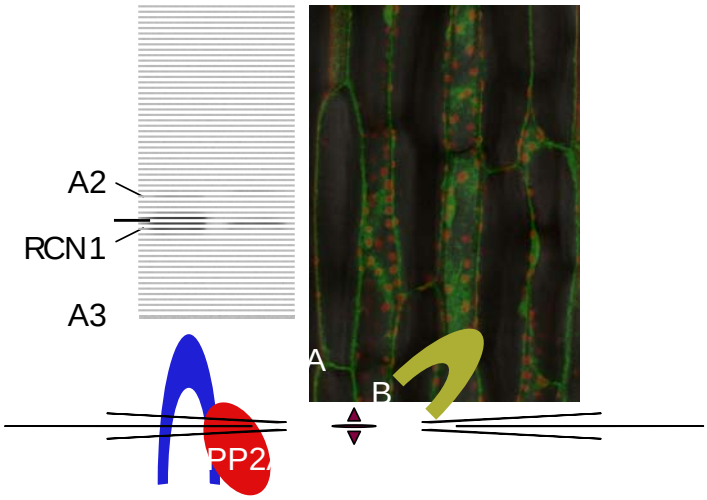
Biology Seminar

Dr. Alison Delong

Department of Molecular Biology, Cell Biology and Biochemistry
Brown University, Providence, RI

The importance of being dephosphorylated: Protein Phosphatase 2A regulation of Arabidopsis seedling development

The serine/threonine protein phosphatase PP2A regulates numerous signaling pathways in plants, but only a few specific proteins have been identified as specific targets for PP2A-mediated dephosphorylation in vivo. Our recent work has focused on analysis of PP2A-mediated regulation of ethylene biosynthesis. The gaseous hormone ethylene is one of the master regulators of plant development and defense. Ethylene biosynthesis is stringently regulated to maintain low levels during normal vegetative growth but allow for rapid production peaks at developmental transitions and under stress conditions. Ethylene negatively regulates cell expansion in most developmental phases; low basal levels of ethylene biosynthesis in dark-grown seedlings are critical for optimal cell expansion during early seedling development. The enzyme 1-aminocyclopropane 1-carboxylate synthase (ACS) performs the rate-limiting biosynthetic step in most tissues, and the expression and turnover of different ACS enzymes are tightly regulated. We find that specific ACS isozymes are targets for regulation by protein phosphatase 2A (PP2A) during Arabidopsis seedling growth, and that reduced PP2A function causes increased ACS activity. Ethylene overproduction in PP2A-deficient plants requires *ACS2* and *ACS6*, genes that encode ACS proteins known to be stabilized by MAPK-mediated phosphorylation. Proteolytic turnover of the ACS6 protein is retarded when PP2A activity is reduced, and PP2A dephosphorylates the ACS6 C-terminal serine residues phosphorylated by MPK6. Surprisingly, we also find that PP2A differentially regulates a second ACS isozyme type. Our data show that PP2A mediates a finely tuned regulation of overall ethylene production by differentially affecting the stability of specific classes of ACS enzymes.



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