Clock gene helps plants prepare for spring flowering, study shows

March 8 2012

Scientists have made fresh discoveries about the processes that govern plants' internal body clocks and help them adjust to changing seasons, triggering the arrival of flowers in spring.

Researchers tested computer models of gene networks in a simple cress plant to determine the role played by a protein, known as TOC1, in governing these daily cycles. The model shows how 12 genes work together to run the plant's complex clockwork, and reset the clock at dawn and dusk each day.

Researchers found that the TOC1 protein, which was previously associated with helping plants to wake up, is in fact involved in dampening gene activity in the evening, helping them stay dormant at night.

The findings, from the University of Edinburgh, contradict what scientists had previously understood about the gene and its role in early morning activity. Scientists in Barcelona independently reached a similar conclusion to the Edinburgh team. The two studies pave the way for further research to define how the cycles improve plant growth and allow plants to adapt to our changing environment.

These internal 24-hour cycles – known as circadian clocks – also allow people, animals and plants to make tiny adjustments as daylight changes, and adapt to changing seasons. Researchers hope their discovery will bring them a step closer to understanding other seasonal rhythms that

affect plants and people – including the flowering of staple crops such as wheat, barley and rice, and the breeding patterns of animals.

The Edinburgh-led study, published in *Molecular Systems Biology*, was funded by the European Commission, Biotechnology and Biological Sciences Research Council and the Engineering and Physical Sciences Research Council. The Barcelona-led study, published in *Science*, was funded by the European Commission, the Ramón Areces Foundation, and the Spanish Ministry of Science and Innovation.

Professor Andrew Millar, of the University of Edinburgh's School of Biological Sciences, who led the modelling study, said: "The 24-hour rhythms of biological clocks affect all living things including plants, animals and people, with wide-ranging effects on sleep, metabolism and immunity. We are now far better placed to understand how this complex process impacts on the plant's life and what happens when the rhythms are interrupted, for example by climate change."

Professor Paloma Mas, of the Centre for Research in Agricultural Genomics in Spain, who led the experimental study, said: "The biological clock controls essential processes in plant growth and development, such as flowering and the control of growth by light. We can now extend the knowledge we have gained of cyclic processes to the major crops and other plants of agronomic interest."

Provided by University of Edinburgh