

Review of: "[Review Article] Melatonin, ATP, and Cataracts: The Two Faces of Crystallin Phase Separation"

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Potential competing interests: No potential competing interests to declare.

Melatonin, ATP, and Cataracts: The Two Faces of Crystallin Phase Separation

This article by Doris Loh and Russel J Reiter explores the intricate interplay between crystallin proteins, melatonin, and adenosine triphosphate (ATP), and their roles in maintaining lens transparency and preventing cataract formation. It begins by emphasizing the critical importance of crystallin proteins in preserving lens clarity and optical quality. These proteins, constituting a significant portion of the lens composition, undergo 3D domain swapping to maintain stability and transparency.

The lens environment, characterized by high protein concentration and molecular crowding, is susceptible to phase separation, which can lead to protein aggregation and cataract formation. Various factors, such as changes in temperature, ion concentrations, oxidative stress, and UV radiation, can trigger this phase separation process.

The article then delves into the protective mechanisms of melatonin and ATP against cataractogenesis. Melatonin acts as a scavenger of reactive oxygen species (ROS), preventing the formation of pathogenic amyloid fibrils by preserving water molecules around proteins. It complements the solubilizing and disaggregating functions of ATP, thereby maintaining the proper balance of bound and free water and preventing aberrant phase separation of crystallins.

The discussion extends to the role of α -crystallin as a molecular chaperone, highlighting its temperature-dependent chaperone-like activity and its ability to prevent protein aggregation induced by UV irradiation. Additionally, the article underscores the importance of the molar ratio of α A- and α B-crystallin subunits in maintaining structural stability and preventing aggregation.

Overall, the article is quite informative from the point of view of cataract formation in ophthalmology. It emphasizes the complex interplay between various factors in the lens environment and their roles in maintaining transparency and preventing cataract formation. It suggests that targeting the synergistic effects of melatonin and ATP could offer a promising strategy for mitigating cataract development.