Can Solution Supersaturation Affect Protein Crystal Quality? S. Gorti. George C. Marshall Space Flight Center, National Aeronautics and Space Administration, Huntsville, AL 35812

The formation of large protein crystals of "high quality" is considered a characteristic manifestation of microgravity. The physical processes that predict the formation of large, high quality protein crystals in the microgravity environment of space are considered rooted in the existence of a "depletion zone" in the vicinity of crystal. Namely, it is considered reasonable that crystal quality suffers in earth-grown crystals as a result of the incorporation of large aggregates, micro-crystals and/or large molecular weight "impurities", processes which are aided by density driven convective flow or mixing at the crystal-liquid interface. Sedimentation and density driven convection produce unfavorable solution conditions in the vicinity of the crystal surface, which promotes rapid crystal growth to the detriment of crystal size and quality. In this effort, we shall further present the hypothesis that the solution supersaturation at the crystal surface determines the growth mechanism, or mode, by which protein crystals grow. It is further hypothesized that protein crystal quality is affected by the mechanism or mode of crystal growth. Hence the formation of a depletion zone in μ-g environment is beneficial due to inhibition of impurity incorporation as well as preventing a kinetic roughening transition. It should be noted that for many proteins the magnitude of neither protein crystal growth rates nor solution supersaturation are predictors of a kinetic roughening transition. That is, the kinetic roughening transition supersaturation must be determined for each individual protein.