

PhD: Food Science

Title: Identification and analysis of miRNAs extracted from plant matrices: study of their nutraceutical activity in humans

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Objectives of the research project and interdisciplinary collaborations:

MicroRNAs (miRNAs), small non-coding RNAs of 16-24 nucleotides, regulate gene expression in plants and mammals, influencing cellular processes and diseases such as cancer. Recent studies suggest that plant miRNAs, ingested with food, can modulate molecular pathways in diseases, enhancing absorption via lipid nanocarriers or extracellular vesicles (EVs). This project's primary aim is to obtain insights into the cross-kingdom anticancer effects of selected miRNAs from grapevine (*Vitis vinifera*) and establish a protocol for delivering these molecules using plant-derived nanovesicles (PDNVs). This goal will be achieved by 1) the bioinformatic selection and validation of *Vitis vinifera* miRNAs isolated from pruning waste and fruits relevant to human health and cross-kingdom bioactivity, 2) isolation and characterization of PDNVs from grapes and their enrichment with miRNAs via electroporation, 3) in vitro and in vivo analysis of the anticancer properties of the selected miRNAs, administered in native form or loaded into PDNVs. These activities will benefit researchers in food technology, plant biology, medicine, and physiology. The results will help develop next-generation nano-delivery systems. The stated objectives will be pursued through collaborations with colleagues from DIA in chemistry (Forino), bioinformatics (D'Agostino), and researchers from CNR, the University of Verona, and the start-up ImmunoVeg (UNINA).

Innovation and originality of the project in relation to the state of the art:

The project introduces innovative elements such as the identification of miRNAs with cross-kingdom activity, applicable to plant species and human pathologies. It valorizes grapevine green pruning residues as a sustainable source of natural compounds for health. Advanced RNA technologies are utilized, and a delivery system based on PDNVs-miRNAs is developed for new therapeutic strategies. Advanced techniques such as cFEG-SEM are analyzed. The project proposes miRNAs as effective anticancer therapies and new diagnostic biomarkers, combining traditional treatments with biotechnological innovations.

Grant availability:

- H2020-MSCA-RISE-2020, The polyploidy paradigm and its role in plant breeding.
- PRIN, DEciphering the molecular MEchanism of powdery mildew defense response in grapevine ThRough a multi-omic Approach (DEMETRA), MUR.
- NUTRAGE, Fondo ordinario per gli enti e le istituzioni di ricerca (FOE 20-21, DBA.AD005.225).

Collaborations with foreign institutions:

- Massimo Iorizzo, North Carolina State University, Kannapolis, USA
- Andrea Minio, University of California Davis, California, USA
- Seuqentia Biotech, Barcelona, Spain
- Additional international collaborations will be defined based on the results