iMedPub Journals

Acta Rheumatologica

2020
Vol.7 No.3

Evidence for the Involvement of Loosely Bound Plastosemiquinones in Superoxide Anion Radical Production in Photosystem II

Pavel Pospíšil
Department of Biophysics,Faculty of Science, Palacký University, Olomouc, Czech Republic
Email: pavel.pospisil@upol.cz

Recent evidence has indicated the presence of novel plastoquinone-binding sites, QC and QD, in photosystem II (PSII). Here, we investigated the potential involvement of loosely bound plastosemiquinones in superoxide anion radical ($O_2^{\bullet-}$) formation in spinach PSII membranes using electron paramagnetic resonance (EPR) spin-trapping spectroscopy. Illumination of PSII membranes in the presence of the spin trap EMPO (5-(ethoxycarbonyl)-5-methyl-1-pyrroline N-oxide) resulted in the formation of $O_2^{\bullet-}$, which was monitored by the appearance of EMPO-OOH adduct EPR signal. Addition of exogenous short-chain plastoquinone to PSII membranes markedly enhanced the EMPO-OOH adduct EPR signal. Both in the unsupplemented and plastoquinone-supplemented PSII membranes, the EMPO-OOH adduct EPR signal was suppressed by 50% when the urea-type herbicide DCMU (3-(3,4-dichlorophenyl)-1,1-dimethylurea) was bound at the QB site. However, the EMPO-OOH adduct EPR signal was enhanced by binding of the phenolic-type herbicide dinoseb (2,4-dinitro-6-sec-butylphenol) at the QD site. Both in the unsupplemented and plastoquinone-supplemented PSII membranes, DCMU and dinoseb inhibited photoreduction of the high-potential form of cytochrome (cyt). Based on these results, we propose that $O_2^{\bullet-}$ is formed via the reduction of molecular oxygen by plastosemiquinones formed through one-electron reduction of plastoquinone at the QB site and one-electron oxidation of plastoquinol by cyt at the QC site. On the contrary, the involvement of a plastosemiquinone formed via the one-electron oxidation of plastoquinol by cyt at the QD site seems to be ambiguous. In spite of the fact that the existence of QC and QD sites is not generally accepted yet, the present study provided more spectroscopic data on the potential functional role of these new plastoquinone-binding sitesPhotosystems are useful and auxiliary units of protein buildings associated with photosynthesis that together complete the essential photochemistry of photosynthesis: the ingestion of light and the exchange of vitality and electrons. Photosystems are found in the thylakoid layers of plants, green growth and cyanobacteria. They are situated in the chloroplasts of plants and green growth, and in the cytoplasmic layer of photosynthetic microorganisms. There are two sorts of photosystems: II and I

Photoexcited electrons travel through the cytochrome b6f complex to photosystem I by means of an electron transport chain set in the thylakoid film. This vitality fall is outfit, (the entire cycle named chemiosmosis), to ship hydrogen (H+) through the layer, into the thylakoid lumen, to give a potential vitality contrast between the thylakoid lumen space and the chloroplast stroma, which adds up to a proton-rationale power that can be utilized to create ATP. The protons are moved by the plastoquinone. On the off chance that electrons just go through once, the cycle is named noncyclic photophosphorylation..

For oxygenic photosynthesis, both photosystems I and II are required. Oxygenic photosynthesis can be performed by plants and cyanobacteria; cyanobacteria are accepted to be the begetters of the photosystem -containing chloroplasts of eukaryotes. Photosynthetic microscopic organisms that can't deliver oxygen have a solitary photosystem like either.

This work is partly presented at 13th world congress on Rheumatology, Orthopedics And Sports Medicine