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Effects of Additives on Surfactant Phase Behavior Relevant to Bacteriorhodopsin Crystallization.

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Our goal is to develop a rational approach to membrane protein crystallization by understanding how protein-detergent interactions influence properties of protein-detergent complexes (PDCs). Although a correlation exists between the osmotic second virial coefficient (B_{22}), protein solubility and crystallization for PDCs near a detergent cloud point, the extent to which interactions among the various components in solution contributes to crystallization remains unclear. We have used self-interaction chromatography (SIC) to measure such interactions for bacteriorhodopsin, focusing in particular on the effects of additives and precipitants, including polyethylene glycol (PEG) and heptane-1,2,3-triol (HT). Although general qualitative agreement is found between the crystallization slot and conditions near the cloud point, we find contrasts in the underlying behavior between PDCs and free micelles. Despite these differences, a direct relationship is observed between the cloud point temperature of a surfactant solution and the corresponding B_{22} value of the PDC solution. These results suggest that detergent interactions may play a constructive role in promoting crystallization from a PDC as well as offer a means by which to affect these in a systematic way.