

# Study finds key molecular mechanism regulating plant translational activity

October 22 2015

---

Plants can't get up and run away when they're being attacked by insects or harsh weather conditions. So they need mechanisms to rapidly respond to a stressful event - being eaten by a bug, for example - and then quickly transition back to "normal" conditions when the stress level subsides.

In a paper published in the journal *Cell*, North Carolina State University researchers show how plants handle - at the molecular level - the release of [ethylene](#), an important gaseous stress hormone that, among other functions, regulates plant growth and stimulates the fruit ripening process. The findings could pave the way to new techniques to engineer [plants](#) to produce better crops or to turn off certain genes.

In the paper, plant geneticists Anna Stepanova and Jose Alonso show that ethylene triggers a process that begins, but doesn't complete, one of the cell's most basic functions - gene expression.

At issue are the plant cell's transcription and translation processes, in which genetic instructions encoded in DNA are transcribed into messenger RNAs, which are then translated into amino acids to create proteins that carry out specific functions.

The researchers show that, when ethylene is perceived, transcription of certain genes that function as circuit breakers of ethylene signaling occurs, but protein production becomes restricted until ethylene is removed.

"Essentially, that means the messenger RNA is being made and stored, but the flow of information does not continue into [protein synthesis](#)," Stepanova said.

"This is a mechanism for the [plant cell](#) to respond very quickly to ethylene but then very rapidly return to normal when the hormone is withdrawn," Alonso added.

Specifically, the paper shows that a key signaling molecule, EIN2, is an essential component in the ethylene-response process. EIN2 protein binds to the messenger RNA of the ethylene circuit breaker EBF2, incapacitating its protein synthesis, and thus allowing for a full activation of plant ethylene responses.

Alonso and Stepanova say that although the results are specific to ethylene, the findings provide a blueprint for examining other plant hormones and their effects on genes.

**More information:** Gene-specific translation regulation mediated by the hormone-signaling molecule EIN2, *Cell*, 2015.

### **Abstract**

The central role of translation in modulating gene activity has long been recognized, yet the systematic exploration of quantitative changes in translation at a genomewide scale in response to a specific stimulus has only recently become technically feasible. Using the well-characterized signaling pathway of the phytohormone ethylene and plant-optimized genome-wide ribosome footprinting, we have uncovered a molecular mechanism linking this hormone's perception to the activation of a gene-specific translational control mechanism. Characterization of one of the targets of this translation regulatory machinery, the ethylene signaling component EBF2, indicates that the signaling molecule EIN2 and the nonsense-mediated decay proteins UPFs play a central role in this

ethylene-induced translational response. Furthermore, the 3'UTR of EBF2 is sufficient to confer translational regulation and required for the proper activation of ethylene responses. These findings represent a mechanistic paradigm of gene-specific regulation of translation in response to a key growth regulator.

Provided by North Carolina State University

Citation: Study finds key molecular mechanism regulating plant translational activity (2015, October 22) retrieved 24 June 2024 from <https://phys.org/news/2015-10-key-molecular-mechanism.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.