Anna Stepanova, Ph.D.

Tailoring hormone responses in plants via synthetic signal integration devices

Abstract:

Phytohormones are key regulators of plant growth and development that control nearly every aspect of plant's life, from embryo development to fruit ripening, from organogenesis to pathogen response. By altering the levels and distribution of hormones, plants can change their growth patterns and adapt to different environments, a phenomenon known as phenotypic plasticity. An overarching goal of my research is to understand how plants employ a limited set of hormones to integrate developmental programs with a wide array of environmental signals and produce adequate responses that enable the plants to survive and reproduce in even hostile conditions. I have been using various molecular, genetic, genomic, biochemical, and cell biology approaches in Arabidopsis and other plant species to explore the role of plant hormones in mediating plant phenotypic plasticity, to decipher the molecular mechanisms of auxin biosynthesis and ethylene signaling, to uncover the interaction nodes between the hormonal pathways, and to determine the contribution of translational regulation in hormone signaling and response. Despite the availability of a wide variety of biotechnological tools to manipulate plant growth, it has been challenging to precisely control when and where hormones are produced in a plant. We are developing a new set of CRISPR-based synthetic genetic devices to target expression of genes of interest to specific cell types. The potential utility of this new approach extends far beyond plants.

Biography:

Anna Stepanova is a Russian-American. She got her Bachelor of Science in Biology from the University of Nevada, Reno (USA) and from Nizhni Novgorod State University (Russia). Anna did her PhD dissertation work in the laboratory of Prof. Joseph Ecker at the University of Pennsylvania and The Salk Institute of Biological Studies investigating the nuclear events in the ethylene signaling pathway in Arabidopsis and characterizing direct targets of the master transcriptional regulator EIN3. In 2001 she moved to North Carolina State University (NCSU) where, together with Jose Alonso, she initiated the study of hormone signal interactions using ethylene and auxin as her experimental system. Their pioneer work has been instrumental in the discovery of the first complete route of auxin biosynthesis in plants, shed critical light on the molecular basis of hormone crosstalk in plants, and led to the identification of a key molecular mechanism that links ethylene perception to the activation of a novel gene-specific translational control mechanism. Currently, the Alonso-Stepanova laboratory at NCSU continues to employ molecular, genetic, genomic, biochemical, and cell biology approaches in Arabidopsis to study the role of auxin and ethylene in mediating plant phenotypic plasticity.

Publications (selected)**:**

1) Merchante et al., Methods Mol Biol, 1573, 163-209, 2017
2) Merchante et al., Plant J., 90(4), 628-653, 2017
3) Stepanova et al., Dev Cell, 39(5), 524-526, 2016
4) Stepanova et al., PNAS, 113(39):10742-10744. 2016