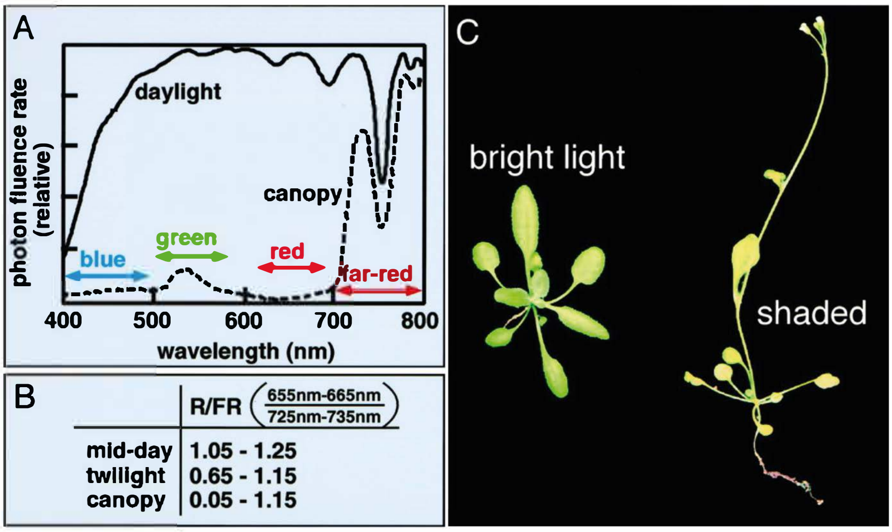
La qualité de la lumière comme indicateur du temps et de l'espace

Source: Neff, M. M., Fankhauser, C. & Chory, J. Light: an indicator of time and place. *Genes & Development* **14**, 257–271 (2000)



The ratio of R/FR light is a good indicator of time and place. (A) Light spectra of daylight and under a plant canopy. (B) R/FR ratios in different times and places.

Source: Martínez-García, J. F. et al. The Shade Avoidance Syndrome in Arabidopsis: The Antagonistic Role of Phytochrome A and B Differentiates Vegetation Proximity and Canopy Shade. *PLoS ONE* **9**, e109275 (2014)

The shade avoidance syndrome (SAS) refers to a set of plant responses aimed at adapting plant growth and development to high plant density environments, like those found in forests, prairies or orchard communities. Two related but different situations can occur in these environments: plant proximity (without direct vegetative shading) and direct plant canopy shade [1]-[3]. Because vegetation preferentially reflects far-red (FR) light compared to other wavelengths, plant proximity generates a reduction in the red (R, about 600-700 nm) to far-red (FR, between 700-800 nm) ratio (R:FR) in the light impinging on neighbors. By contrast, under a plant canopy, light from the visible region (called photosynthetically active radiation or PAR, between 400-700 nm) is strongly absorbed by the chlorophyll and carotenoid photosynthetic pigments whereas FR, which is poorly absorbed by the leaves, is transmitted through (or reflected from) vegetation. As a consequence, under direct plant canopy shade both the amount of PAR (light quantity) and R:FR (light quality) are greatly reduced, in the latter case mostly by the selective depletion of R light caused by the filtering of sunlight through the leaves [1], [2], [4]-[6].

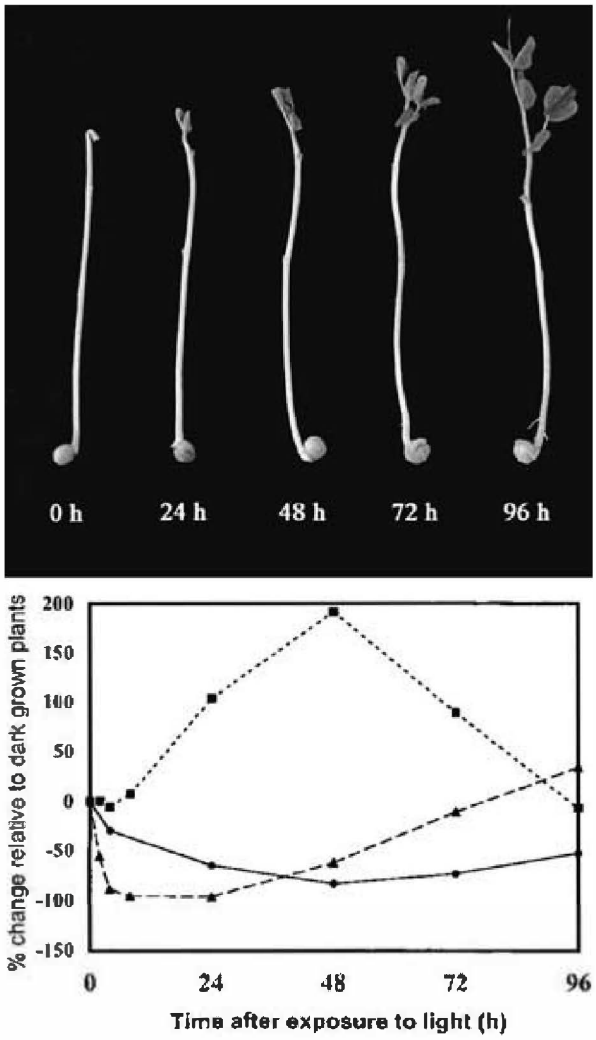
Etiolement - dé-étiolement

Source: Li, J., Li, G., Wang, H. & Wang Deng, X. Phytochrome Signaling Mechanisms. ***The Arabidopsis Book / American Society of Plant Biologists*** ***9*** **(2011)**

Dark-grown seedlings undergo skotomorphogenesis (etiolation) and are characterized by long hypocotyls, closed cotyledons and apical hooks, and development of the proplastids into etioplasts. Light-grown seedlings undergo photomorphogenesis (deetiolation) and are characterized by short hypocotyls, open and expanded cotyledons, and development of the proplastids into green mature chloroplasts (McNellis and Deng, 1995).

Source: Symons, G. M. & Reid, J. B. Interactions Between Light and Plant Hormones During De-etiolation. ***Journal of Plant Growth Regulation*** **22, 3–14 (2003).**

Light has a profound influence on virtually all aspects of plant growth and development, including seed germination, seedling development, morphology and physiology of the vegetative stage, the control of circadian rhythms and flowering (Kim and others 2002; Nemhauser and Chory 2002). The effect of light on plant growth and development is perhaps most obvious during the transition from a dark-grown (etiolated) to a light-grown (de-etiolated) morphology. Etiolated dicotyledonous seedlings exhibit a phenotype that includes a pronounced apical hook, elongated epicotyl/hypocotyl and undifferentiated chloroplast precursors (Chory and others 1996; Clouse 2001). Upon exposure to light, seedlings undergo a number of dramatic changes, including a significant reduction in the rate of elongation, opening of the apical hook, expansion of true leaves and the development of mature chloroplasts (Chory and others 1996; Clouse 2001; Figure 1).



Top: Morphological changes in WT pea seedlings during de-etiolation. All plants were grown for 7 days at 20°C in continuous darkness before being transferred to continuous W light at an intensity of 150 μmol.m^{-2}s^{-1}. Bottom: Percentage change in endogenous hormone levels in etiolated WT plants after exposure to light. All plants were grown for 7 days at 20°C in continuous darkness before being transferred into continuous W light at an intensity of 150 μmol.m^{-2}s^{-1}. Values represent the percentage change in hormone levels (relative to the ng/g FW levels in the dark-grown controls) at various timepoints (0, 2, 4, 8, 24, 48, 72, and 96 h) after exposure to light. Each value was calculated using the mean hormone levels, determined from three individual replicates, each containing either 5 or 6 plants. [Square] indicates the change in IAAlevels, [circle] the change in ABA and [triangle] the change in GA1 at each time point.

While the perception of light through photoreceptors is well understood, the downstream components of light-signal transduction and the mechanisms by which light mediates phenotypic change are not clear (Fankhauser and Chory 1997; Fankhauser and Staiger 2002; Nemhauser and Chory 2002). However, many of the light-induced changes during de-etiolation, particularly the change in stem elongation, are also known to be regulated by plant hormones (Garcia-Martinez and Gil 2002). Thus the integration of light and hormone signalling pathways is also thought to be required for normal plant development (Clouse 2001). Indeed, plant hormones are thought to act as transducers of the light signal by mediating the effects of light on plant growth and development (Nemhauser and Chory 2002). A number of plant hormones have been implicated in the regulation of morphological change during de-etiolation, including gibberellins (GA), indole-3-acetic acid (IAA), abscisic acid (ABA), cytokinins (CK), brassinosteroids (BRs) and ethylene (Chory and Li 1997; Garcia-Martinez and Gil 2002; Kraepiel and Miginiac 1997; Neff and others 2000; Tian and Reed 2001).