

Crystallization of Proteins- Rousseau

Protein crystallization is an important step in the recovery, purification, and characterization of these complex biological macromolecules. It is especially significant that crystallization is carried out under conditions that allow recovery and purification without denaturation (loss of biological activity). A number of researchers have noted the difficulty of crystallizing certain proteins; these problems often stem from either lengthy induction periods for nucleation or the requirement of high driving forces for growth that lead to poor crystal quality.

Catalyzing Nucleation. Our research has examined the possibility of using specific substrates to catalyze nucleation of selected proteins. The work has addressed inducing protein crystallization from solutions at lower concentrations than those required for spontaneous crystal formation. Not only does this reduce the time for the process, it means that the crystals formed have an opportunity to grow under conditions leading to better crystal quality.^{1, 2, 3}

Diseases. Protein crystallization also plays a role in some diseases. It is believed that in such instances, the control of crystal formation may mitigate onset of the disease or lead to therapies for treatment. We have explored such phenomena with apoferritin, whose crystallization is a clinically recognized feature in some forms of cataract disease. The work spawned development of a new apparatus for quantitatively studying crystal formation and growth,⁴ and identified cadmium to be critical to crystal formation.⁵

¹ W. L. Kimble, T. E. Paxton, R. W. Rousseau, and A. Sambanis, "The Effect of Mineral Substrates on the Crystallization of Lysozyme," *Journal of Crystal Growth*, **187**, 268–276(1998).

² T. E. Paxton, A. Sambanis, and R. W. Rousseau, "Mineral Substrates as Heterogeneous Nucleants in the Crystallization of Proteins," *Journal of Crystal Growth*, **198/199**, 656–660(1999).

³ T. E. Paxton, A. Sambanis, and R. W. Rousseau, "Influence of Vessel Surfaces on the Nucleation of Protein Crystals," *Langmuir*, **17**, 3076–3079(2001).

⁴ K. Bartling, A. Sambanis, and R. W. Rousseau, "Multiwell Microbatch Crystallization on a Thermal Gradient," *Crystal Growth and Design*, **5**, 1559–1564(2005).

⁵ K. Bartling, A. Sambanis, and R. W. Rousseau, "Dependence of Apoferritin Crystal Growth on Temperature and Cadmium Concentration," *Crystal Growth and Design*, **7**, 569–575(2007).