Photophosphorylation Encyclopedia Article

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Photophosphorylation

Photophosphorylation is the light powered production of energy-rich adenosine triphosphate (ATP) during photosynthesis. ATP is formed by phosphorylation of adenosine diphosphate (ADP) in a reaction that stores energy in the bond linking ADP with an added phosphoryl group. Light provides the needed energy and in the process is converted into chemical energy. The chemical energy stored in ATP is used to synthesize sugars and other biochemical products of photosynthesis. In green plants the process takes place in a plant organelle called the chloroplast. The primary light-absorbing pigment is called chlorophyll, and is the substance responsible for the plant's green color. Based on the type of electron flow involved there are two types of photophosphorylation, cyclic and non-cyclic. In cyclic photophosphorylation the electron associated with a chlorophyll molecule is excited by a light photon but than returns to the original chlorophyll molecule from which it was emitted, whereas in the non-cyclic process electrons are transferred from an emitting to an accepting chlorophyll molecule. In either case, intermediate electron carriers mediate the flow and capture the energy lost by the electron in returning to an unexcited state. The intricate energy conversion process requires a precise structural organization of thylakoid membranes in the interior of the chloroplast to successfully couple electron flow to the ATP producing process. Any disruption of the elaborate thylakoid structure leads to an uncoupling of electron flow from ATP production, and photosynthesis is no longer possible.