

## PRT6-UBR domain for oxygen sensing in plants

Ting-Jhen Lin (林廷真)<sup>1,2</sup>, Chih-Chen Lin (林致成)<sup>3</sup>, Jian-Li Wu (吳建利)<sup>1,2</sup>, Ming-Che Shih (施明哲)<sup>3</sup> and Meng-Chiao Ho (何孟樵)<sup>1,2\*</sup>

<sup>1</sup>Institute of Biological Chemistry, Academia Sinica, Taipei 115, Taiwan

<sup>2</sup>Institute of Biochemical Sciences, National Taiwan University, Taipei 106, Taiwan

<sup>3</sup>Agricultural Biotechnology Research Center, Academia Sinica, Taipei 115, Taiwan  
joeho@gate.sinica.edu.tw

### Abstract

Despite atmospheric oxygen is produced and released mostly by plants, oxygen is essential to plants and almost all other life on earth for respiration to generate energy and other cellular biochemistry. Therefore, oxygen sensing and hypoxia responding mechanisms are found broadly across taxa. Despite some degree of similarity, the oxygen sensing mechanism in mammalian and plant involving a series of post-translational modifications are chemically distinct. In animal, the hydroxylation of HIF1 $\alpha$  by HIF prolyl hydroxylases and oxygen triggers its ubiquitin-mediated degradation. In contrast, in flowering plants, group VII ethylene response factor (ERFVII) are oxidized via oxygen-depend Arg/N-end rule.

In the N-end rule pathway of targeted proteolysis, the Nt-Met-Cys of ERFVII is converted to the exposed Nt-Cys followed by rate-limiting Nt-cysteine oxidization by PCOs to turn into a negatively charged cysteine sulfinic acid (CysO<sub>2</sub>). The following arginylation by ATE1 result an distinct N-degron, Nt-Arg-CysO<sub>2</sub>. The N-degron is then recognized by UBR domains of a specific set of E3 ligases for ubiquitination and proteolysis by UPS.

In this study, we identified two highly conserved motifs among UBR domain of plant E3 ligase, PROTEOLYSIS 6 (PRT6). Our structural, biophysical and *ex vivo* studies indicated these two conserved motifs are for the recognition of the negatively charged cysteine sulfinic acid of N-degron that is a unique modification in plants. Therefore, these two conserved motifs may be evolved to adapt the oxygen-dependent Arg/N-end rule as oxygen sensing mechanism in plants.

**Keywords** – *plant oxygen sensing, N-end rule, UBR domain.*