

# Plant Pigment: Phytochromes and Photoreceptors Notes

## *General Information*

Location:

Photoreceptors (cell membrane, general case)      Phytochromes (cytoplasm)

Method of transfer: (n/a)

Structure:

Phytochrome is a photoreceptor, a pigment that plants use to detect light. It is a protein with a bilin chromophore. It has two different chemical structures that are interconvertable. The forms are named by the color of light that they absorb.

Main roles:

- Detect mainly red and far-red region of the visible spectrum
- Regulates germination of seeds
- Shade avoidance

Phytochrome vs. photoreceptor: location is generally different. Phytochrome has two chemical structures.

## *Specific Information*

Role of phytochromes in seed germination:

After a seed germinates, the hypocotyls lifts the cotyledons above the soil. The growth of hypocotyls is rapid until the plant penetrates the soil and is exposed to light. Once in the light, the growth of the hypocotyls is inhibited by the Pfr phytochromes.

Difference between red & far-red light for phytochromes:

The two forms of phytochrome differ in their absorption spectra. Pr is a blue form that absorbs red light (660 nm) and Pfr is a blue-green form that absorbs far-red light (730 nm).

Phytochrome switching:

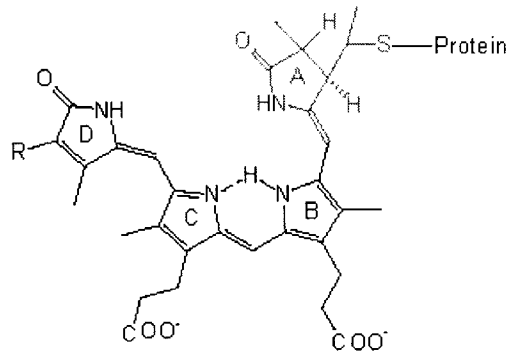
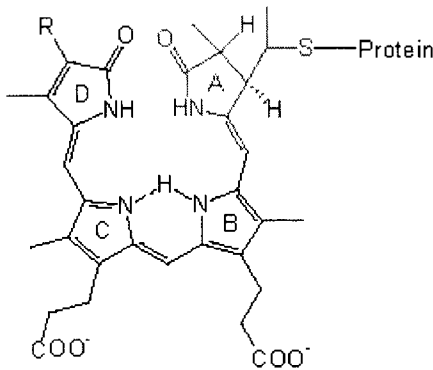
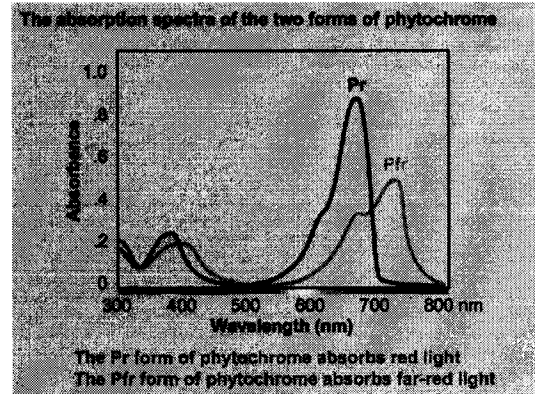
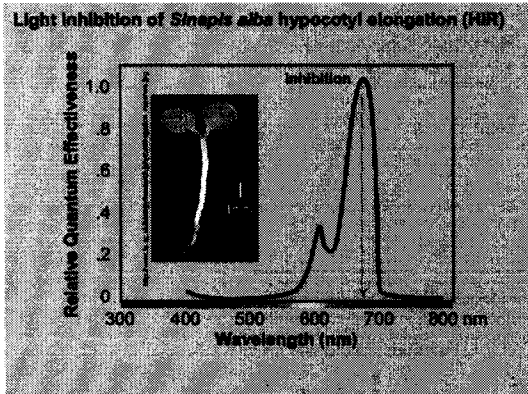
Pr is a blue pigment that turns into Pfr after absorbing red light. Pfr is a blue-green pigment that turns into Pr after absorbing far-red light.

Role of phytochromes in shade avoidance:

Shade avoidance is a set of responses that plants display when they are subjected to the shade of another plant. Plants can tell the difference between the shade of an inanimate object and the shade of another plant, in which case the far red light is more responsive than red light. Phytochrome can measure the ratio of far-red to red light, and thus to detect whether the plant is in the shade of another plant, so it can alter its growth strategy.

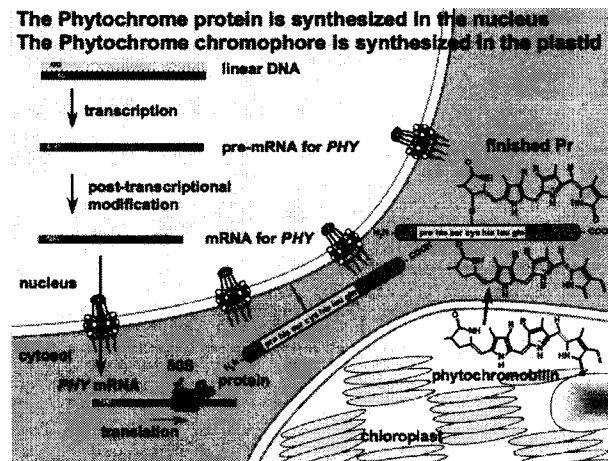
Vocabulary:

- Photoreceptor – a protein pigment used to detect light in order to carry out different processes
- Phytochrome – a type of photoreceptor that consists of a light-absorbing pigment with a protein chain. It absorbs red and far-red lights in the visible spectrum.
- Bilin - Bilins or bilanes are biological pigments formed in many organisms as a metabolic product of certain porphyrins.
- Chromophore - A chromophore is a region in a molecule where the energy difference between two different molecular orbitals falls within the range of the visible spectrum.



P<sub>R</sub>

P<sub>FR</sub>



[http://plantphys.info/Plant\\_Physiology/phytochrome.html](http://plantphys.info/Plant_Physiology/phytochrome.html)

<http://www.mobot.org/jwcross/duckweed/phytochrome.htm> (for more info)

Textbook: P.804-805, 817-819