Plant clock gene also works in human cells

December 1 2010

A gene that controls part of the 'tick tock' in a plant's circadian clock has been identified by UC Davis researchers. And not only is the plant gene very similar to one in humans, but the human gene can work in plant cells -- and vice versa. The research is published this week in the journal *Proceedings of the National Academy of Sciences*.

"It's surprising to find a clock gene that is performing the same function across such widely unrelated groups," said Stacey Harmer, associate professor of plant biology in the UC Davis College of Biological Sciences and senior author on the paper.

Major groups of living things -- plants, animals and fungi -- all have circadian clocks that work in similar ways but are built from different pieces, Harmer said. The newly identified gene is an exception to that.

Harmer and UC Davis postdoctoral scholar Matthew Jones, with colleagues at Rice University in Houston and the Salk Institute for Biological Studies in La Jolla, identified the "Jumonji-containing domain 5 gene," or JMJD5, from the lab plant *Arabidopsis* by screening existing databases for genes that were switched on along with the central plant clock gene, TOC1.

JMJD5 stood out. The protein made by the gene can carry out chemical modification of the histone proteins around which DNA is wrapped, and can likely regulate how genes are turned on and off -- potentially making it part of a clock oscillator.

When Harmer and colleagues made *Arabidopsis* plants with a deficient gene, they found that the plants' in-built circadian clock ran fast.

A similar gene is found in humans, and human cells with a deficiency in this gene also have a fast-running clock. When the researchers inserted the plant gene into the defective human cells, they could set the clock back to normal -- and the human gene could do the same trick in plant seedlings.

Because the rest of the clock genes are quite different between plants and humans, Harmer thinks that the fact that a very similar gene has the same function in both plants and humans is probably an example of convergent evolution, rather than something handed down from a distant common ancestor.

Convergent evolution is when two organisms arrive at the same solution to a problem but apparently from different starting points.

Maintaining accurate circadian rhythms is hugely important to living things, from maintaining sleep/wake cycles in animals to controlling when plants flower.

Provided by University of California - Davis