

Research activity

Role of DNA repair in the plant response to abiotic stress. Aim of the research is the molecular characterization of genes involved in the response to genotoxic stress (DNA Damage Response-DDR), as useful tools to detect the level of genotoxicity in plants. The research activity at the Plant Biotechnology Laboratory has led to the isolation and molecular characterization of novel genes involved in DNA repair processes *in planta*. A PhD project is currently ongoing as part of Paola Pagano's work dealing with the use of Arabidopsis mutants defective in DDR-related genes, in collaboration with colleagues from University of Paris-Saclay.

MicroRNAs in the context of DDR. An intriguing aspect related to the transcription regulation process involves the activity of microRNAs (miRNAs). MicroRNAs contribute to the modulation of gene expression at the post-transcriptional level, triggering translational repression or gene silencing by binding to complementary sequences on target mRNA transcripts. We investigate the role of miRNAs in the plant response to genotoxic stresses and in relation to DDR. A novel line of research deals with the potential of plant miRNAs to be transferred through diet to phylogenetically distant species. All these works are being carried out in collaboration with colleagues from the Laboratory of Bioinformatics, Mathematical Modelling, and Synthetic Biology (Department of Electrical, Computer and Biomedical Engineering-Centre for Health Technology, University of Pavia) and Institute for Sustainable Plant Protection (National Council of Research, Research Unit of Bari).

Genome editing and its applications in plants. In collaboration with the International Rice Research Institute (IRRI), a new PhD projects has been started by Conrado Jr. Duenas who is studying the germination challenges in biofortified rice plants. Lines of biofortified rice are obtained through different approaches that include conventional breeding, genetic engineering and genome editing. CRISPR/Cas9 tools are being employed to develop a protocol for DNA-free genome editing system.

Molecular profile of seed quality. Aim of the research is the identification of molecular indicators of seed quality (vigor). DNA repair pathways are activated during the early phase of seed germination (imbibition), when the so-called 'pre-germinative metabolism' is triggered. A working system has been established, using imbibed seeds from model plants (Legumes, *Medicago truncatula*; Solanaceae, *Petunia hybrida*; Cereals: *Oryza sativa*) in order to validate the role of novel DNA repair genes during the pre-germinative metabolism. Development of novel, non-invasive, easy-to-use methods to assess seed quality is being carried out for a new PhD project by Adriano Griffo, in collaboration with the Laboratory of Bioinformatics, Mathematical Modelling, and Synthetic Biology (Department of Electrical, Computer and Biomedical Engineering-Centre for Health Technology, University of Pavia) and the Plant Germplasm Bank (Department of Earth and Environmental Sciences, University of Pavia).