

linked and competing synthetic pathways."

The short day and long day plants are believed to differ due to relative rates of P_{800} and P_{700} interconversion. It is felt that a high level of P_{800} maintained during a long dark period is needed for the flowering of a short day plant whereas in a long day plant low P_{800} processes are critical. It may also be said that the differences between short day and long day plants may not be due to the phytochrome alone.

MECHANISM OF PHYTOCHROME ACTION: -

The exact mechanism of the action of phytochromes is not known. They act probably - (i) by controlling active transport of ions and molecules across membranes probably by regulating ATPase activity (ii) by controlling the activity of membrane bound hormones such as gibberellins.

(iii) modulating the activity of membrane bound proteins. (iv) McC/ to Galston and coworkers hydroxylation of flavonoid compound is affected by phytochromes. Mohr, however suggests that radiation influences some 'basic metabolic change in the cell' responsible for many different effects, and influences on flavonoid hydroxylation patterns presumably represent only one such change.

(v) Works of K.V. Thimann and coworkers suggest that phytochrome action involves the synthesis of nucleic acids and enzymes which may be responsible for physiological changes. Mohr and others have found evidence to suggest that phytochrome effects are mediated by activation of genes that code for specific messenger RNA molecules which in their turn code for specific enzymes. The enzymes then bring about the biochemical changes resulting to several observed physiological responses.

(vi) There are certain responses due to red or far-red light which are too fast to be explained by the gene activation or repression hypothesis. Nyctinastic (photonastic) movements of flowers are good examples of such rapid responses. The time needed for such response is so short that it can not allow gene activation, mRNA synthesis, enzyme synthesis and enzymatic changes. It is therefore, felt that P_{800} in such cases causes a quick rise in the permeability of the plasma membrane.

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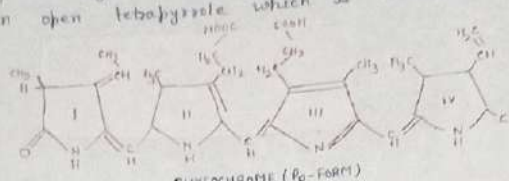
of membranes to solutes. Increased solute concentration causes endosmosis and increase in turgor pressure of the cells of pulvinus which results in closing movements of leaves. Phytohormones in such cases may act by affecting the permeability of the membrane.



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thus stimulating flowering in long day plants.

In recent years the prosthetic group or the chromophore of the pigment phytochrome has been isolated and shown to be an open tetrapyrrole which is related to phytylcyanobilin.



PHYTOCHROME (Pr-FORM)

RING I IN Pfr-FORM

Fig. - Structures of chromophores of Pr and Pfr forms of phytochrome.

Phytochromes have been detected in wide range of plants in angiosperms, gymnosperms, bryophytes and algae. Etiolated seedlings grown in dark have been used extensively in this connection. They have distinctly been detected in different parts of seedlings in roots, hypocotyls, cotyledons, coleoptiles, stems, petioles, leaf blades, vegetative buds, floral receptacles, inflorescences, developing fruits and seeds. Presence of phytochrome has also been shown indirectly in other plant materials. Phytochromes are believed to be located on cell membranes.

In the recent past spectrophotometric examinations have led Brigg and others to assume that most of the phytochrome is present in an inactive form.

Hartman the German physiologist has proposed a modified scheme of phytochrome action:

Inactive form

Pr $\xrightarrow{\text{red light}}$ Pfr $\xrightarrow{\text{far-red light}}$ Pfr^x $\rightarrow$ Biological form

Dark decay

↑
↓
x

Ac/c to him the biologically active form of phytochrome is some unknown derivative of Pfr. The fact that phytochrome has been found in several different physical forms and that several contradictory observations have been made, workers have concluded that Pfr (or Pfr^x) may undergo two or more reactions only one of which leads to the biologically active form. Evans (1975) says that Pfr (or Pfr^x) - "control the flow of reactive substances into x

linked and competing synthetic pathways."

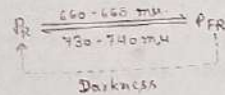


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PHYTOCHROME

It has already been seen that a brief exposure with red light during critical dark period inhibits flowering in short day plants and this inhibitory effect can be reversed by a subsequent exposure with far red light. Similarly the prolongation of the critical light period or the interruption of the dark period stimulates flowering in long day plants. This inhibition of flowering in short day plants and the stimulation of flowering in long day plants involves the operation of a proteinaceous pigment called as phytochrome.

- * The pigment phytochrome exists in two different forms —
 - (i) Red light absorbing form which is designated as P_R .
 - (ii) Far-red light absorbing form which is designated as P_{FR} .
- * These two forms of the pigment are photochemically interconvertible.
- * When P_R form of the pigment absorbs red light (660-665 m μ), it is converted into P_{FR} form.
- * When P_{FR} form of the pigment absorbs far-red light (730-740 m μ), it is converted into P_R form.
- * The P_{FR} form of the pigment gradually changes into P_R form in darkness.



It is considered that during the day the P_{FR} form of the pigment is accumulated in the plant which is inhibitory of flowering in short-day plants but is stimulatory in long-day plants. During critical dark period in short-day plants, this form gradually changes into P_R form resulting in flowering. A brief exposure with red light will convert this form again into P_{FR} form thus inhibiting flowering. Reversal of the inhibitory effect of red light during critical dark period in SDP by subsequent far-red light exposure is because the P_{FR} form after absorbing far-red light (730-740 m μ) will again be converted back into P_R form.

Prolongation of the critical light period or the interruption of the dark period by red light in long-day plants will result in further accumulation of the P_{FR} form of the pigment.