Inositol Phospholipid Metabolism in Arabidopsis: Characterized and Putative Isoforms of Inositol Phospholipid Kinase and Phosphoinositide-Specific Phospholipase C—Commentary

Mueller-Roeber B, Pical C (2002) Inositol phospholipid metabolism in Arabidopsis. Characterized and putative isoforms of inositol phospholipid kinase and phosphoinositide-specific phospholipase C. Plant Physiol **130:** 22–46

Lipid signals derived from membrane phospholipids, such as polyphosphoinositides, serve as essential regulators of multiple physiological processes in eukaryotic cells. Although phosphoinositides were initially perceived as players in mammalian signaling cascades, it is now clear from numerous reports that they are important for mediating plant responses to environmental stresses and for the establishment of tropic and polar growth. The presence of phosphoinositides in plants was established in the early 1980s; however, much of the early work focused on plant species that were not genetically tractable, thereby precluding a systematic, functional analysis of phosphoinositide metabolism in plants. With the completion of the Arabidopsis (*Arabidopsis thaliana*) genome sequence in 2001, new avenues of investigation were opened. The diligent and careful survey of the Arabidopsis genome for sequences related to lipid signaling performed by Bernd Mueller-Roeber and Christophe Pical in 2002 was the first comprehensive compilation of the major families of enzymes involved in inositol phospholipid metabolism in plants. In addition to providing an overview of the relevant plant gene families and establishing a uniform nomenclature, the 2002 article by Mueller-Roeber and Pical also discussed the differences in plant and animal phosphoinositide metabolism and clarified discrepancies/controversies arising from the comparison of different biological systems. For example, the authors pointed out that plants lacked the class I and II phosphatidylinositol (PI) 3-kinases and lacked genomic data to support G-protein or receptor Tyr kinase-regulated classes of phospholipase C. Additionally, the article highlighted the presence of plant-specific protein domains in PI 4-kinases and phosphatidylinositol phosphate (PIP) kinases, noting, for the first time, the presence of ubiquitin-like domains in many of the type II family of PI 4-kinases and the membrane occupation and recognition nexus domains of the PIP kinases, a unique plant-specific feature of the subfamily B PIP kinases. By analyzing the genomic data and comparing it to experimental results from previous biochemical analyses, Mueller-Roeber and Pical provided the community with a single compendium to embrace. Even more importantly, for those new to the area of phosphoinositide signaling, a rich resource of information was created, clarifying the status of the field, revealing questions as yet unanswered, and discussing the limitations of some commonly used experimental approaches. Overall, this contribution by Mueller-Roeber and Pical cannot be overemphasized in its importance for those in the field as well as for those not well versed in lipid signaling.

Submitted by Ingo Heilmann, Yang Ju Im, Catherine Dieck, Imara Y. Perera, and Wendy F. Boss
Department of Cellular Biochemistry, Institute for Biochemistry and Biotechnology, Martin-Luther-University Halle-Wittenberg, 06120 Halle (Saale), Germany (I.H.); and Departments of Microbiology (Y.J.I.), Plant Biology (Y.J.I., I.Y.P., W.F.B.), and Genetics (C.D.), North Carolina State University, Raleigh, North Carolina 27695

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