A non-canonical auxin-sensing mechanism is required for organ morphogenesis in Arabidopsis

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Tissue patterning in multicellular organisms is the output of precise spatio-temporal regulation of gene expression coupled with changes in hormone dynamics. In plants, the hormone auxin regulates growth and development at every stage of a plant's life cycle. Auxin signaling occurs through binding of the auxin molecule to a TIR1/AFB F-box protein allowing interaction with Aux/IAA transcriptional repressor proteins. These are subsequently degraded via the 26S proteasome leading to de-repression of auxin response factors (ARFs). How auxin is able to elicit such a diverse range of developmental responses through a single signaling module has not yet been resolved. Here we present an alternative auxin-sensing mechanism in which the auxin response factor ARF3/ETTIN through interactions with process-specific transcription factors controls expression of downstream targets. This non-canonical hormone-perception mechanism is important for coordinating growth and patterning in diverse developmental contexts such as gynoecium morphogenesis, lateral root emergence, ovule development and secondary branch formation. Disrupting the auxin-sensing ability induces morphological aberrations with consequences for plant fitness. Therefore, our findings introduce a novel transcription factor-based mechanism of hormone perception in plants.