Late embryogenesis abundant (LEA) proteins were first described about 30 years ago as accumulating in plant seeds during late stages of embryogenesis. Later they were also found in vegetative plant tissues, especially after exposure to abiotic stresses and in several desiccation tolerant bacteria and invertebrates. Most LEA proteins are IDPs under physiological conditions and many fold upon drying. Simultaneous RNAi silencing of the two highly homologous, strongly cold induced Arabidopsis thaliana plastidial LEA proteins COR15A and COR15B results in plants with impaired freezing tolerance and changed leaf morphology. The recombinant proteins are disordered in solution, but mostly α-helical in the dry state, as shown by CD spectroscopy. This gain of structure also takes place under conditions of low water availability mimicking partially frozen systems and is enhanced in the presence of lipid membranes. In silico analysis indicates folding into amphipathic α-helices. Matching this structure, FTIR spectroscopy showed that both proteins interact with liposomes in the dry state, presumably through the helices’ hydrophobic face resulting in liposome stabilization during freezing and drying. Collectively, our findings suggest that the COR15 proteins protect plants during freezing by associating with labile membranes during dehydration accompanied by protein folding. However, both COR15 proteins are also able to protect LDH during freeze-thawing in vitro. Therefore we are currently evaluating a possible protective effect of COR15 proteins on different chloroplast enzymes in vivo using COR15 RNAi silencing.