Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Light scattering studies of human crystallin proteins and loss of transparency in cataracts BENJAMIN MOHR, MURUGAPPAN MUTHUKUMAR, University of Massachusetts Amherst — The human lens derives its transparency and refractive index from the interactions between crystallin proteins (α-, β-, γ-crystallin). When the ordering of these crystallins is perturbed, insoluble macromolecular aggregates of crystalline proteins can occur resulting in cataracts. Using dynamic light scattering (DLS) and fast protein liquid chromatography (FPLC), we have conducted a detailed study of the formation of these aggregates. Our DLS results on γ-crystallin solutions exhibit the occurrence of slow and fast modes demonstrating the spontaneous formation of aggregates (hydrodynamic radius, Rh $\sim$ 200 nm) in equilibrium with monomeric proteins (Rh $\sim$ 3 nm). On the other hand, DLS results on α-crystallin solutions clearly demonstrate that α-crystallin molecules exist as a single population (Rh $\sim$ 18 nm). Our results on mixtures of α- and γ-crystallin solutions show that the α-crystallin tends to demolish the clumps of γ-crystallin. Our exploration of environmental effecs (temperature, pH, salt concentration) has revealed the macromolecular mechanism of dissolution of crystallin aggregates, providing a strategy for cataract prevention and insight into protein-protein interactions.

Murugappan Muthukumar
University of Massachusetts Amherst

Date submitted: 11 Nov 2011 Electronic form version 1.4