doi:10.2533/chimia.2017.310 Chimia 71 (2017) 310 © Swiss Chemical Society

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How Do Plants Know When to Let Go?

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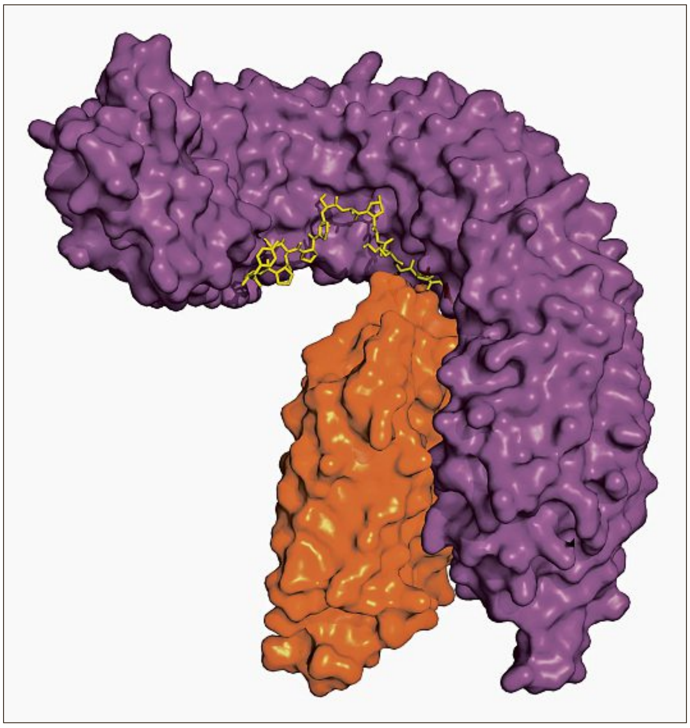
Keywords: Membrane receptor · Organ separation · Peptide hormone · Signaling complex · Structural biology

Plants have the capacity to renew themselves and get rid of damaged or no longer needed organs. By this mechanism plants conserve energy, spread their seeds and avoid the spread of pathogen infections. But when does a plant know when is the right time to let go? This process is specifically controlled by the receptor protein HAESA, located at the surface of specific cells that form a layer around the future break point. When it is time to shed an organ, a small hormone called IDA instructs HAESA to trigger the shedding event. Elucidating the underlying mechanism of this communication process will be crucial, for example, to optimize crop production by reducing fruit loss and synchronizing fruit harvesting.

Using protein biochemistry, structural biology and genetics we have uncovered the molecular details of this process. Our experiments show that the hormone IDA binds directly to a canyon-shaped pocket in HAESA. IDA binding to HAESA generates a new surface of interaction that is then recognized by another receptor protein called SERK1. SERK1 binding to the HAESA-IDA complex leads to the release of signals inside the cell that trigger the shedding of organs.

With the chemical mechanism at the atomic level at hand, we can now use this information to carry out rational drug design to generate compounds that mimic or antagonize the IDA hormone. This will represent a very powerful tool allowing us to control the process from the outside, for example, by watering or spraying with these compounds. The next step following on from this work is to identify and dissect what are the signals produced when IDA activates HAESA.

Activation of the HAESA receptor triggers the shedding of leaves in the fall.



Overall view of the three-dimensional structure of the active receptor complex. The receptor HAESA is depicted in deep purple, the hormone IDA in yellow, and SERK1 is highlighted in orange.

The combined use of protein biochemistry, structural biology and genetics offers a powerful combination to dissect and understand communication events in plants. This approach provides valuable information to allow for rational drug design to regulate physiological processes in plants.

Acknowledgement

We thank C. Henzler and L. Broger for technical assistance, and the staff at beam lines PXII and PXIII of the Swiss Light Source (Villigen, CH). We would also like to thank Paula Santiago for donating the 'forest in the fall' original picture. This work was supported by the Swiss National Science Foundation (grant no: 31003A_156920) and a long-term fellowship from EMBO.

Received: March 6, 2017

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