How Plants Respond to Heavy Metal: Insights from Genes and Metabolites

Volkova, Anna (School: Gymnasium #2)

Heavy metals (HM) cause oxidative stress in plant cells. Insight in the mechanisms of the early stress response to heavy metal intoxication is crucial for the development of (transgenic) plants that are resistant to heavy metals. The purpose of our project is to evaluate the state of the antioxidant system under increased levels of HM. We measured the content of the low-molecular-weight antioxidant vitamin C, determined the activity of antioxidant ascorbate peroxidase (APX) enzyme and the expression of the individual Apx genes in the model plant Arabidopsis thaliana in response to treatment with copper and cadmium ions. Our data shows that the content of reduced vitamin C decreased while the amount of the oxidized form increased after treatment with copper ions. This concurred with the inactivation of APX. It has been proven that the individual members of the Apx multigenic family have different expression patterns in response to the stress. This indicates their differential roles in the protective response of plants. The state of the antioxidant system of the plant cell can serve as a marker of plant health and resistance to soil contamination by heavy metals. Based on our data, we suggest to create plants with overexpression of individual Apx genes or with elevated content of vitamin C. Such plants could grow on soils contaminated with copper and cadmium ions. Accumulation of these ions in plants will promote soil bioremediation.

Awards Won: