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Perspective

Brief Note on Molecular Mechanism of Photosynthesis

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DESCRIPTION

Photosynthesis is a light-driven process of organic molecule production and is required as a starting component and energy source for the entire cellular process. It is carried out by primary producers including terrestrial plants, algae, and oxygen anoxic photosynthetic bacteria. Oxygen photosynthesis has two stages. A photo-dependent reaction that produces NADPH and ATP molecules containing oxygen as by-products, and a photo-independent reaction that uses NADPH and ATP as energy sources to convert carbon dioxide into organic molecules. Light-dependent processes require light-absorbing dyes that are classified as carotenoids, bilins, and chlorophylls. Chlorophyll and carotenoids are ubiquitous in all photosynthetic organisms, but the phycobiliprotein complex bilin is specific for cyanobacteria, red algae, glaucophytes, and cryptophytes. There are multiple variations of each dye, and certain species of organisms have a particular set optimized for light uptake and photosynthetic efficiency in a particular environment. The common chlorophyll in oxygenated photosynthetic organisms is chlorophyll a, and chlorophyll b, c, d, or f is synthesized depending on the organism. Chlorophyll d (3 formyl chlorophyll a) and chlorophyll F (2 formyl chlorophyll a) have long-range long-wavelength absorption characteristics, that is, redshifted chlorophyll.

Oxygen-evolving photosynthesis is the main reaction in cyanobacteria, green algae, and plants that converts the solar energy of almost every life on earth into chemical energy. The photoreaction of photosynthesis is driven by a complex of Photosystem I (PSI) and Photosystem II (PSII). These complexes use the captured sunlight to excite the primary donor, causing a linear electron transfer reaction. PSI catalyzes transmembrane electron transfer by sunlight. Oxidation of plastocyanins inside the thylakoid membrane and reduction of ferredoxin in the stroma. PSI is the most efficient photoelectric device in nature with quantum efficiency close to 100% because all photons captured by PSI are used for electron transfer. PSI plays an important role in photosynthetic adaptation to changing environments, primarily through participation in PSI Cyclic Electron Transfer (CET), state transitions, and stoichiometric coordination of optical systems. In the CET reaction, electrons are returned from ferredoxin to PSI *via* plastoquinone, producing ATP without accumulating NADPH. It is believed to balance the ATP/ NADPH ratio. Two independent pathways have been identified in angiosperms. One is the antimycin A-sensitive signaling pathway involving the Proton Gradient Regulation 5 (PGR5) and PGR5like 1 (PGRL1) complexes. Alternative pathways include the NADH Dehydrogenase-Like (NDH) complex. While the PGR5–PGRL1 signaling pathway is required for efficient photosynthesis and photoprotection, the NDH signaling pathway is designed to prevent over reduction of chloroplast stroma, especially under stress conditions.

The mechanism of photosynthesis

Photosynthesis is an ideal introduction to this topic. Robert blankenship, a leader in photosynthesis research, offers a modern approach to photosynthesis in this accessible and well-written text. This book provides a brief overview of the basic principles of energy storage and the history of the field, then moves on to more advanced topics such as electron transfer pathways, dynamics, genetic engineering, and evolution. Throughout, the blankenship it contains an interdisciplinary focus that makes this book attractive in all areas. A leading expert in photosynthesis and chairman of the international photosynthesis study group. An authoritative text that appears for the first time in 10 years. Emphasizes an interdisciplinary approach that appeals to all science students. Emphasizes recent advances in molecular structure and mechanics. Text containing only comprehensive processing of both bacterial and plant photosynthesis. Includes up-to-date insights and research on structural information, improved spectroscopic techniques, and advances in biochemical and genetic methods. Presents the most comprehensive treatment of the origin and evolution of photosynthesis. A comprehensive appendix that fully introduces the physical principles of photosynthesis, including thermodynamics, kinetics, and spectroscopy.

Function overview of photosystem 1 and 2

Photosystem I is a large membrane protein complex. The cyanobacterial PSI is composed of 12 protein subunits that are non-covalently linked to 127 cofactors (chlorophyll, carotenoids, fes clusters, phylloquinones). Photosystem I catalyzes photodriven electron transfer from the luminal side (ie, inside the thylakoid) soluble Cu-containing protein plastocyanin to the thylakoid membrane stroma side (outside) ferredoxin. There is some flexibility with respect to soluble electron donors and acceptors. The heme-containing soluble protein cytochrome c6 may function as a substitute for photosystem I in cyanobacteria or as a unique electron donor. In plants, algae, and cyanobacteria that grow under iron deficiency conditions, flavodoxin may function as an electron acceptor instead of ferredoxin. Photosystem I of the

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thermophilic cyanobacteria Synechococcuse longatus is a primer with a molecular weight of 1056,000 Da. It is the largest and most complex membrane protein whose structure has been elucidated.

Photosystem II catalyzes the transfer of photo driven electrons from water to plastoquinone. It supplies electrons throughout the photosynthetic process by extracting electrons from water.