Limited proteolysis mechanisms in plants for selective protein translation to improve heat tolerance

Panagiotis N. Moschou [1#,]

[1] Institute of Molecular Biology and Biotechnology, Foundation for Research and Technology-Hellas, 71500, Heraklion, Greece.

[2] Department of Biology, University of Crete, 71500, Heraklion, Greece

Presenting author: Panagiotis N. Moschou, email: panagiotis.moschou@imbb.forth.gr
* Corresponding author: Panagiotis N. Moschou, email: panagiotis.moschou@imbb.forth.gr

ABSTRACT

Heat waves threaten agriculture in the EU and worldwide. Exactly how we can protect our crops precisely and rapidly from heat is a lingering question with important implications for future food security. My lab focuses on the potential of a rapid stress response that we recently discovered and tries to incorporate this knowledge into the design of new breeding strategies to improve crops.

To bolster heat tolerance, we established an innovative approach for the control of protein production networks by repurposing proteolytic pathways that control the dynamics of organelle-like assemblies known as condensates [1-3]. These condensates have unique properties that allow them to store functionally related proteins and RNAs in the cytoplasm as networks called “coregulons”. These coregulons are responsible for undocumented rapid and synchronized stress responses, for example during heat, that depend on proteolysis. The discovered coregulons ensure an unappreciated rapid response to stress important for plant acclimation and this knowledge can be exploited to engineer desirable crop traits.

I will thus discuss this discovery and how to use cutting-edge approaches to collect an extensive dataset of coregulons important for growth and environmental adaptation. Furthermore, I will discuss how we can control coregulons by refining and developing new approaches of protease-substrate capture, and how we can convert this knowledge into a generic strategy to improve the tolerance of crops to several stresses.

We have thus established an ambitious research program, potentially game-changing that can help combat the escalating problem of food security and extend our comprehension of how organisms adapt to dynamic environments.

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