Eukaryotic cells have ubiquitously utilised the myo-inositol backbone to generate a diverse array of signalling molecules. This is achieved by arranging phosphate groups upon the six carbons of the inositol ring. In fact, there is virtually no biological process that does not take advantage of the uniquely variable architecture of the phosphorylated inositol ring. In inositol biology, phosphates are able to form three distinct kinds of covalent bond: phosphoester, phosphodiester and phosphoanhydride bonds, with each playing a different role in phosphate biology. The phosphoester bond links phosphate groups to the inositol ring to form the soluble inositol phosphates. The variable arrangement of phosphates forms the basis of the signalling capacity of these molecules. Phosphate groups can also form the structural bridge between myo-inositol and diacylglycerol through the phosphodiester bond. The resulting lipid-bound inositol phosphates, or phosphoinositides, further expand the signalling potential of this family of molecules. Furthermore, the 6-carbon inositol ring is notable for its ability to host more phosphates than it does carbons. These unusual organic molecules are commonly referred to as the inositol pyrophosphates, due to the presence of one or more highly energetic phosphoanhydride bond (pyro- or diphosph-). Inositol pyrophosphates themselves constitute a varied family of molecules with one or more pyrophosphate moiety/ies located on different positions of the inositol ring. Considering the unique relationship between phosphate and inositol, it should come as no surprise that members of the inositol phosphate family also regulate cellular phosphate homeostasis. The inositol pyrophosphates play a fundamental role in this process by controlling the metabolism of inorganic polyphosphate (polyP).