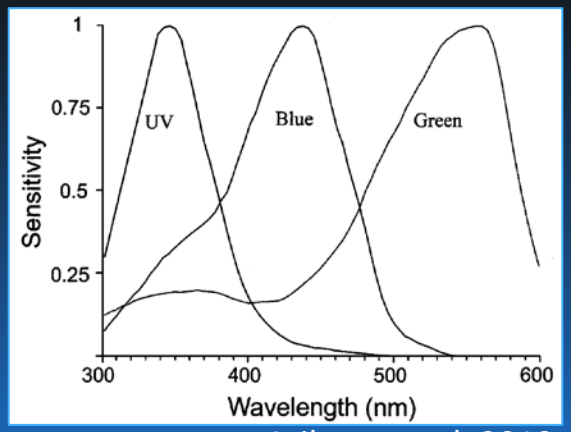


Continuous light



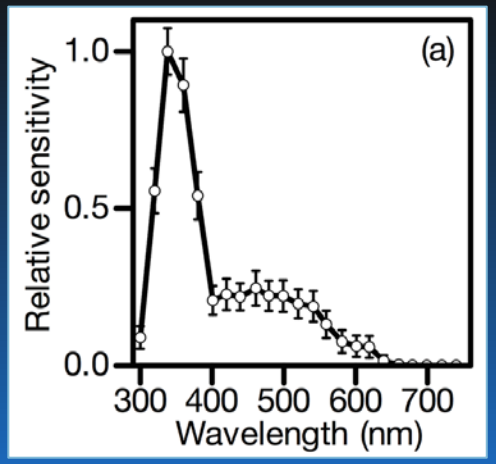
Whole CEA Ecosystem

Pollinators



Arikawa et al. 2013

Integrated pest management



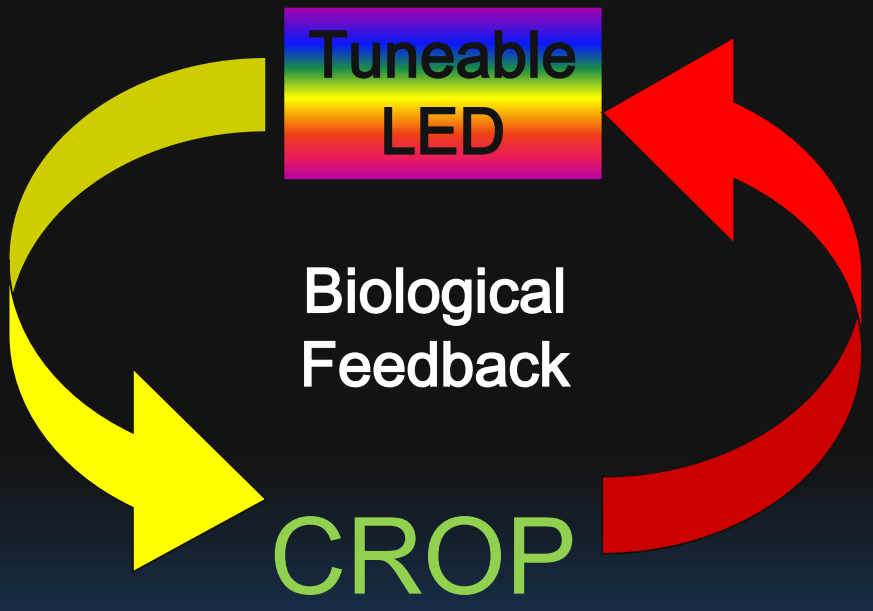
Tokushoma et al. 2016

Future: Energy Savings through Biological Efficacy

1. Incorporate Biological Efficacies

- Biomass efficacy (g/kWh)
- Nutrient density efficacy (μ/mg FW)

- Water use efficiency
- Photosynthetic efficiency
- Photochemical efficiency



2. Self-regulated light control

Thank You!

(New Scientist 2015)

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