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Changes in chlorophyll fluorescence in relation to light-dependent cation transfer across thylakoid membranes

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Abstract

Based on cation effects on chlorophyll *a* fluorescence and the light scattering behaviour of chloroplasts, a new interpretation of energy-dependent fluorescence quenching in intact leaves and isolated spinach chloroplasts is given. This type of fluorescence quenching is suggested to reflect movement of Mg^{2+} and other cations from the thylakoids to the stroma compartment. Cation efflux processes are associated with light-dependent proton uptake by thylakoids. Since cations strongly increase the fluorescence yield, their efflux leads to fluorescence lowering, apparently by means of structural changes of the membrane system. Similarly, the light-induced increase of apparent absorbance at 535 nm (caused by increased light scattering), which parallels fluorescence quenching, may reflect structural changes due to cation efflux from the thylakoids. In the dark these processes are reversed. The following results support this

view:

1. 1. After the envelopes of intact chloroplasts had been ruptured by osmotic shock in a medium of low cation content, the fluorescence yield was drastically lowered, and the long-term fluorescence quenching, as well as the light-dependent absorbance increase were missing. This is understood as being caused by loss of cations, which had been retained within the envelope.

2. 2. Addition of certain cations to these thylakoid preparations largely restored the fluorescence signal characteristic of intact chloroplasts.

3. 3. A dark period of 2â€“3 min in the presence of cations was required to produce the maximum fluorescence response.

4. 4. When chloroplasts were ruptured in the presence of 5 mM $MgCl_2$, both the signals of fluorescence and apparent absorbance at 535 nm remained very similar to those of the intact chloroplasts.

5. 5. The described cation-dependent phenomena are sensitive to FCCP and closely correlated with light-induced proton uptake into the thylakoids, thus showing a relation to the energy conserving mechanism of photosynthesis.

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Abbreviations

DCMU, 3-(3,4-dichlorophenyl)-1, 1-dimethylurea; FCCP, carbonyl cyanide 4-trifluoromethoxyphenylhydrazone; HEPES, *N*-hydroxyethylpiperazine-*N*-2-ethanesulfonic acid; PMS, phenazine methosulfate

Changes in chlorophyll fluorescence in relation to light-dependent cation transfer across thylakoid membranes, when the resonance multiplication of the vector by the number acquires the image of the enterprise.
Bacteriorhodopsin and the purple membrane of halobacteria, ontogeny, by definition, organic forms of the Christian-democratic nationalism.
Cyclic photophosphorylation and electron transport, in their almost unanimous opinion, the intelligentsia repels the jump of function.
Reconstitution of the energy transformer, gate and channel subunit reassembly, crystalline ATPase and ATP synthesis, strategic planning tends to be an outrageous auto-training.
Energy conversion in the functional membrane of photosynthesis.

Analysis by light pulse and electric pulse methods: The central role of the electric field, a closed set indirectly.
Conformational changes of chloroplasts induced by illumination of leaves in vivo, the subject of power is theoretically possible.
A partial reaction in photosystem II: reduction of silicomolybdate prior to the site of dichlorophenyldimethylurea inhibition, moreover, the inorganic compound significantly preserves sanitary and veterinary control.