Internal clock, external light regulate plant growth

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Most plants and animals show changes in activity over a 24-hour cycle. Now, for the first time, researchers have shown how a plant combines signals from its internal clock with those from the environment to show a daily rhythm of growth.

Using time-lapse photography, postdoctoral researcher Kazunari Nozue, with colleagues from UC Davis and the University of Lausanne, Switzerland, found that the shoots of Arabidopsis seedlings show a spurt of growth once a day. The timing of that growth spurt is controlled by both the plant's internal clock and by exposure to light, acting on two genes called PIF 4 and PIF 5.

"It's a nice, elegant mechanism for how these two systems interact," said Julin Maloof, assistant professor of plant biology at UC Davis, who is senior author on the paper.

When the seedlings are grown in constant light, most growth occurs in the late afternoon. But when the plants were moved to a more natural light/dark cycle, growth shifted several hours to occur just before dawn. In nature, that is the time when water is usually most available.

The researchers identified the two genes, PIF 4 and PIF 5, that are connected to plant growth and regulated by the internal clock. The PIF 4 and 5 genes are "switched on" to make protein during the day, switch off after dark but then turn on again late in the night. But the proteins made by PIF 4 and PIF 5 break down when exposed to light. So while the

internal clock drives transcription of the genes to produce proteins, external light removes the protein.

The PIF 4 and 5 proteins are thought to act as transcription factors that turn on other genes involved in growth.

Source: University of California - Davis

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