UNIVERSITÀ DEGLI STUDI DI PADOVA

CORSO DI DOTTORATO IN BIOSCIENZE

Giovedì 11 ottobre 2018
ore 16:30 - Aula Magna, Polo Vallisneri

Plants, Oxygen and Water Extremes

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Periods of too much or too little water – floods or droughts – are a significant cause of crop loss and food insecurity. All major crops are susceptible to drought, and with the exception of rice are vulnerable to flooding. Rice grown in rain-fed paddies is responsible for 30% of all rice produced. However, rain-fed rice often has too much or two little water due to climatic extremes, leading to yield instability. Through international efforts, beneficial genes of traditional landraces have been identified that enable rice to be seeded directly underwater to limit weed competition or to tolerate full submergence during vegetative development. One of these genes, *SUBMERGENCE1A* (*SUB1A*), provides metabolic and developmental plasticity that increases yield stability. The SUB1A transcription factor provides a growth quiescence survival strategy during submergence and oxygen deficiency, limiting growth of the shoot when submerged and enhancing regrowth after desubmergence. Rice that is transiently submerged or water deprived can recover as long as axillary (tiller) meristems remain viable; *SUB1A* significantly increases tiller regrowth after water extremes. I will describe our use of two powerful methods for deep insight into gene regulatory processes: INTACT (Isolation of Nuclei TAgged in specific Cell Types) and TRAP (Translating Ribosome Affinity Purification). We have used these to monitor chromatin dynamics, transcription and mRNA translation in specific cell-types and zones of rice to define plasticity in metabolism and development that underlie mechanisms of survival of water extremes.

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