Biotechnological approach to the evaluation of the short-term stress response in plant cells

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Abiotic stress factors, like drought, salinity, temperature and toxic elements, can limit plantsgrowth and productivity. Several publications have investigated physiological and cellular effects derived from substantial changes in gene expression or triggered by drastic physical changes, but mechanisms inducing immediate endomembrane remodeling remain mostly unknown.

In this work, looking for new targets for genetic improvement, we isolated and transformed tobacco protoplasts with a set of endomembrane fluorescent markers that preferably label structure related to the conventional or unconventional secretion pathway, and we evaluatedthe effects of some abiotic stresses (cold, drought, salinity, and cadmium) on the endomembrane system in a short period of time.

The endomembrane system was unaffected by stresses caused by cold, 4°C, or drought (generated with the application of mannitol). When salt stress was applied, we observed a greater involvement of the ER in the formation of structure related to the unconventional secretion pathway: incremental doses of sodium chloride showed an increase in structure not only related to the unconventional pathway, but also of hybrid structure in which the marker of the unconventional secretion pathway co-localized with the marker of the conventional secretion pathway. When cadmium stress was applied, we observed a generalslowdown in both conventional and non-conventional secretion pathway.

It is unclear if these changes are immediate or the result of genetic control, but knowing these mechanisms will have important implications for the improvement of crops resilience in the context of climate change.