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AtNOGC1 protein bioelectrode for the determination of stress signalling molecules Nitric Oxide (NO), Carbon Monoxide (CO) and Calcium ion (Ca2+)

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Statement of the Problem: Abiotic and biotic stresses affect plant growth and development, which lead to major crop losses. Purpose of this study is to develop stress tolerant crops through determining the binding affinity of signaling molecules such as nitric oxide (NO), carbon monoxide (CO) and calcium ion (Ca2+), which bind and activate plant proteins such as AtNOGC1 that induce stress tolerance in plants.

Literature: AtNOGC1 is a novel plant protein with a guanylyl cyclase (GC) activity in vitro and is characterized by the heme NO and or oxygen (O2) binding domain (H-NOX), which sense NO and O2.

Methodology and results: AtNOGC1 was expressed and purified as a~67.7 kDa protein and was used to develop an electrochemical enzyme based-biosensor by immobilizing the protein onto the glassy carbon electrode (GCE) surface. Electrochemistry technique such as cyclic voltammetry (CV) was used to determine the binding affinity of the AtNOGC1 protein to stress signaling molecules. The mono-oxygenation catalytic cycle of AtNOGC1 binding towards NO took place in a reduction reaction and both the Fe3+ and the Fe2+ state of the heme binds to CO. The dynamic linear range of the Ca2+ was determined to be from 1 nM to 3 nM.

Discussion and conclusion: This study demonstrated that AtNOGC1 protein plays an important role as an electron transporter in redox reactions and that it binds to NO, CO, and Ca2+. AtNOGC1 protein bioelectrode is reproducible and can be used to determine the binding of many biological molecules in a short, reliable period of time. This research aims to pave a way towards the development of stress-tolerant crops to improve food security in order for the population to have an access to reliable, sufficient, affordable and nutritious food.

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