Function and evolution of oxygen and nitric oxide sensing through the N-end rule pathway

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Our recent work uncovered the simple biochemical mechanism that plants use to simultaneously sense oxygen and nitric oxide (NO), through the N-end rule pathway of ubiquitin-mediated proteolysis [1,2]. The AP2-domain ERFVII transcription factors were shown to be substrates of this pathway, with conditional stability based on the oxidation status of Cys-2 providing a homeostatic response mechanism to changes in oxygen and NO levels. This mechanism is used by plants to measure important ecological cues to protect the stem cell niche and enhance survival [3]. I will discuss our attempts to understand how plants use this unique and evolutionarily ancient branch of the Ubiquitin Proteasome System to perceive environmental change through sensing fluctuations in both gases. I will also provide evidence that this mechanism includes not only ERFVII substrates, but a cohort of other unrelated proteins, allowing a rapid response to changes in gas levels at the proteome level. Although the N-end rule pathway is ancient, evolution of ERFVIIs and other substrates occurred relatively recently in the land plant lineage.

1. Gibbs et al Nature 2011
2. Gibbs et al Molecular Cell 2014
3. Abbas et al Current Biology 2015