

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

Maher M. Akl¹

¹ Mansoura University

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Introduction

The article titled "Melatonin, ATP, and Cataracts: The Two Faces of Crystallin Phase Separation," authored by Doris Loh and Russel J. Reiter, provides an in-depth analysis of the roles that melatonin and adenosine triphosphate (ATP) play in preventing the formation of cataracts through the mechanism of crystallin phase separation. The authors present a comprehensive overview of how the delicate balance between melatonin and ATP helps maintain lens transparency and prevent cataractogenesis, an age-related condition leading to vision impairment.

Summary of Content

The authors discuss the high concentration of crystallin proteins in the lens, which is crucial for maintaining transparency and optical quality. They highlight the chaperone-like activity of crystallins in protecting the lens against protein aggregation and misfolding, which can be triggered by changes in temperature, ion and salt concentrations, and various stresses such as reactive oxygen species (ROS) and ultraviolet radiation. The article elaborates on the protective mechanisms of melatonin, which scavenges ROS and prevents water molecule removal from protein hydration shells, thereby averting pathogenic amyloid fibril formation. Additionally, melatonin complements ATP's ability to solubilize and disassemble protein aggregates.

The interplay between melatonin and ATP is underscored as a vital factor in preserving the proper ratio of bound water to free water, thus preventing aberrant phase separation of crystallins. The decline in melatonin and ATP production with age, exacerbated by light exposure at night, is posited as a contributing factor to the progression of cataracts and glaucoma.

Strengths

- 1. Comprehensive Literature Review:** The article extensively reviews current literature, providing a solid background on the molecular biology of crystallins, their role in lens transparency, and the pathogenesis of cataracts.
- 2. Mechanistic Insights:** The detailed explanation of the molecular mechanisms by which melatonin and ATP prevent cataract formation is a significant strength. This provides a clear understanding of the biochemical interactions involved.

3. Interdisciplinary Approach: The integration of concepts from biochemistry, molecular biology, and ophthalmology demonstrates a thorough and interdisciplinary approach to the subject matter.

Weaknesses

1. Lack of Experimental Data: The article primarily relies on literature review and theoretical mechanisms without presenting new experimental data to support the hypotheses.
2. Depth of Statistical Analysis: While the article references numerous studies, there is a lack of quantitative analysis or meta-analysis that could strengthen the conclusions drawn.
3. Focus on Hypothetical Mechanisms: The article extensively discusses hypothetical scenarios and mechanisms, which, although insightful, would benefit from empirical validation.

Recommendations for Improvement

1. Inclusion of Empirical Data: Incorporating recent experimental studies or conducting new research to provide empirical evidence supporting the theoretical mechanisms discussed would enhance the article's credibility.
2. Quantitative Analysis: Performing a meta-analysis of existing data or including statistical analyses to quantify the effects of melatonin and ATP on cataract prevention would provide a stronger foundation for the conclusions.
3. Broader Implications: Discussing the broader implications of the findings for clinical practice and potential therapeutic interventions could make the article more relevant to practitioners in the field.

Conclusion

The article "Melatonin, ATP, and Cataracts: The Two Faces of Crystallin Phase Separation" offers a detailed and well-researched review of the roles of melatonin and ATP in cataract prevention. By addressing the identified weaknesses and incorporating the recommended improvements, the article could significantly contribute to the understanding of cataractogenesis and the development of novel therapeutic strategies. Based on the current review, the article is a valuable contribution to the field and merits publication with minor revisions.

Approval for Publication

Considering the article's comprehensive review of literature and theoretical insights into the mechanisms of cataract prevention, it is recommended for publication following minor revisions to address the highlighted weaknesses.