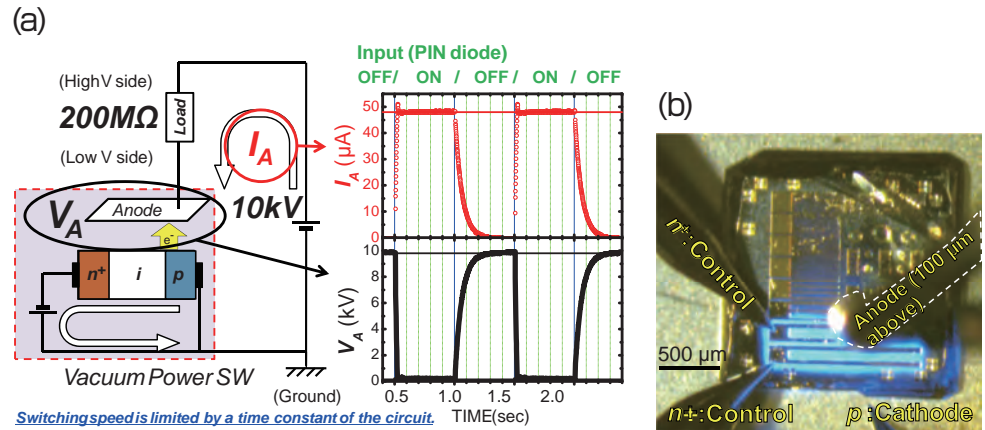


# High-voltage vacuum power switch for smart power grids

## Innovation with unique properties of diamond semiconductors

We have developed vacuum power switches rated at 10kV, building electron emitters (essentially PIN diodes) from hydrogen-terminated diamond, whose negative-electron affinity enables it to supply a large amount of current across a high vacuum when it is turned on. We also calculated that the technology could be scaled up to 100kV or higher, making the approach a promising one to control smart grids.



10 kV switching result of a vacuum power switch (a), and a top view image (b)

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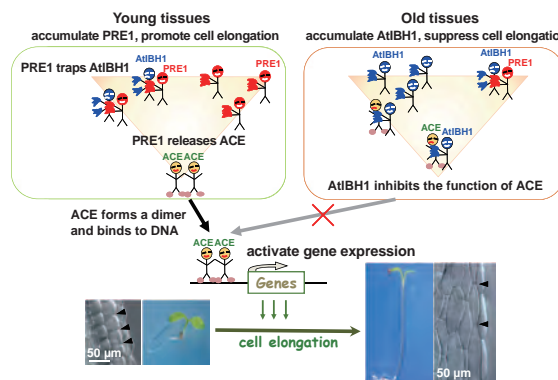
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# A system that regulates height and size of leaves and seeds in plants

## Tri-antagonistic bHLH transcription factors regulate cell elongation in plants

In plants, basic helix-loop-helix (bHLH) transcription factors play important roles in the control of cell elongation. Two bHLH proteins, PACLOBTRAZOL RESISTANCE1 (PRE1) and *Arabidopsis* ILI1 binding bHLH1 (AtIBH1), antagonistically regulate cell elongation in response to brassinosteroid and gibberellin signaling, but the detailed molecular mechanisms by which these factors regulate cell elongation remain unclear. Here, we identify the bHLH transcriptional activators for cell elongation (ACEs) and demonstrate that PRE1, AtIBH1, and ACEs constitute a tri-antagonistic bHLH system that competitively regulates cell elongation. In this system, ACEs directly activate the expression of enzyme genes for cell elongation by interacting with their promoter regions. AtIBH1 negatively regulates cell elongation by interacting with the ACEs and thus interfering with their DNA binding. PRE1 interacts with AtIBH1 and counteracts the ability of AtIBH1 to affect ACEs. Therefore, PRE1 restores the transcriptional activity of ACEs, resulting in induction of cell elongation.



A tri-antagonistic basic helix-loop-helix system regulates cell elongation in plants.

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