Deciphering how light controls stomatal production in plants

August 3 2021

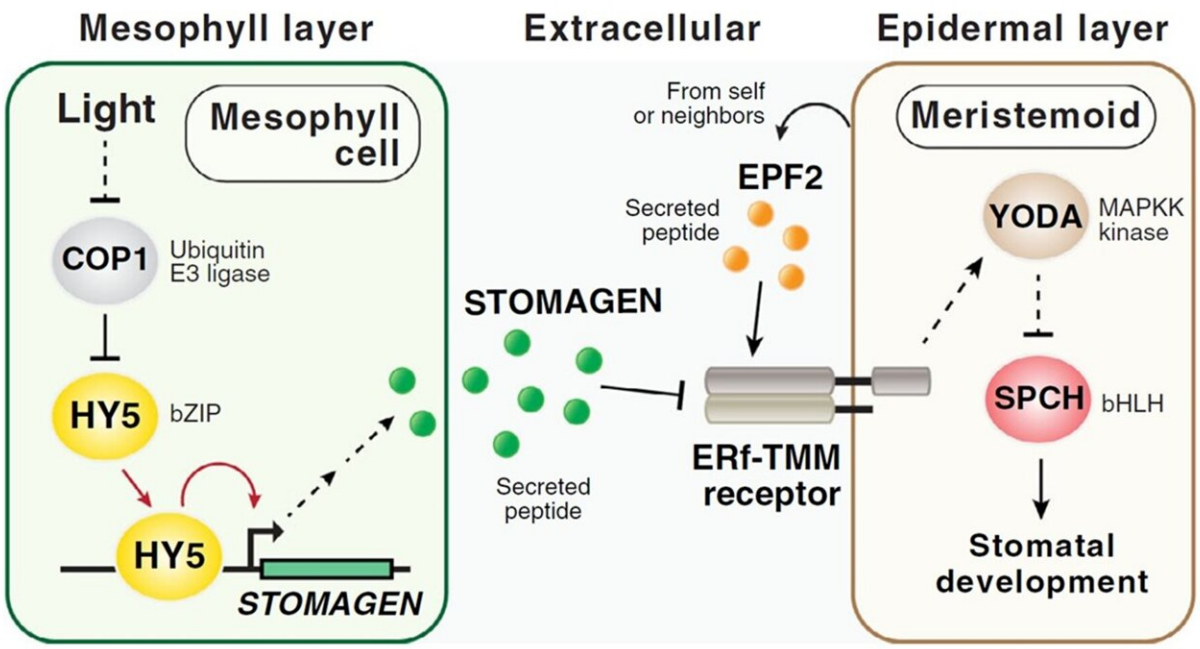

Figure shows a model of the HY5-STOMAGEN module in promoting light-mediated stomatal development. Light suppresses COP1 and leads to HY5 accumulation. In the mesophyll layer, HY5 binds and induces STOMAGEN production. The increased production of STOMAGEN in turn inhibits the repressive signalling pathway of the epidermal stomatal lineage, leading to the accumulation of SPCH and enhanced stomatal production. Credit: *Nature Communications*

NUS biologists have discovered the mechanism of how light regulates

stomatal production on the leaf surface, a process critical for the adaptation and fitness of plants.

Stomata are pores found on the outer layer (epidermis) of leaves and stems that control the rate of gas exchange in land plants. The number, size and distribution of stomata vary widely and change with external factors, enabling plants to adapt to diverse environments. It is widely accepted that light, as a critical external signal on plant development, triggers production of stomata for carbon dioxide uptake. However, the detailed mechanism of how light signals are linked to stomatal production remains unclear.

Extensive studies have found that a gene ELONGATED HYPOCOTYL 5 (HY5) plays important roles in light-mediated developmental changes in plants. Prof Lau On Sun and his team from the Department of Biological Sciences, National University of Singapore have established a link between HY5 and light-triggered stomatal production. The researchers found that under light, HY5 positively regulates stomatal development at early stages. Interestingly, they discovered that HY5 is expressed in the inner tissue of leaves (mesophyll) and activates STOMAGEN, which is secreted into the extracellular space and in turn stabilizes the master regulator of stomatal development SPEECHLESS (SPCH) on the epidermis. This leads to enhanced stomatal production (see Figure). The exciting results from this research reveal that environmental stimuli could modify gene expression in cells from one tissue and subsequently influence cell development from another tissue.

Prof Lau said, "The findings are intriguing as it suggests there is tight coordination between tissue layers in plants when they respond to the environment. Embarking on this, we plan to investigate if other stimuli, including plant hormones and temperature changes, may play a role in stomatal development through HY5 and STOMAGEN. The regulatory module uncovered here could also serve as an entry point for improving

plant vigor in diverse growing conditions."

More information: Shenqi Wang et al, Light regulates stomatal development by modulating paracrine signaling from inner tissues, *Nature Communications* (2021). DOI: 10.1038/s41467-021-23728-2

Provided by National University of Singapore