

## Turning on the Flowering Switch in Plants

Dr Liou Yih-Cherng, Department of Biological Sciences

Scientists at the National University of Singapore (NUS) have found a way to 'coax' plants to start flowering. In a recent study, a multi-disciplinary team of NUS scientists showed that the plant version of Pin1 - an important enzyme that is highly expressed in human cancers and markedly depressed in Alzheimer's diseased brains – controls flowering time of plants. This is the first time that scientists have managed to turn on the flowering 'switch' in plants.



The team from the university's Department of Biological Sciences found that an over-expression of Pin1At (plant version of Pin1) will significantly speed up flowering of plants. Specifically, researchers had found a novel genetic pathway that regulates flowering in plants. This breakthrough, considered as the first Pin1 model in plant, was reported in top-notch scientific journal, *Molecular Cell*, on 15 January 2010.

Dr Liou Yih-Cherng, Principal Investigator of the project, described the discovery as an 'accidental but sweet surprise'. A plant biologist in his team, Dr Wang Yu, was studying the human Pin1 function in mammalian cells and out of curiosity, she took her spare time to "play" with plant Pin1 (Pin1At) using Arabidopsis plant as a model. After knocking-out the Pin1At in Arabidopsis (picture above), she found the flowering time was dramatically delayed, while over-expression of Pin1At significantly enhanced flowering.

The research team approached Associate Professor Yu Hao, who is an expert working in the area of flowering control and also another corresponding author in this paper, to further explore the mechanism behind the observation. Liu Chang, a PhD student working in Assoc Prof Yu's laboratory, is also another contributor to this breakthrough work. Associate Professor Yang Daiwen, a structural biologist, was later roped in to use Nuclear Magnetic Resonance (NMR) spectroscopy to help the team better understand how Pin1At accelerates changes in the chemical structure of the proteins controlling flowering time.

### Turning on the 'flowering' switch

Pin1, a molecular switch, is an enzyme called proline isomerase that changes the chemical structure of proline amino acid in other proteins such as those controlling flowering time. Just like turning on a switch at home, Pin1At turns on the flowering process by speeding up structural changes of proteins that control flowering time (*i.e.* the flowering 'switch'), which is key to regulating the flowering time in plants. In fact, most interestingly, this central mechanism of how Pin1 regulates the floral genes is highly similar to that of Pin1 in mediating tumor formation and Alzheimer's disease.

## Potential Applications

By controlling flowering time, the findings have important applications in the floral industry. For instance, plants could be engineered to flower faster so as to increase yield of rice and other crops. Dr Liou added, "Together with our previous studies on roles of Pin1 in human cancers and Alzheimer's, the current findings not only reveal a novel regulator mechanism in plant development, but they also shed light on the identification of new PIN1 and Pin1-like proteins and their relevant biological processes in human diseases"

Since plant PIN1 and human PIN1 share similar biological processes, identifying more PIN 1 targets (both from plants and/or mammalian) may help to design Pin1 therapeutic drugs for human cancers and other diseases in the future.