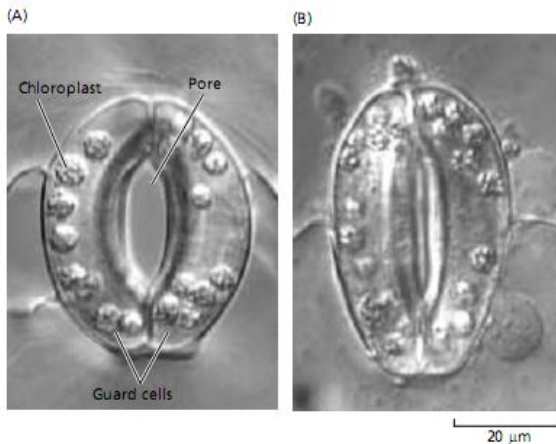
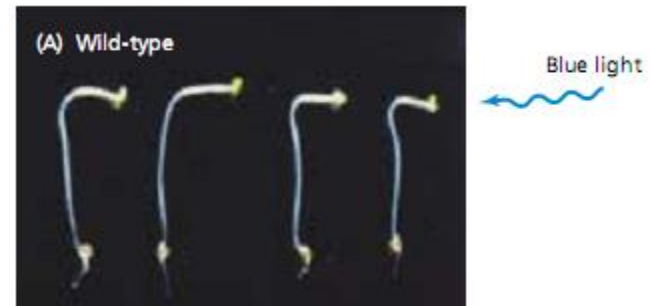


# FOTOMORFOGÉNESIS

- cantidad
- duración
- dirección
- calidad espectral



**FIGURE 18.8** Light-stimulated stomatal opening in detached epidermis of *Vicia faba*. Open, light-treated stoma (A), is shown in the dark-treated, closed state in (B). Stomatal opening is quantified by microscopic measurement of the width of the stomatal pore. (Courtesy of E. Ravesh.)



# FOTOMORFOGÉNESIS

- cantidad
- duración
- dirección
- calidad espectral

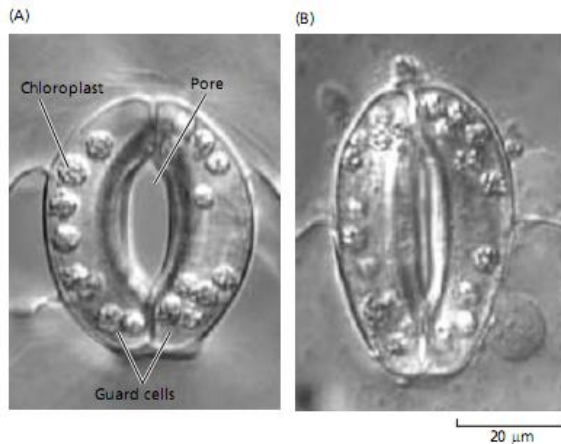
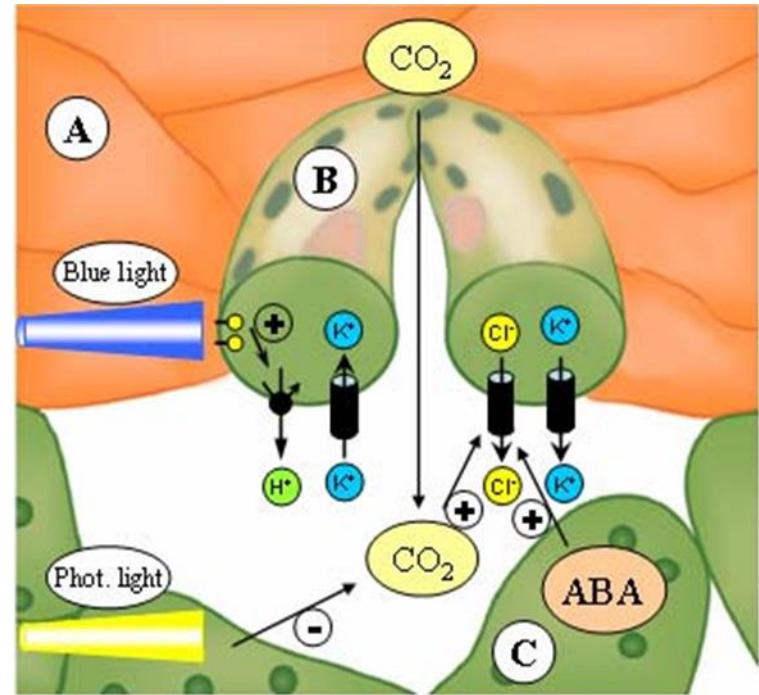


FIGURE 18.8 Light-stimulated stomatal opening in detached epidermis of *Vicia faba*. Open, light-treated stoma (A), is shown in the dark-treated, closed state in (B). Stomatal opening is quantified by microscopic measurement of the width of the stomatal pore. (Courtesy of E. Raveh.)



# FOTOMORFOGÉNESIS

- cantidad
- duración
- dirección
- calidad espectral

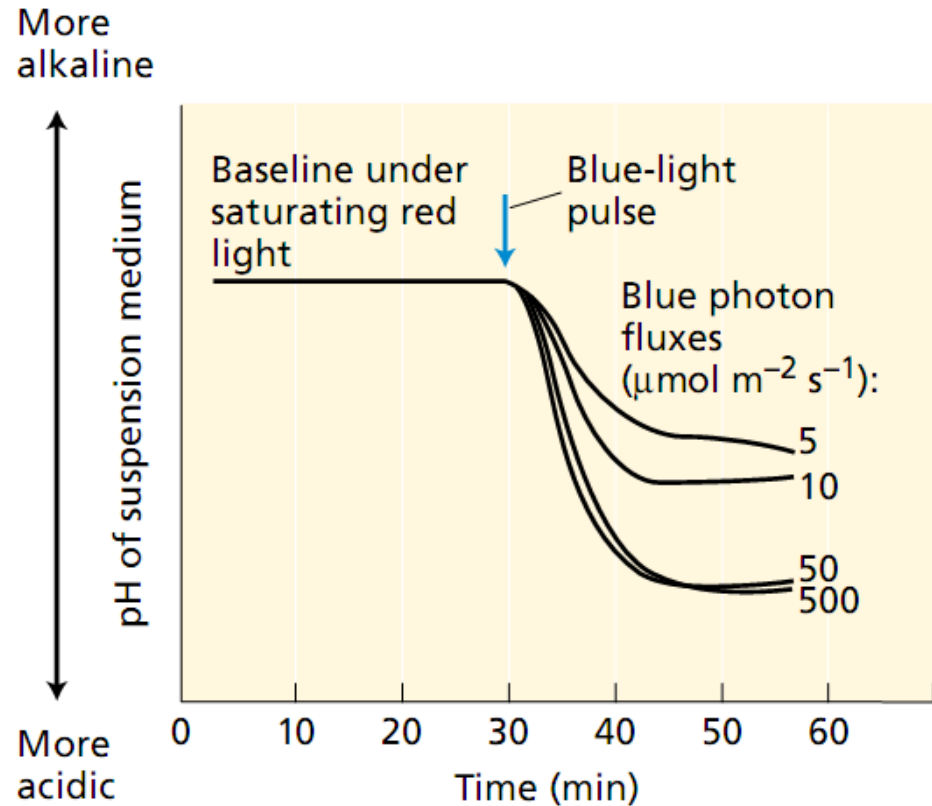
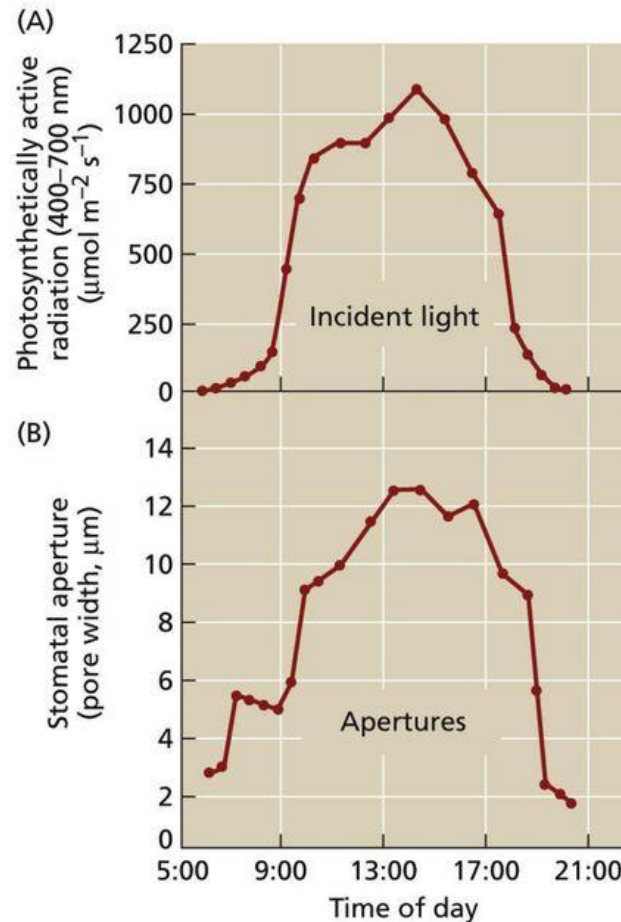


Figure 18.7 Stomatal opening tracks photosynthetic active radiation at the leaf surface

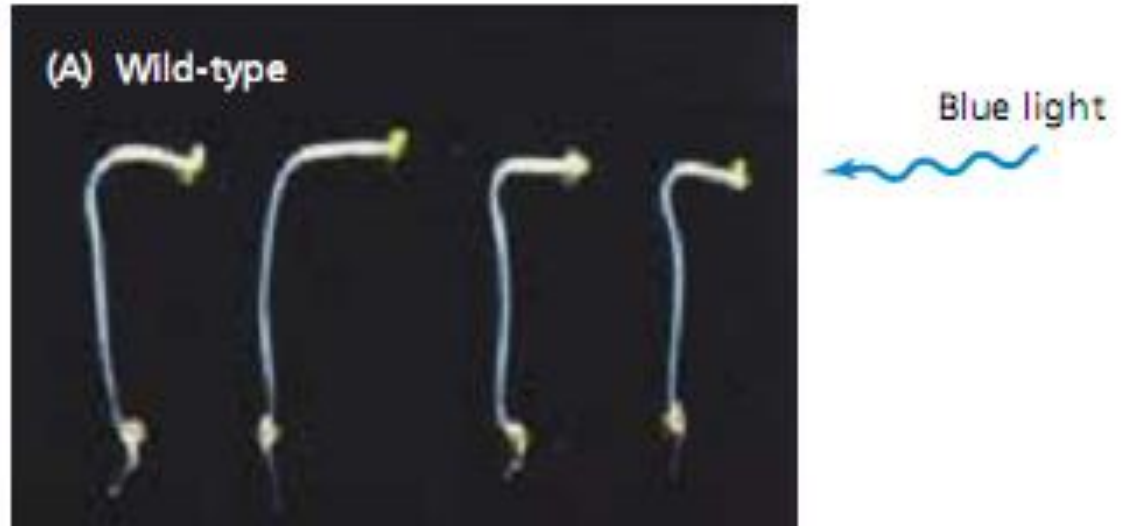
## FOTOMORFOGÉNESIS

- cantidad
- duración
- dirección
- calidad espectral



# FOTOMORFOGÉNESIS

- cantidad
- duración
- dirección
- calidad espectral



# FOTOMORFOGÉNESIS

- cantidad
- duración
- dirección
- calidad espectral

(A) Light-grown corn



(B) Dark-grown corn



(C) Light-grown bean



(D) Dark-grown bean



# FOTOMORFOGÉNESIS

- cantidad
- duración
- dirección
- calidad espectral



Días largos    Días cortos

# FOTOMORFOGÉNESIS

- UV-B (280-320 nm)
- Azul (400-500) y UV-A (320-400)
- Rojo (600-700)
- Rojo Lejano (700-750)

**UVR-8**

**criptocromos, fototropinas**

**fitocromos**

**fitocromos**



# FITOCROMOS

## RESULTS



Dark (control)



Red

Dark



Red Far-red

Dark



Red

Far-red

Red

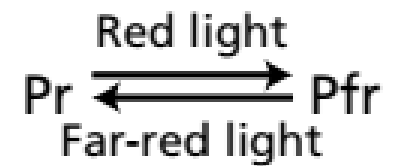
Dark



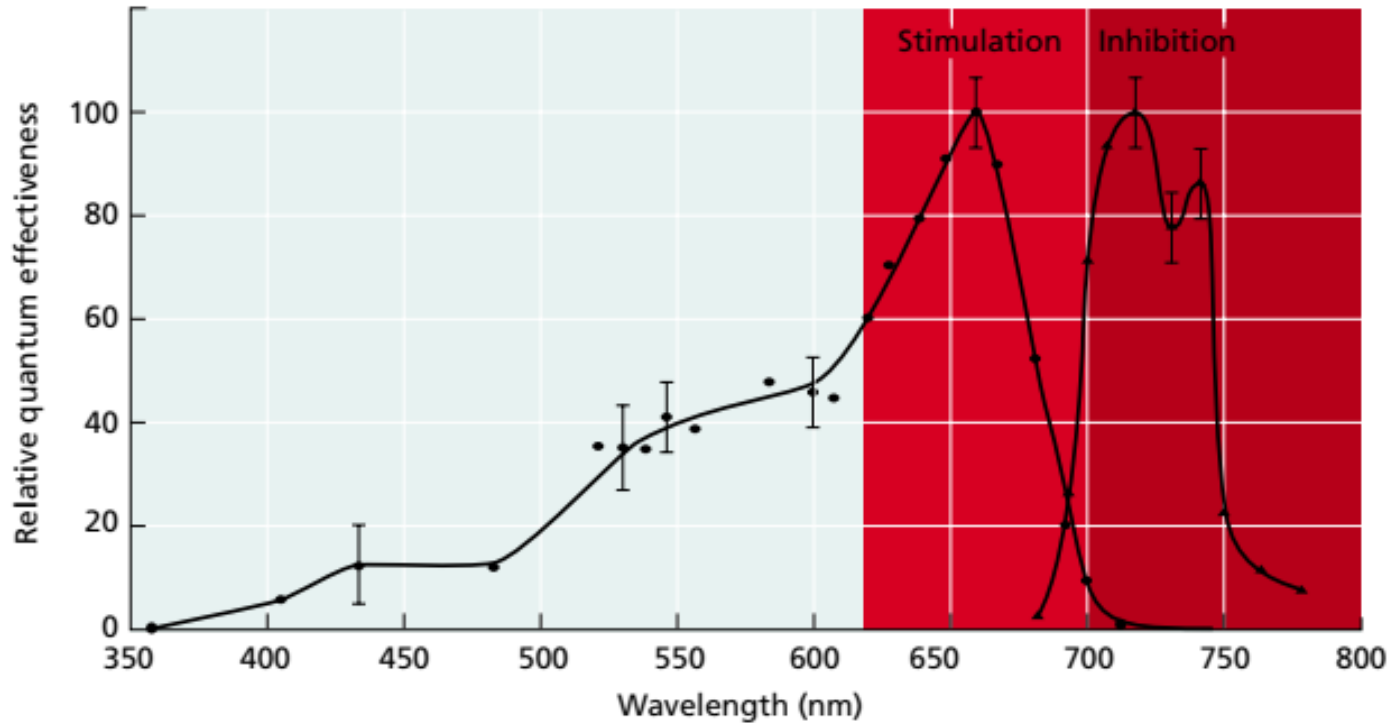
Red Far-red

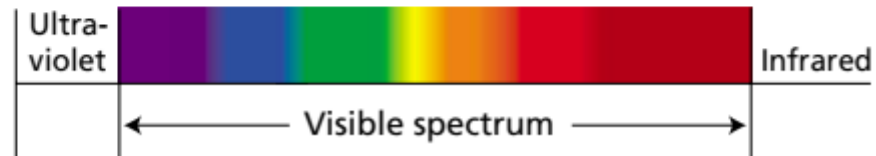
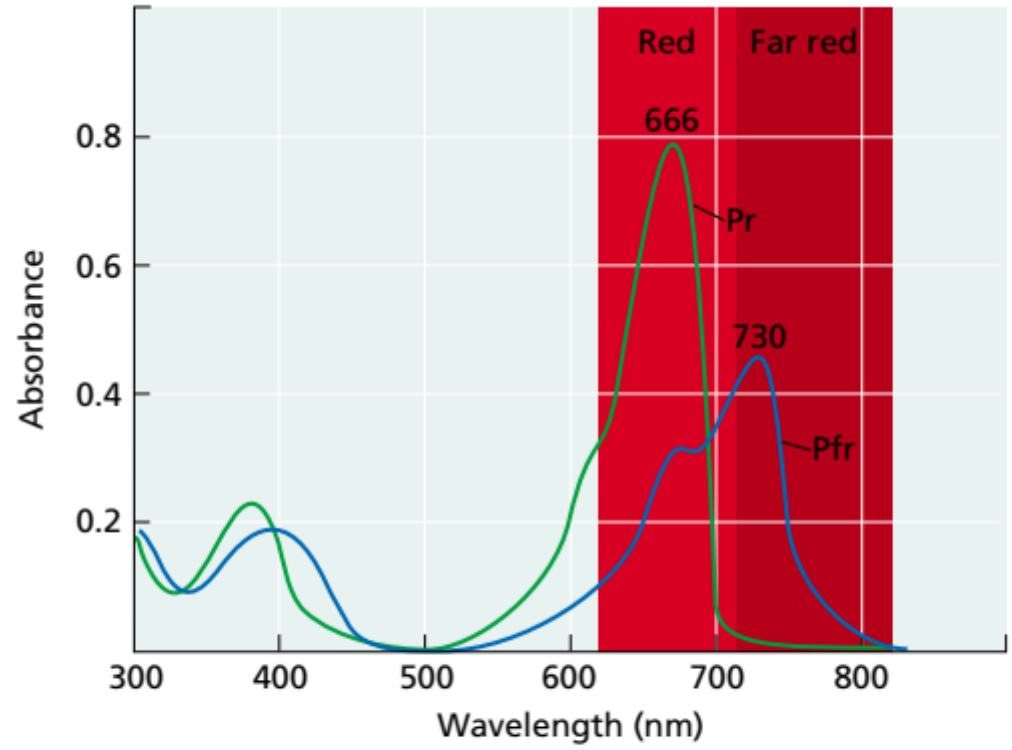
Red

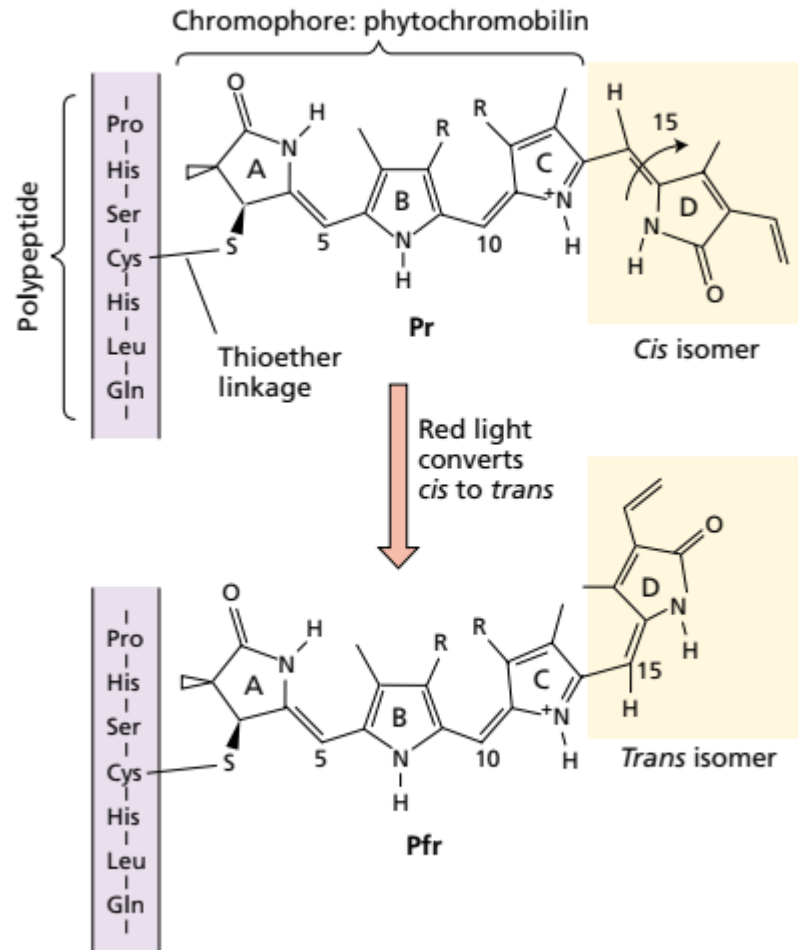
Far-red

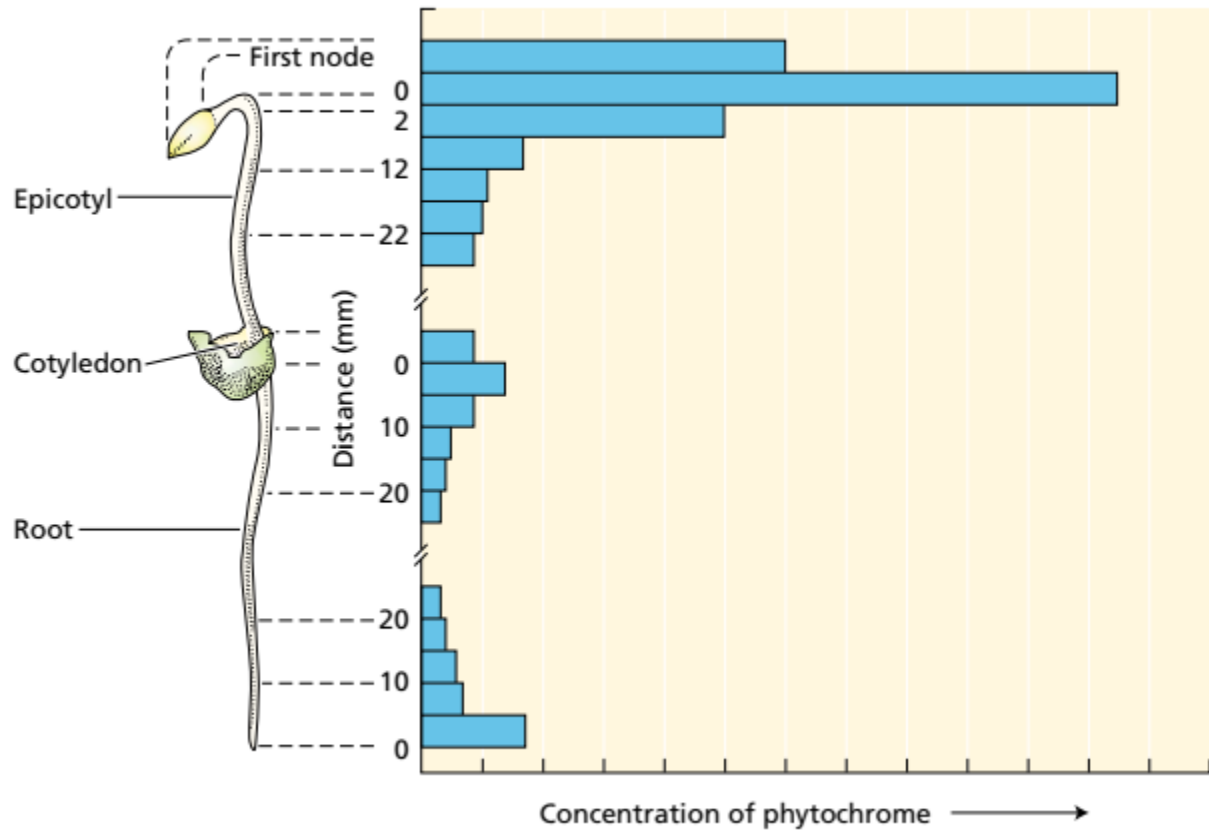


# FITOCROMOS



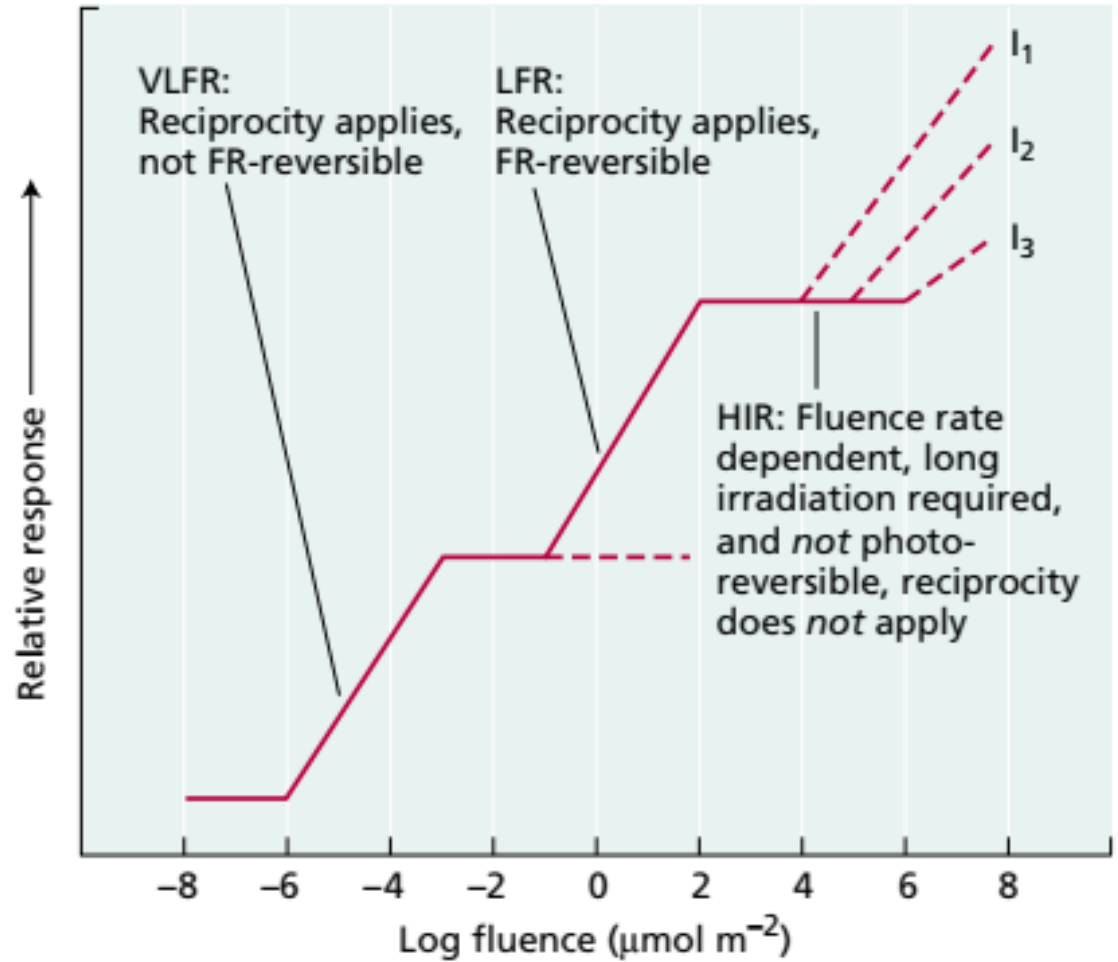






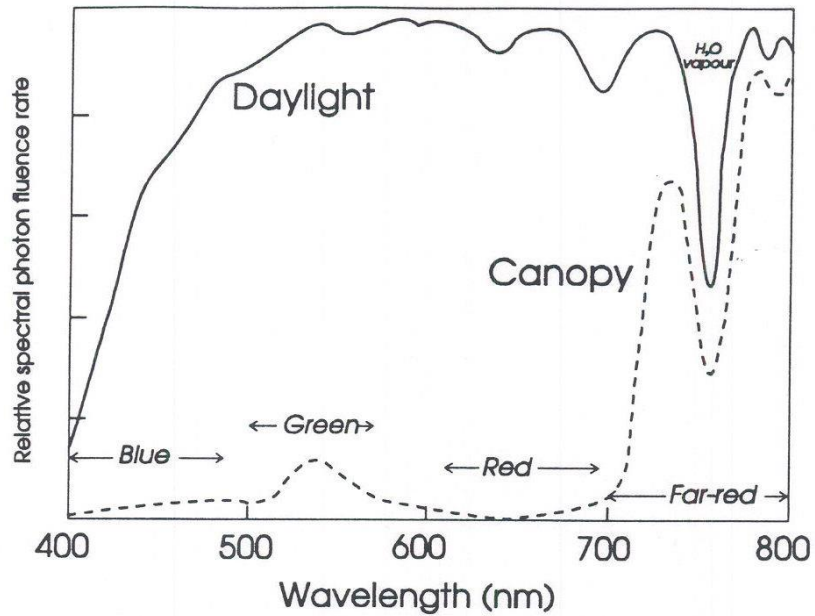
## FITOCROMOS (At)

phyA (VLFR y HIR)  
phyB (LFR)  
phyC  
phyD  
phyE



# FUNCIONES ECOLOGICAS DEL FITOCROMO

- respuestas al sombreado
- percepción de “vecinos”
- germinación de semillas



$$R/FR = \frac{\text{Photon fluence rate in 10 nm band centered on 660 nm}}{\text{Photon fluence rate in 10 nm band centered on 730 nm}}$$

**TABLE 17.3**  
Ecologically important light parameters

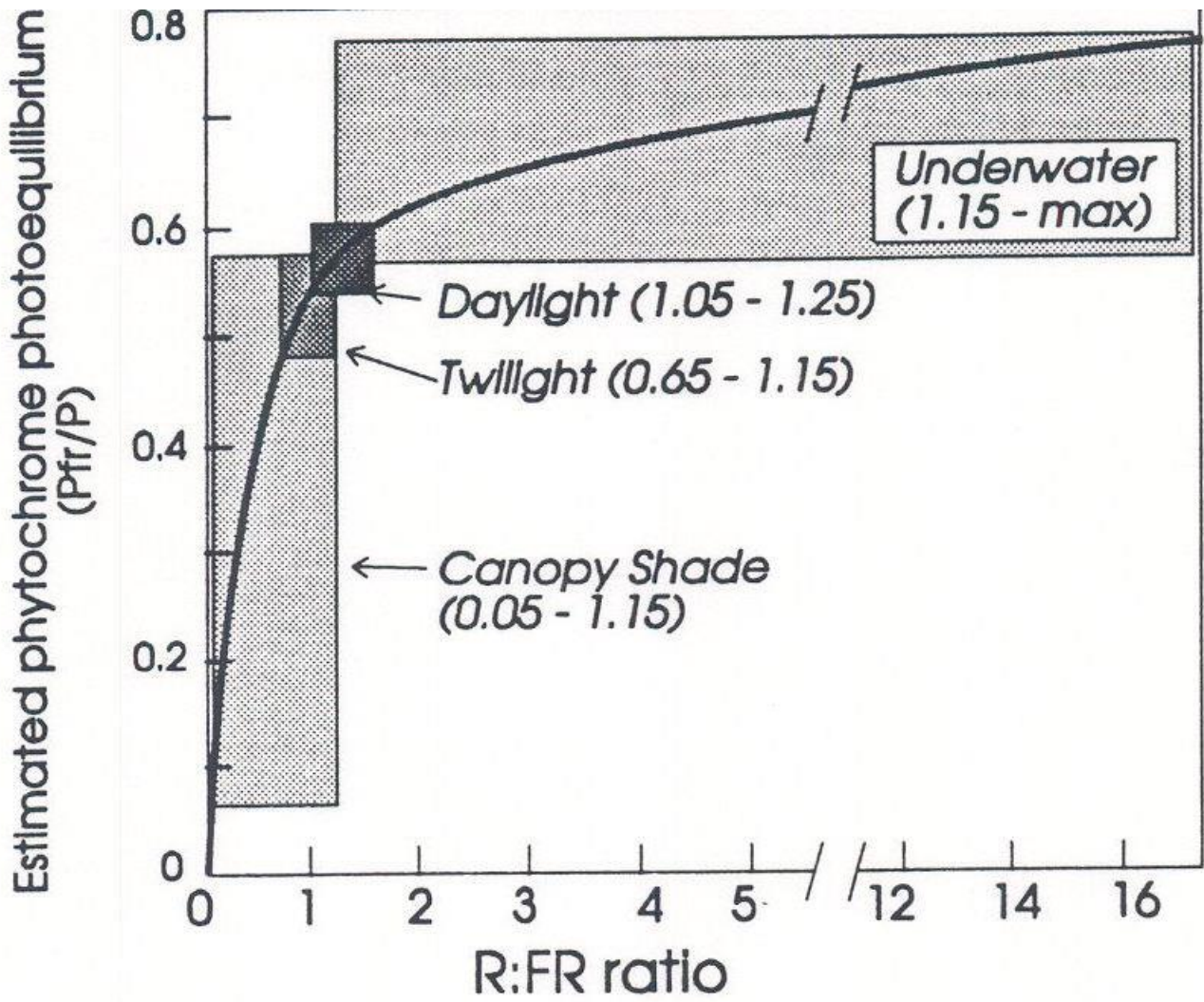
	Photon flux density ( $\mu\text{mol m}^{-2} \text{s}^{-1}$ )	R/FR <sup>a</sup>
Daylight	1900	1.19
Sunset	26.5	0.96
Moonlight	0.005	0.94
Ivy canopy	17.7	0.13
Lakes, at a depth of 1 m		
Black Loch	680	17.2
Loch Leven	300	3.1
Loch Borrallie	1200	1.2
Soil, at a depth of 5 mm	8.6	0.88

Source: Smith 1982, p. 493.

Note: The light intensity factor (400–800 nm) is given as the photon flux density, and phytochrome-active light is given as the R:FR ratio.

<sup>a</sup>Absolute values taken from spectroradiometer scans; the values should be taken to indicate the relationships between the various natural conditions and not as actual environmental means.





## Respuestas a la luz filtrada por un canopy

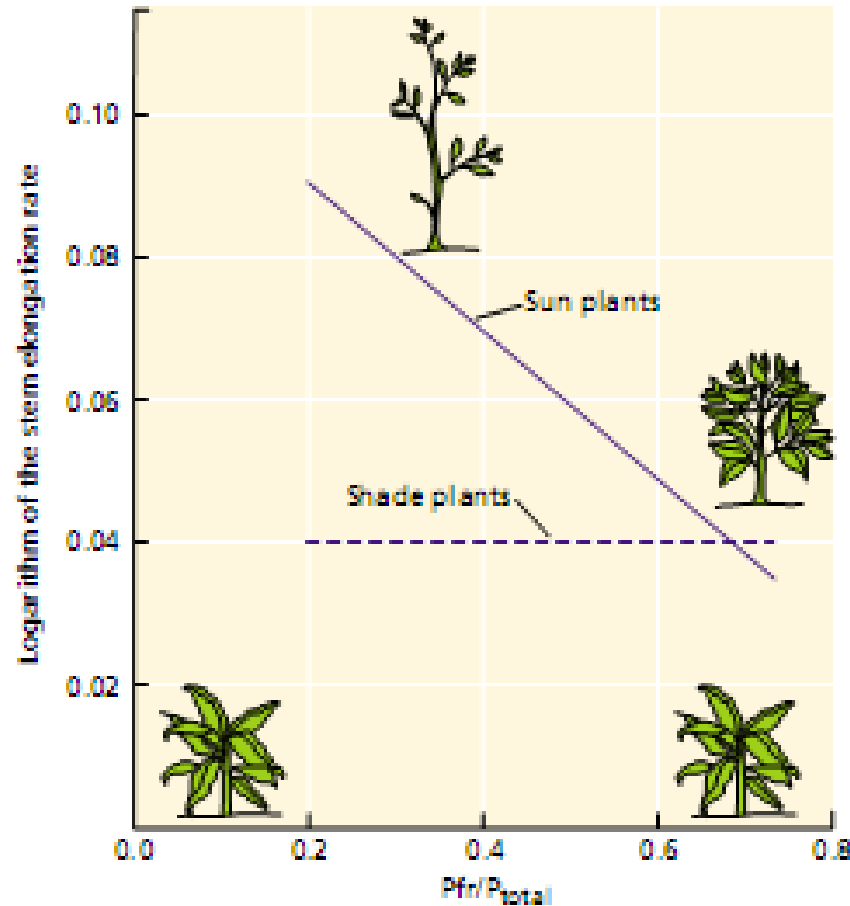
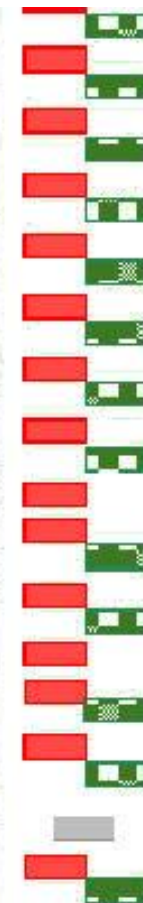
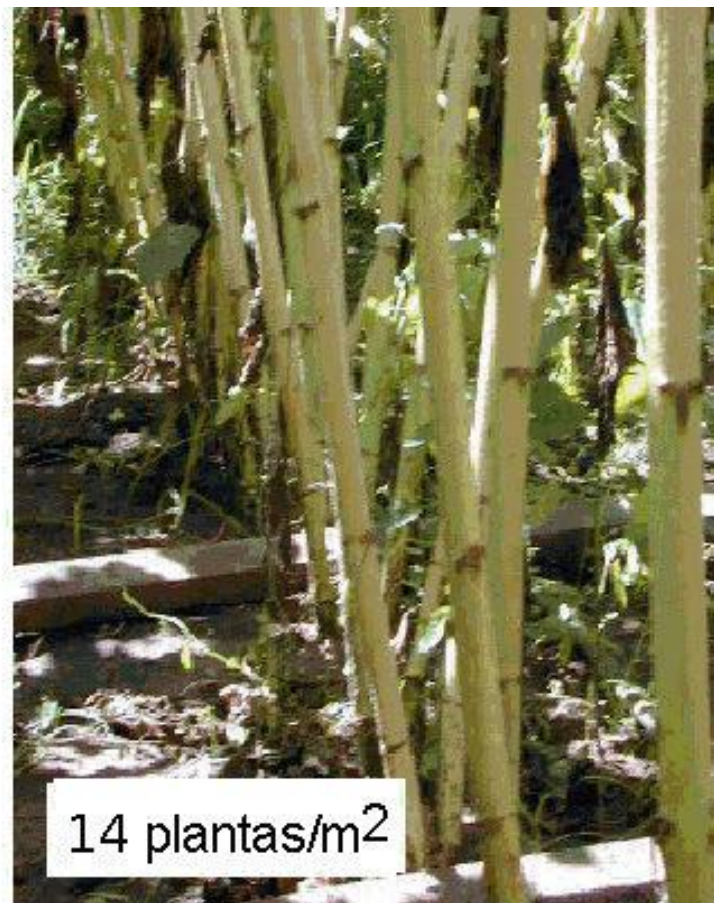
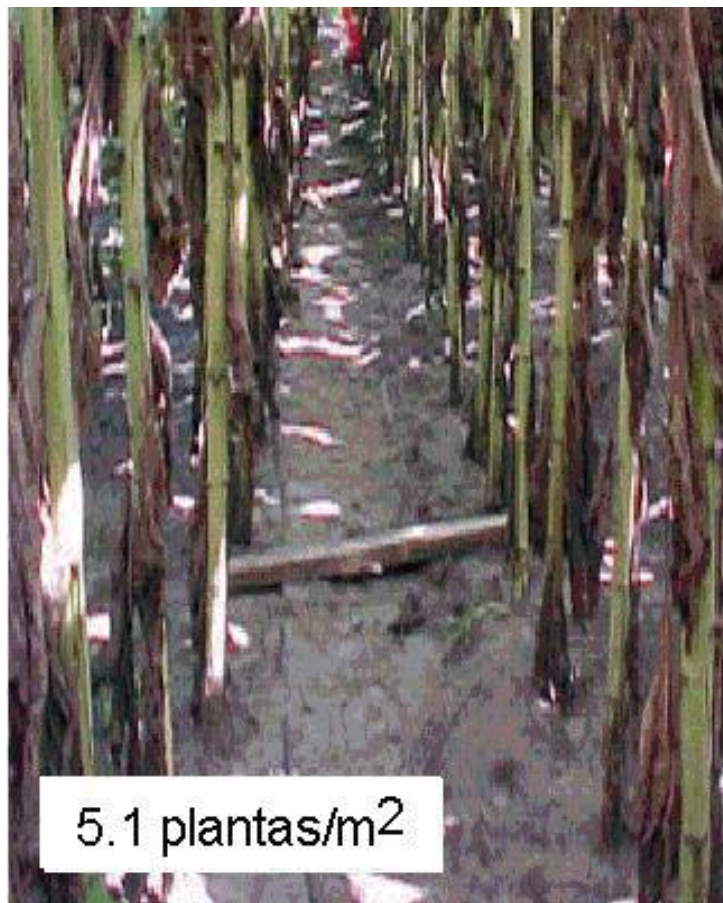




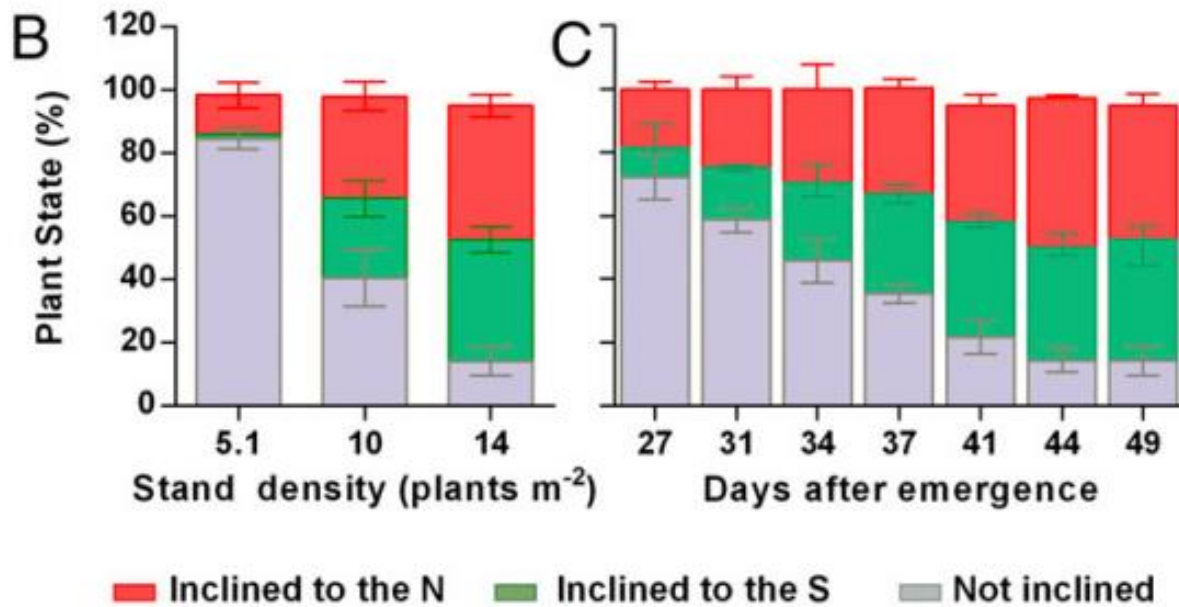
FIGURE 17.11 Role of phytochrome in shade perception in sun plants (solid line) versus shade plants (dashed line). (After Morgan and Smith 1979.)



 Inclinadas hacia el N

 Inclinadas hacia el S

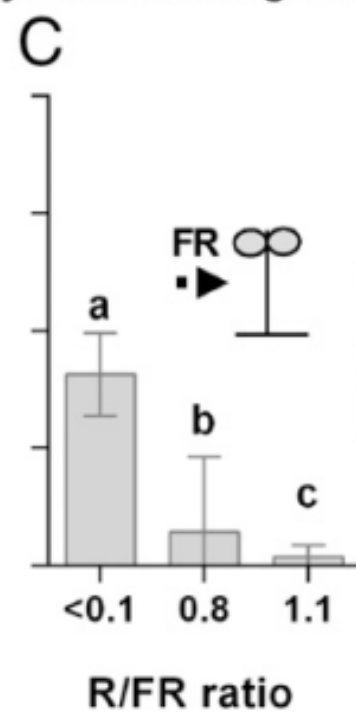
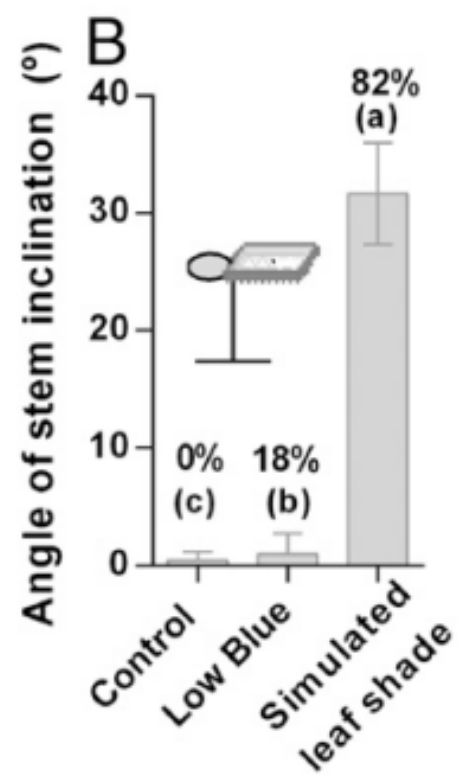
 No inclinadas



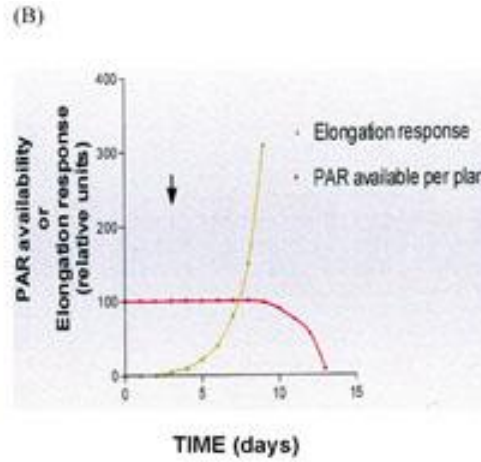
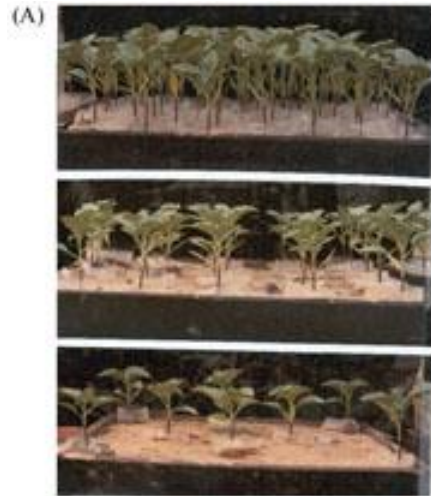




La posición del ápice de las plantas a lo largo de un surco va cambiando con el tiempo. El ápice marcado con el círculo verde claro sombrea a sus dos vecinas (marcadas con los círculos rojo y azul). Estas dos se inclinan en dirección opuesta al sombreo. Luego, la vecina de la azul (señalada con un círculo blanco) se inclina en dirección opuesta a la anterior. Así comienza la ola de inclinaciones. La línea punteada indica el surco de siembra. En la parte superior derecha figura fecha y hora de cada foto. Foto: gentileza de los investigadores.



# Respuestas a la luz reflejada por “vecinos”

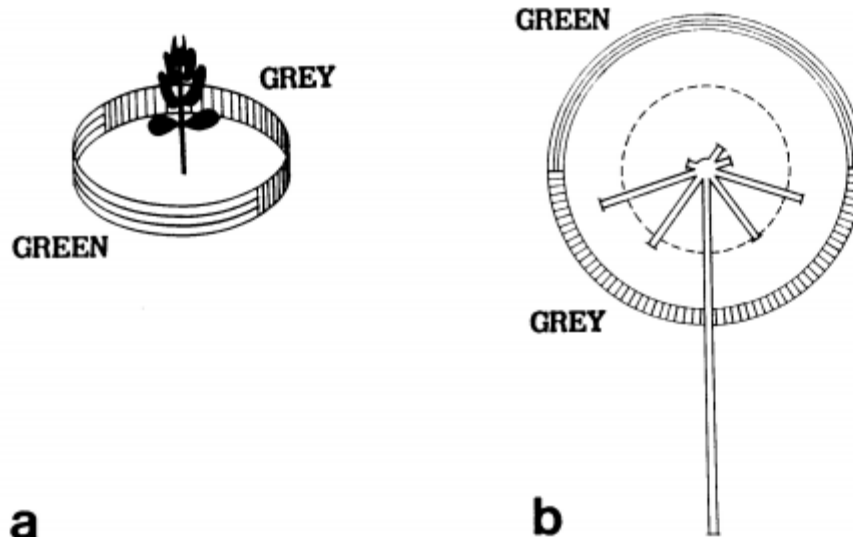




**Respuestas a la luz reflejada por “vecinos” en *Portulaca oleraceae***







**Fig. 5a, b.** Influence of horizon light filters on the development of *Portulaca* seedlings. **a** A pot with a single plant was surrounded by plastic rim, only 2 cm high. One half of this plastic was green and the other grey. The green plastic transmitted and reflected far-red light but was otherwise similar to the grey plastic. **b** Relative frequency (not length) of plants with their main shoot developing towards various directions. 93 of the 98 plants in the experiment avoided the plastic that transmitted and reflected far-red light ( $p < 0.0001$ )

## Germinación por muy bajos flujos de luz (VLFR)

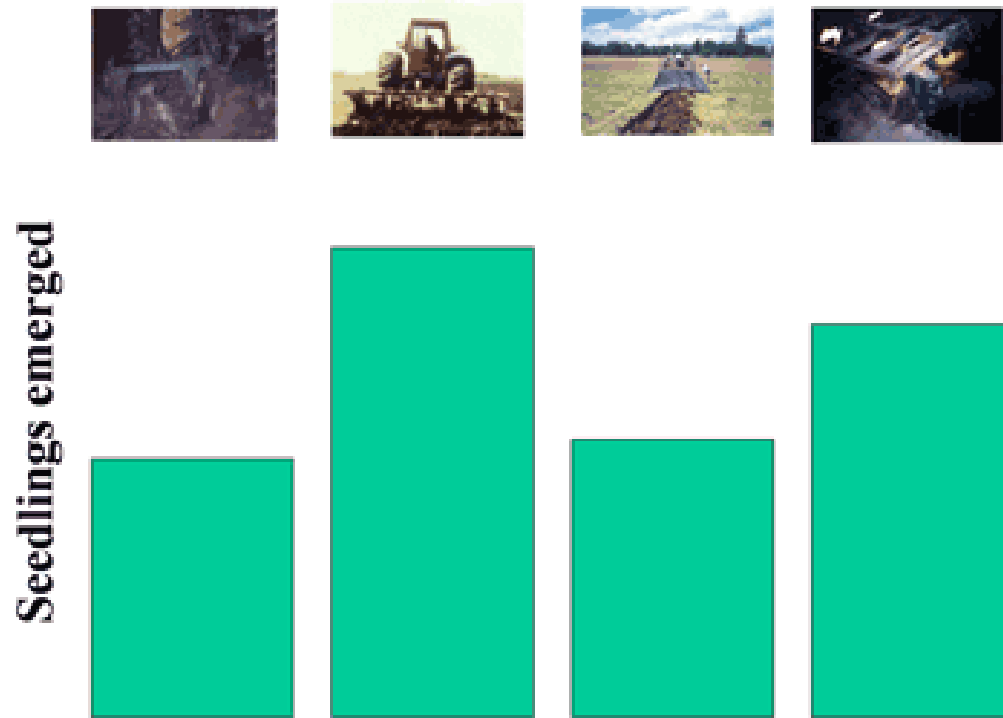


Fig. 2

## RESPUESTAS A LA LUZ AZUL



FIGURE 18.3 Time-lapse photograph of a corn coleoptile growing toward unilateral blue light given from the right. The consecutive exposures were made 30 minutes apart. Note the increasing angle of curvature as the coleoptile bends. (Courtesy of M. A. Quiñones.)

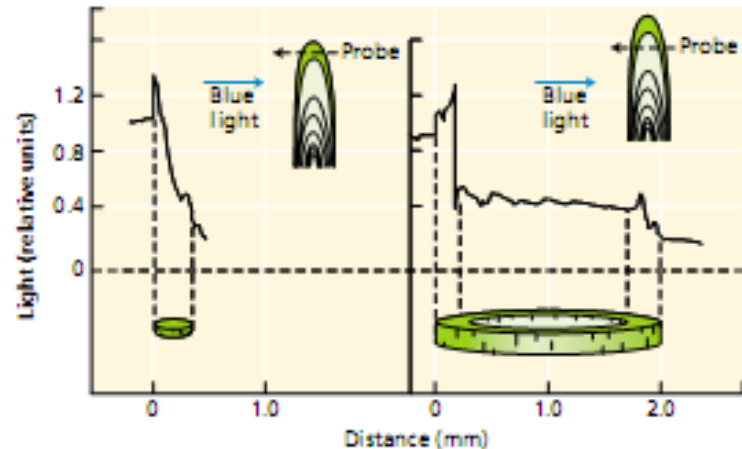
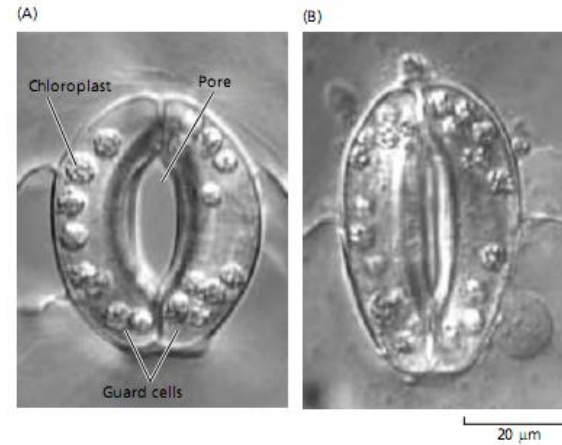
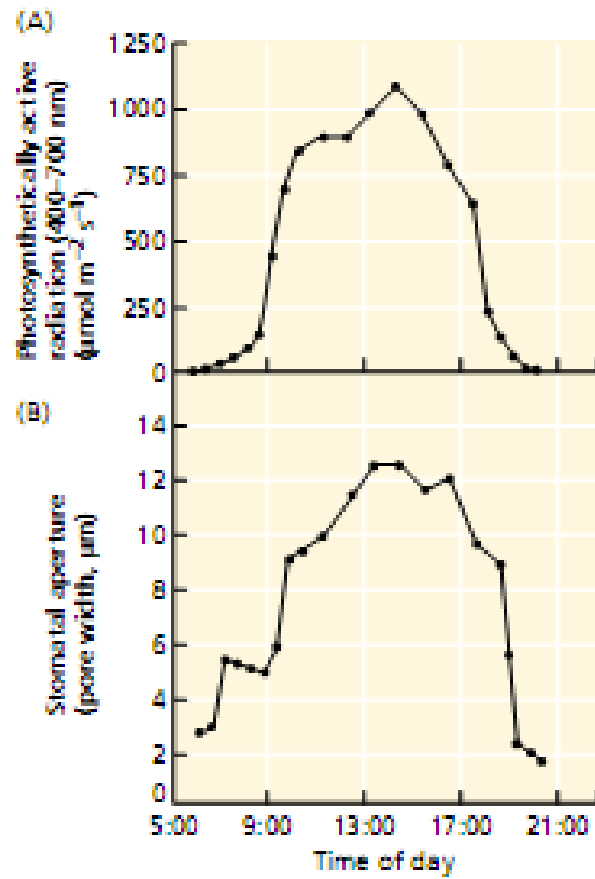
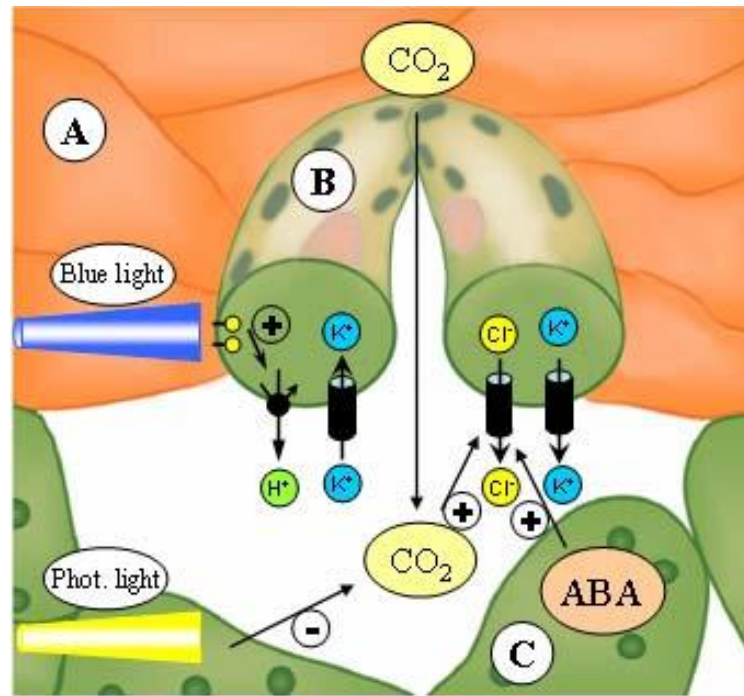


FIGURE 18.5 Distribution of transmitted, 450 nm blue light in an etiolated corn coleoptile. The diagram in the upper right of each frame shows the area of the coleoptile being measured by a fiberoptic probe. A cross section of the tissue appears at the bottom of each frame. The trace above it shows the amount of light sensed by the probe at each point. A sensing mechanism that depended on light gradients would sense the difference in the amount of light between the lighted and shaded sides of the coleoptile, and this information would be transduced into an unequal auxin concentration and bending. (After Vogelmann and Haupt 1985.)



**FIGURE 18.8** Light-stimulated stomatal opening in detached epidermis of *Vicia faba*. Open, light-treated stoma (A), is shown in the dark-treated, closed state in (B). Stomatal opening is quantified by microscopic measurement of the width of the stomatal pore. (Courtesy of E. Ravesh.)



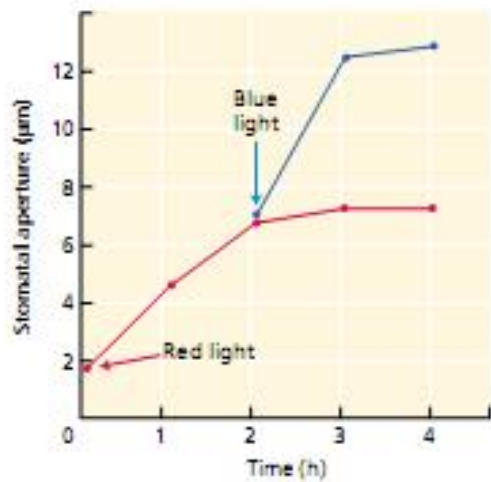
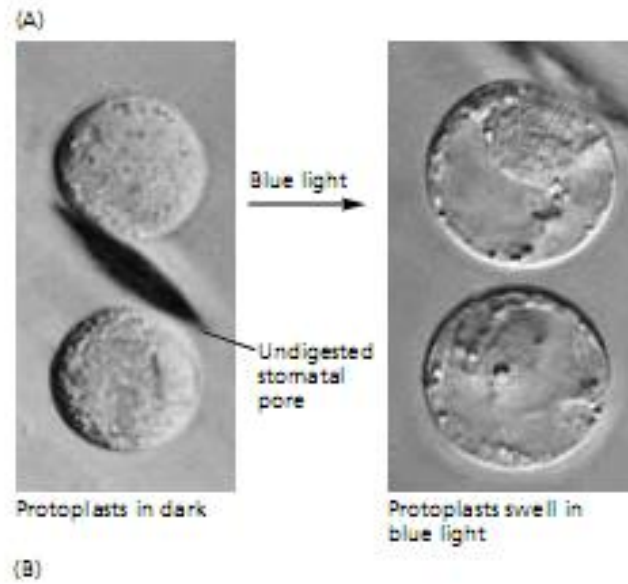


FIGURE 18.10 The response of stomata to blue light under a red-light background. Stomata from detached epidermis of *Commelina communis* (common dayflower) were treated



# CRIPTOCROMOS

- Desetiación
- Expansión de cotiledones
- Síntesis de antocianinas

At: Cry1 & Cry2

Cry1: elongación hipocótilo,  
reloj circadiano

Cry2: expansión cotiledones

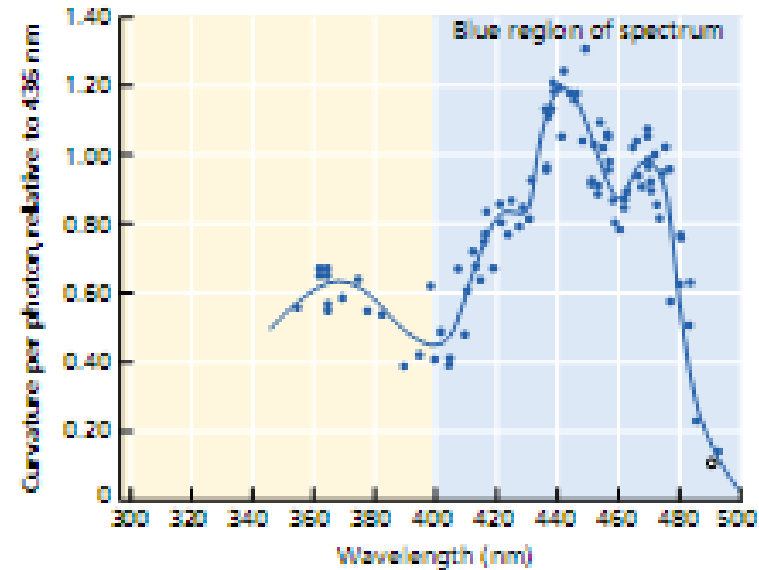
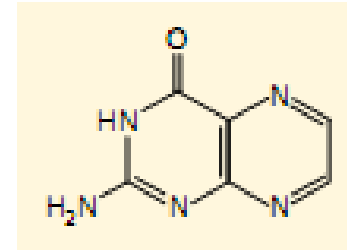
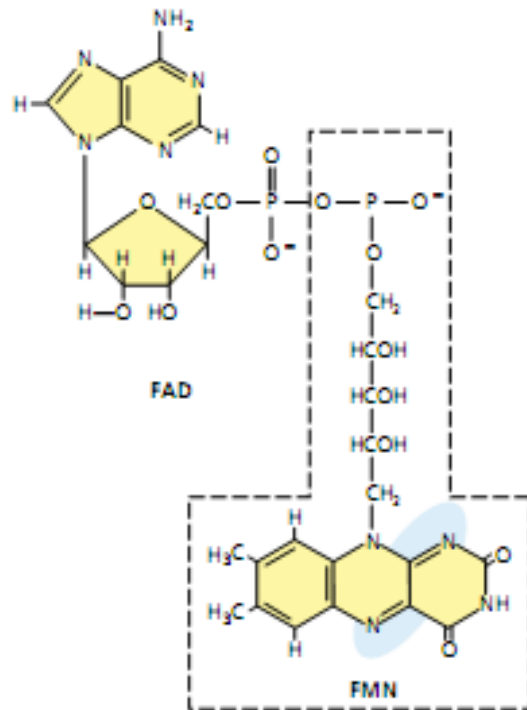


FIGURE 18.1 Action spectrum for blue light-stimulated phototropism in oat coleoptiles. An action spectrum shows the relationship between a biological response and the wavelengths of light absorbed. The “three-finger” pattern in the 400 to 500 nm region is characteristic of specific blue-light responses. (After Thimann and Curry 1960.)

(B)



**A pterin (fully oxidized)**



# FOTOTROPINAS

## •Fototropismo

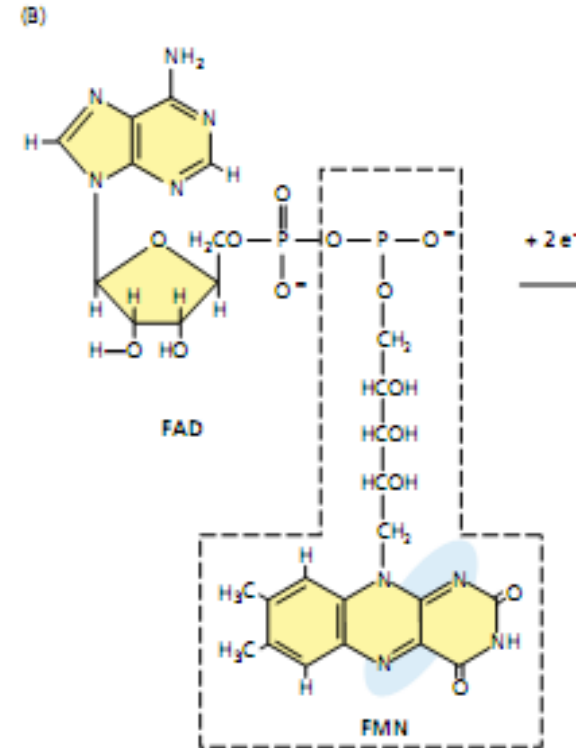
At: Phot1 & Phot2

Phot1: bajos flujos cuánticos

Phot2: altos flujos cuánticos



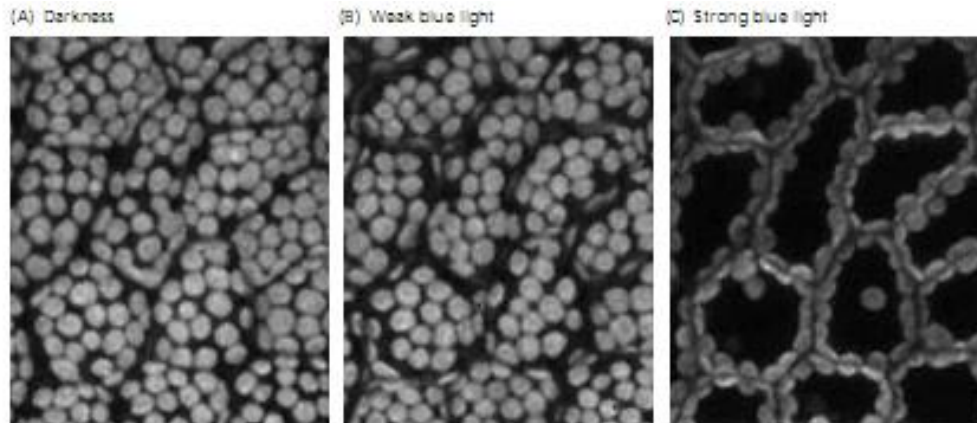
FIGURE 18.3 Time-lapse photograph of a corn coleoptile growing toward unilateral blue light given from the right. The consecutive exposures were made 30 minutes apart. Note the increasing angle of curvature as the coleoptile bends. (Courtesy of M. A. Quiñones)



# FOTOTROPINAS: movimientos de los cloroplastos

Phot1

Phot2



**FIGURE 9.5** Chloroplast distribution in photosynthesizing cells of the duckweed *Lawia*. These surface views show the same cells under three conditions: (A) darkness, (B) weak blue light, and (C) strong blue light. In A and B, chloroplasts are positioned near the upper surface of the cells,

where they can absorb maximum amounts of light. When the cells were irradiated with strong blue light (C), the chloroplasts move to the side walls, where they shade each other, thus minimizing the absorption of excess light. (Micrographs courtesy of M. Tialka and M. D. Fricker.)

<u>Fenómeno fotosensible</u>		<u>Flujo cuántico requerido</u>	<u>Fotoreceptor</u>
Germinación (VLFR)	R	$10^{-6} - 10^{-4} \mu\text{mol m}^{-2}$	Phy A
Percepción de vecinos, sombra (reversibilidad R/RL)	R / RL	$1 - 10^2 \mu\text{mol m}^{-2}$	Phy B
Inhibición del crecimiento (desetiolación)	A - R		Phot 1 Cry 1, Cry2, PhyA, Phy B
Fototropismo	A	$> \mu\text{mol m}^{-2} \text{s}^{-1}$	Phot 1, Phot 2
Síntesis de clorofila, antocianinas (desetiolación)	A - R	$> \mu\text{mol m}^{-2} \text{s}^{-1}$	Cry 1, Cry 2, Phy B
Movimientos de los cloroplastos	A	$10 - 2500 \mu\text{mol m}^{-2} \text{s}^{-1}$	Phot 1, Phot 2
Apertura estomática	A	$10 - 2500 \mu\text{mol m}^{-2} \text{s}^{-1}$	Phot 1, Phot 2, zeaxantina