Advancements in *in vitro* culture techniques and genetic transformation for grapevine improvement

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Grapevine (*Vitis vinifera* L.) stands as a pivotal fruit crop with immense economic significance globally, contributing substantially to the agricultural sector and the overarching global economy. *In vitro* culture methodologies have emerged as indispensable tools for the propagation, preservation, and genetic enhancement of grapevine, particularly through the induction and maintenance of embryogenic calli, which hold considerable promise for various biotechnological applications, including those employing New Plant Breeding Techniques (NPBT).

Despite the potential of NPBT to augment grapevines by introducing desirable traits such as disease resistance, tolerance to environmental stress, and enhanced fruit quality, its present application is limited by notable technical and biological issues. These challenges encompass the considerable heterozygosity of the grapevine genome, resistance to transformation, the requisite presence of embryogenic calli specific to the genotype of interest, and the intricacies associated with regenerating embryos post-transformation.

In our investigation, we developed a novel system incorporating Growth-Regulating Factors (GRFs) and their associated proteins, the GRF-Interacting Factors (GIFs), aimed to enhance the regenerative potential of genetically transformed calli, notably within the Glera genotype, which holds particular importance in Prosecco winemaking. To evaluate the efficacy of this system, a series of experiments were conducted on recalcitrant embryogenic calli derived from the Glera genotype. Six months following genetic transformation, the regeneration efficiency was evaluated by quantifying the number of developed embryos resulting from each transformation event and assessing their capacity to mature into viable plants.