



University of Genova
Department of Earth, Environmental
and Life Sciences

Doctorate Course in Earth and
Environmental Science and
Technology

**Curriculum in biology applied to
agriculture and the environment**

Università degli Studi di Genova



Dottorato in Scienze e Tecnologie
per l'Ambiente e il Territorio

Research Theme N. 10

Titolo Caratterizzazione funzionale di citocromi b561 vegetali: da reazioni di ossido-riduzione a processi di fioritura

Title Functional characterization of plant cytochrome b561: from redox reactions to flowering processes.

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Program description including the formation program abroad

Plant cytochromes b561 are electron carriers having ascorbate as specific donor. We measured, for the first time, electronic currents mediated by a Drosophila cytochrome b561, proposing a mathematical model, which fully describes the complicated relationships among the electron acceptor, electron donor, and membrane voltage. We confirmed similar results for a plant cytochrome b561 from soybean (*Glycine max*) able to reduce ferric chelates. Both Drosophila and soybean cytochromes were expressed in oocytes from *Xenopus laevis* as heterologous system. We were subsequently able to record electron currents in vacuoles isolated from the mesophyll of model plant *Arabidopsis thaliana*. These data indicate, in line with the recently published crystallographic structure, that the tonoplast cytochrome b561 has two binding sites for ascorbate, facing respectively the cytosolic and the luminal side. Currents were totally absent in two lines of Arabidopsis knock-out of the same crystallized protein. The homozygous knock-out mutants were generated by the group of Prof. Trost (University of Bologna), with whom there is a long-standing and fruitful collaboration. Furthermore, these mutant plants exhibit a significant delay in flowering. The aim of the PhD project is the continuation of this research, to highlight the complex molecular aspects that give rise to the phenotype detected in the mutants. A mobility period abroad of 3-6 months can be organized in collaboration with international research groups from Germany or France.

Financial support

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Tutor's publications (max 3)

Picco, C., Scholz-Starke, J., Naso, A., Preger, V., Sparla, F., Trost, P., and **Carpaneto, A.** (2014). How are cytochrome b561 electron currents controlled by membrane voltage and substrate availability? *Antioxidants & Redox Signaling*. 21, 384–391.

Picco, C., Scholz-Starke, J., Festa, M., Costa, A., Sparla, F., Trost, P., and **Carpaneto, A.** (2015). Direct Recording of Trans-Plasma Membrane Electron Currents Mediated by a Member of the Cytochrome b561 Family of Soybean. *Plant Physiology*. 169, 986–995.

Gradogna A, Scholz-Starke J, Pardo JM, **Carpaneto A.** (2021). Beyond the patch-clamp resolution: functional activity of nonelectrogenic vacuolar NHX proton/potassium antiporters and inhibition by phosphoinositides. *New Phytologist*. 229:3026-3036