Interaction between alpha-crystallin proteins and membranes

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The cataract, induced by light scattering from eye lens clouding, is the major cause of the blindness in the group of aged people. The most effective treatment of cataract is replacing the clouding eye lens with an artificial one. It not only has a surgical risk but also accompany with the high medical expense. Thus, to develop the non-surgical and preventive treatments on cataract is important and urgent. Unfortunately, the lack of understanding on mechanism of cataract makes it difficult to be carried out.

In the vertebrate eye lens, alpha-crystallin(α-crystallin) is the major structural protein and consists of two subunits, αA and αB, which are used to maintain lens transparency throughout life. As a member of the small heat shock protein family (sHsp), α-crystallin exhibits chaperone-like activity to prevent misfolding or aggregation of key proteins in the lens associated with cataract diseases. It was believed that lens membrane is a key factor to reduce its function and eventually result in cataract[1]. The previous studies reported that binding capacity of α-crystallin to lens lipids increases with age[2], and high molecular complex, comprising α-crystallin and misfolding protein, showed higher association with membrane[1]. However, the structural details have not been provided.

To clarify the interaction between membrane and α-crystallin, high purity αA and αB crystal proteins were expressed from E. coli and purified by affinity and size exclusion chromatography. Size exclusion chromatography experiments showed that both αA and αB crystallin proteins exhibited oligomeric complexes in solution. The chaperone-like activity of αA and αB were checked by the assays of lysozyme, insulin and alcohol dehydrogenase (ADH). Circular dichroism (CD) was used to monitor the secondary structure changes of crystallin proteins induced by binding to membranes. Finally, lamellar X-ray diffraction (LXD) was used to probe crystallin-induced structural change of membrane.

Keywords –Alpha-crystallin, membrane interaction, lamellar X-ray diffraction (LXD), Circular dichroism (CD).

References

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