## INFLUENCE OF COPPER AND CADMIUM IONS ON THE ELECTRON TRANSPORT IN PHOTOSYSTEM II

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## INTRODUCTION

Photosystem II (PSII) is a protein-lipid-pigment complex bound in plant thylakoids membranes. Thylakoids are organelles located in chloroplasts of high plants cells.

PSII is involved in photosynthesis – a process using light to produce chemical energy. The excitation energy is transmitted the special chlorophyll pair called Reaction center. Exited reaction center realises an electron reducing the first electron acceptor: pheophytin molecule. By the same mechanism electrons are transported to next acceptors and ATP and NADPH – chemical energy molecules is formed.

The understanding of electron transport time constants and amplitudes give us information about the efficiency of photosynthesis.

## MATERIALS

We studied electron transport in PSII on thylakoids isolated from spinach leaves and investigated the action of two heavy metals often present in the environment: cooper and cadmium.

Copper has one of the most toxic effects on plants among heavy metals [2] and photosystem II is the most sensitive site of that ion.







Measurements was done on the superhead fuoremeter using Kautski effect, which consist on studding the comportment of fluorescence of PSII under the effect of continuous light.

The oxidized state of  ${\rm Q}_{\rm A}$  quenches fluorescence. The fluorescence yield gives information about electron transport efficiency.

We obtained 3 time constants and corresponding amplitudes. The slowest time constant  $t_2$  (represented on graphs) corresponds to electron transport from PQ<sup>+</sup> in the bounding place  $Q_A$  to PQ<sup>+</sup> in the  $Q_B$  site.







## **OBSERVATIONS AND CONCLUSION**

• Cooper and cadmium ions both act on the  $Q_A - Fe - Q_B$  complex and at high concentration they deactivate photosystem II. At higher concentrations both ions act on light harvesting complexes destroying light harvesting antenna - chlorophylls.

• Measurement also showed that cooper is a more efficient electron transport inhibitor that cadmium. Cooper concentration at 100 µM causes an 83% decrease of active reaction centers, whereas the same concentration of cadmium induces only a 5% decrease.

• We observe a particular effect of cooper ions. They act on the cytochrome b<sub>559</sub>, which may be due to the fact that copper is a protonophor. It has also been showed that copper acts on the oxygen-evolving complex (OEC) [1]

• Finally, we could indicate the **minimal** number of bounding places of metals ions in PSII → 6 bounding places for Cu<sup>2+</sup> and 4 for Cd<sup>2+</sup> ions.

INNOVATIVE ECONOMY