E0019

SAXS of Lens Crystallin Proteins. A. Mirarefi[1], S. Boutet[2], A. Kiss[3], A. DeVries[3], C. Cheng[3], I.K. Robinson[2] and C. Zukoski[1,4], [1]Biophysics, [2]Physics, [3]Animal Bio, [4]Chem.and Biomol. Eng., UIUC, IL.

Cataracts are the leading cause of blindness worldwide. Mammalian lenses undergo a reversible cold-induced cataract that has been used as a model to study the aggregation state of the lens crystallin proteins. While cow lenses exhibit a cold-cataract at 19ºC, the lenses of Antarctic fish, which lives at -2ºC, are transparent. Within the lens there are three primary crystallins (α,β and γ) that can be distinguished by size. The α and β proteins exist as complex oligomers and the γ crystallins as dimers and monomers. It is the γF (γIVa) crystallin that has been implicated in mammalian cold-cataract formation. We have begun to characterize differences between the endothermic cow and the ectothermic Antarctic toothfish's lens crystallins to understand the variations in protein interactions.

Because fish lenses lack the refractive benefit of the air/cornea interface that the cow enjoys, they must be denser in protein in order to both refract and focus light. Our hypothesis is that the fish lens would generate large osmotic pressures unless the proteins are attractive. This comparative study between the cow and fish lenses examined the protein association and how this association is influenced by changes in temperature.
We characterized changes in intact fish lens microstructure as temperature was varied. Comparisons for lenses of fish that live in different thermal environments showed characteristic spacings of ~14nm independent of species or temperature. This size corresponds to that expected for close packed α crystallins indicating that the process used to extract proteins from the lens does not induce large attractions. In addition, the lack of sensitivity of scattering to temperatures of $\pm$10ºC of the physiological temperatures suggest that α crystallins of the mammals and fish do not greatly change their size or packing properties as temperature is varied, and thus are not significant contributors to cold cataract formation.