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29 October 2012 | News | By BioSpectrum Bureau

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Singapore: A research team led by Dr Erh-Min Lai, an associate research fellow at the Institute of Plant and Microbial Biology, part of Academia Sinica in Taiwan, recently reported the regulatory mechanisms of a bacterial protein secretion system named type VI (T6SS). The research team used a soil bacterium *Agrobacterium tumefaciens*, a causal agent of crown gall disease (a common plant disease) and an important gene transfer tool, as a model system to unravel the molecular mechanisms underlying how T6SS is activated by acid.

This work was published in the journal *PLoS Pathogens*.

The laboratory of Dr Erh-Min Lai previously discovered T6SS in *Agrobacterium tumefaciens* and has since focused on understanding the mechanistic and biological functions of T6SS in this disease-causing bacterium. *Agrobacterium tumefaciens* is capable of transferring cancer-causing genes from bacterial cells into plant cells to induce plant tumors. Because of this unique interkingdom DNA transfer ability, *Agrobacterium tumefaciens* has become the most popular gene transfer agent for creating transgenic plants for research and agriculture.

Structural and functional studies revealed that T6SS assembles into a phage tail-like needle structure to inject cytotoxic effectors into host cells to allow disease development and/or increase bacterial survival. Thus, a smart bacterium must properly control the expression and activity of T6SS to cope with diverse environments when necessary. However, the signals and regulatory mechanisms of most T6SSs remain largely unknown.

In this report, the research team discovered that T6SS is activated by acidity via an ExoR-ChvG/ChvI cascade. In a neutral pH (7.0) growth environment, T6SS is off as the sensor kinase ChvG is inactivated by binding with ExoR repressor. When *Agrobacterium tumefaciens* senses the acidic signal (pH 5.5), ExoR is rapidly degraded and thereby de-represses ChvG to activate T6SS. This is the first report to unravel the molecular mechanisms underlying the acid-activated T6SS.

"Because the plant wound site and intercellular space are at acidic pH, the activation of T6SS by an acidic signal may implicate its role during Agrobacterium-plant interactions," said Dr Lai. Because ExoR, ChvG/ChvI, and T6SS are widespread in many animal and plant pathogens, the regulation of T6SS by the ExoR-ChvG/ChvI cascade may be universal regulatory mechanisms in these bacteria.